

**CANCER TREATMENT NUTRITION-RELATED SIDE EFFECTS AND THE
NUTRITION STATUS OF ADULT CANCER PATIENTS ATTENDING TEXAS
CANCER CENTER, KENYA**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF MASTER OF PUBLIC
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
APRIL, 2025

DECLARATION AND APPROVAL

Declaration

This thesis is my original work and has never been presented for any academic award in any institution

Reg. No: MPH/2021/86733

Signature 

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DEDICATION

I dedicate this work to my parents (Mr. and Mrs. Oduor), niece (Nia Keira), sister (Jenipher Oduor), and mentor Prof. Anselimo Makokha (JKUAT).



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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 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.



ABSTRACT

In Kenya, the third leading cause of death is cancer, and it accounts for 7% of the total deaths every year. Advancements in research and technology have led to the availability of many cancer treatment options. However, these cancer treatments can have adverse effects on the nutrition status and general health of the patient. The extent to which each treatment option or combined treatment affects the nutrition status of cancer patients remains unknown in Kenya. The broad objective of this study was to assess cancer treatment nutrition-related side effects and nutrition status of adult cancer patients attending Texas Cancer Center, Kenya. An analytical cross-sectional study design was used in the study. A sample of 384 adult cancer patients were recruited for the study. Systematic sampling was used to enroll eligible participants. Data was collected using semi-structured questionnaires. Nutrition status was assessed using the body mass index score, while dietary practice was assessed using a dietary diversity score, food frequency questionnaire, and meal frequency. Quantitative data was analyzed using statistical software package version 17. Descriptive analysis was computed by mean, mode, and percentages. Inferential statistics (Pearson's chi-square) and logistic regression were used to test for associations between nutrition status and various independent variables. The prevalence of cancer nutrition-related side effects was 34% (n=129) among the 384 respondents. Of the nutrition-related side effects, decreased appetite was the most (n= 49, 38%), with the least experienced main symptom being nausea (n=14, 11%). With regards to dietary practices, 96% (n=369) of the respondents had three meals or more per day, with only 15 (4%) having less than three meals a day, hence 104 respondents (27%) had a low dietary diversity score. The study further found that only 41% (n=157) had an optimal nutrition status. The following factors were found to be associated with the nutrition status of the participants; age (AOR=6.73; CI, 1.88-24.11; p- value= 0.003), occupation status (AOR=2.57; CI, 1.42-4.68; p- value= 0.002), sex (AOR=2.64; CI, 1.33-5.26; p- value= 0.006), household size (AOR=1.79; CI,1.03-3.12; p- value= 0.039), level of education (AOR=10.81; CI, 1.29-90.66; p- value= 0.028), nutrition-related side effects of treatment (AOR=1.66; CI,0.73-3.75; p- value= 0.002), and dietary patterns (AOR=0.55; CI, 0.15-1.13; p- value= 0.032). The study findings indicate the significance of regular nutrition screening for individuals undergoing cancer treatment. This screening is important to identify and manage any potential side effects related to the cancer treatment regimen. Timely management of these side effects is essential to ensure optimal treatment outcomes and improve the overall quality of life for cancer patients. Therefore, the study recommends that healthcare professionals deliberate in assessing the nutrition status of all cancer patients to improve their healthcare management.

TABLE OF CONTENTS

DEDICATION	ii
ACKNOWLEDGEMENT	iii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ABBREVIATIONS AND ACRONYMS	xi
OPERATIONAL DEFINITION OF TERMS	xii
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the study.....	1
1.2 Problem statement.....	3
1.3 Objectives of the study.....	4
1.3.1 Broad objective.....	4
1.3.2 Specific Objective.....	4
1.5 Study hypothesis.....	5
1.6 Justification of the study.....	6
1.7 Significance of the study.....	6
1.8 Scope of study.....	7
1.9 Limitations of the study.....	7
1.10 Assumptions.....	8
1.11 Conceptual framework.....	8
CHAPTER TWO: LITERATURE REVIEW	10
2.1 Overview of cancer.....	10
2.2 Nutrition-Related Side Effects of Treatment among Cancer Patients.....	11
2.3 Dietary practices of cancer patients.....	16

2.5	Socio economic and demographic characteristics among Cancer patients	28
2.6	Gaps in the reviewed literature.....	30
CHAPTER THREE: RESEARCH METHODOLOGY.....		32
3.1	Study site	32
3.2	Research design	32
3.3	Target population	32
3.3.1	Inclusion criteria.....	33
3.3.2	Exclusion criteria.....	33
3.4	Sample size.....	33
3.5	Sampling technique	34
3.6	Data collection instruments.....	34
3.7	Data collection procedures.....	35
3.7.1	Sociodemographic and economic characteristics.....	35
3.7.2	Nutrition related side effects	35
3.7.3	Dietary practices	35
3.7.4	Nutrition status	36
3.8	Validity and reliability of data collection tools	36
3.8.1	Validity of the data collection tools.....	37
3.8.2	Reliability of the data collection tools.....	37
3.9	Data analysis and presentation	37
3.10	Ethical considerations.....	40
CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSIONS		41
4.1	Response rate of the respondents	41
4.2	Prevalence of cancer treatment nutrition-related side effects of the respondents.....	41

4.3	Dietary practices of the respondents.....	44
4.3.1	Meal frequency	44
4.3.2	Dietary diversity of the participants	46
4.4	Nutrition status of the respondents	48
4.5	Demographic and socio-economic characteristics of the study population ...	51
4.6	Relationship between the study variables	56
4.6.1	Relationship between nutrition status and cancer treatment nutrition-related side effects.....	56
4.6.2	Relationship between nutrition status and dietary practices	58
4.6.3	Relationship between Nutrition status and socioeconomic and demographic characteristics of the Respondents	62
4.7	Hypotheses testing.....	69
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS		
	70
5.1	Summary	70
5.2	Conclusions	70
5.3	Recommendations of the study	71
5.3.1	Recommendations for Policy	71
5.3.2	Recommendations for Practice.....	71
5.3.3	Recommendations for Further Research	71
APPENDICES		89
APPENDIX A: INFORMED CONSENT		89
APPENDIX B: RESEARCHER ADMINISTERED QUESTIONNAIRE		91
APPENDIX D: NACOSTI APPROVAL		101
APPENDIX E: MKU ERC APPROVAL		102

APPENDIX F: MKU INTRODUCTION LETTER 103

APPENDIX G: SIMILARITY INDEX ENDORSED BY SUPERVISORS 104



LIST OF TABLES

Table 3.1 Data analysis and presentation _____ **Error! Bookmark not defined.**38

Table 4.1 Socioeconomic and demographic characteristics of the respondents ___**Error!**

Bookmark not defined.

Table 4.2. Relationship between nutrition status and socioeconomic and demographic characteristics of the respondents _____ 67

Table 4.3. Relationship between nutrition status and nutrition-related side effects of cancer treatment _____ **Error! Bookmark not defined.**

Table 4.4. Relationship between nutrition status and dietary practices **Error! Bookmark not defined.**



LIST OF FIGURES

Figure 3.1. Data analysis and presentation.	8
Figure 4.2. Prevalence of cancer treatment nutrition-related side effects of the respondents	44
Figure 4.3. Meal frequency of the respondent	45
Figure 4.4. Eating patterns of the respondents	47
Figure 4.5. Nutrition status of the respondents	51



LIST OF ABBREVIATIONS AND ACRONYMS

BMI:	Body mass index
ECOG:	Eastern Cooperative Oncology Group
FFQ:	Food frequency questionnaire
KIIs:	Key informant interviews
KNH:	Kenyatta National Hospital
LMICs:	Low and middle-income
MAM:	Moderate acute malnutrition
MNA:	Mini Nutrition Assessment
MUAC:	Mid-upper arm circumference
QoL:	Quality of life
SAM:	Severe acute malnutrition
SES:	Socio economic status
TCC:	Texas Cancer Center
WHO:	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Cancer Treatments- For this study, cancer treatments comprised radiotherapy, chemotherapy, surgery, hormonal therapy, and combined treatments as used in the management of cancer.

Dietary practices- In this study, dietary practices referred to the dietary patterns of cancer patients and those that will be determined using meal frequency, dietary diversity, and food frequency.

Nutrition-related side effects- These consist of the aftermath of cancer treatments and specifically refer to any side effect that affects the patient's food intake.

Nutrition status- A person's condition of health that is influenced by an individual's dietary practices and the body's ability to utilize the nutrients. In this study, it comprises of the patients' BMI.

Sarcoma- Type of cancer occurring in various locations of the bod

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Cancer is a generic term used to refer to a group of diseases that affect whichever part of the body, and results in the quick formation of abnormal cells that grow beyond their usual boundaries and can spread to other body parts or organs (WHO, 2017). Cancer can start from anywhere in the body and when the abnormal cells grow out of control, it leads to the crowding of the normal functioning cells, and this makes it hard for the body to function optimally (American Cancer Society, 2015). The leading cause of death worldwide is cancer, accounting for 10 million deaths (1 in 6 deaths) according to WHO, 2020. In 2020, there were 18.1 million cancer cases globally- 9.3 million were men, whereas 8.8 million were women. In Africa, 1.1 million new cancer cases were reported, and there were 711,429 cancer-related deaths. Cancer prevalence was at 2.2 million in Africa. In Kenya, the cancer incidence rate is 47, 887 with 32,987 cancer-related deaths (WHO, 2020). 100 types of cancer exist and are named after the tissue or organ that they first originated from or based on the cells that formed them (National Cancer Institute, 2015). Cancer deaths in 2015 were mainly from the following cancer types; lung cancer caused 1.69million deaths, liver cancer caused 788,000 deaths, 774,000 deaths from colorectal cancer, stomach 754,000 deaths, and 571,000 deaths resulted from breast cancer (National Cancer Institute, 2015).

Cancer can be categorized into stages depending on the tumor size and how far it has spread. There are two main ways of staging cancer growth namely TNM system which denotes tumor, node, and metastasis, and the numbering system which stages cancer as I, II, III, or IV, where stage I usually indicates that the tumor is small and hasn't

metastasized while stage IV is where the cancer has become big or/and spread to other organs. While cancer cases have been on the rise over centuries, cancer treatment has slowly evolved over the years (American Cancer Society, 2014). There are many types of treatments and the type of treatment received depends on the stage which the cancer is, and the type of cancer. These cancer treatments are surgery, radiotherapy, chemotherapy, immunotherapy, targeted therapy, hormone therapy, and stem cell transplant (National Cancer Institute, 2017). These treatments and cancer itself can have long-term and/or short-term side effects to a cancer patient which can in turn affect their dietary practice and nutrition status. These side effects can include weight gain, weight loss, anemia, appetite loss, fatigue, hair loss, diarrhea, and many others (Cancer Research UK, 2017). Cancer patients are, in fact, among the most undernourished patient populations.

Compared to malnutrition brought on by mere starvation, malnutrition in cancer patients is very different in that, anorexia, cachexia (varying from pre-cachexia to cachexia), and sarcopenia are a few of the numerous causes and severe effects of disease-associated malnutrition in cancer patients. Inadequate dietary intake contributes to malnutrition in cancer patients, which can limit physical function by depleting body fat and lean mass reserves. Changed appetite signals may cause cancer patients to experience loss of appetite. Physical limitations such as mouth ulcers, nausea, vomiting, discomfort, intestinal blockages, or malabsorption among cancer patients may also cause limitations in the food quantities that they have, as well as the absorption of nutrients (Maasberg et al., 2017). Tumors or immune cells generated by pro-inflammatory cytokines frequently bring about systemic inflammation among cancer patients. The body's metabolic requirements could rise as a result of this inflammation, which could also reduce hunger and trigger an accelerated breakdown of muscle protein. Pre-cachexia which is

determined through clinical signs and metabolic markers presents in the form of significant weight loss or wasting syndrome that results (Maasberg et al., 2017). Body composition can be used to assess malnutrition, and often malnutrition in cancer patients seems to be particularly obvious; revealing 50% to 80% of cancer patients present with minimal lean body mass, an indication of malnutrition. Despite that, both clinicians and many patients, and their carers frequently overlook the risk of malnutrition in cancer patients. Malnutrition risk may not even be properly handled even when it is acknowledged. Only a fraction of the cancer patients who are at risk of malnutrition got nutritional intervention, according to hospital studies in Europe (Muscaritoli et al., 2017).

Given only the existence of limited information on cancer, as well as limited established relationships between various cancer-related variables, this study assessed the cancer treatment nutrition-related side effects and nutrition status of adult cancer patients attending Texas Cancer Center, with key interest in dietary practices and, sociodemographic and economic characteristics of these patients.

1.2 Problem statement

The third leading cause of morbidity in Kenya is cancer. Cervical, esophagus, breast, and prostate cancer are the common cancer types in Kenya. Others include the stomach, head and neck, liver, colon and rectum, and soft tissue sarcoma (Cancer Research UK, 2015). There are about 36,000 new cancer cases in Kenya every year. Over 27,000 deaths occur yearly due to cancer, and this accounts for about 7% of total national mortality per year (NCI, 2017). Even after accessing treatment, a good cancer prognosis is not assured, secondary to the impact that the disease has on dietary practice and nutrient

utilization. In any case, cancer treatment can also have adverse effects on the nutrition status of cancer patients for example malnutrition. Cancer treatments have different side effects on healthy tissues and cells near the treatment area and may affect taste, smell, appetite, or ability to eat and absorb nutrients from foods and this is what leads to malnutrition in cancer patients (Ayal, 2013). The extent to which each treatment option or combined treatment affects the nutrition status of cancer patients remains unknown in Kenya. Moreover, based on Opanga et al., 2017, even though they were able to identify that 31% of the patients were undernourished due to nutrient depletion and inadequate food intake caused by the diagnosis and cancer treatment options, the research gap in drawing relationships between various variables (sociodemographic and economic characteristics, nutrition-related side effects, dietary practices), and nutrition status of the patients still exists. Other than that, there is very scanty information on dietary practices and nutrition status of cancer patients, which eventually could lead to high cancer mortality rates, reduced drug efficacy, and poor drug nutrient interactions among this patient population.

1.3 Objectives of the study

1.3.1 Broad objective

To assess cancer treatment nutrition-related side effects and nutrition status of adult cancer patients attending Texas Cancer Center, Kenya

1.3.2 Specific Objective

1. To determine the prevalence of cancer treatment nutrition-related side effects among cancer patients attending Texas Cancer Center, Kenya.

2. To determine the dietary practices of cancer patients attending Texas Cancer Center, Kenya.
3. To establish the nutrition status of cancer patients attending Texas Cancer Center, Kenya.
4. To determine the relationship between sociodemographic characteristics and nutrition status of cancer patients attending Texas Cancer Center, Kenya.
5. To establish the relationship between cancer treatment nutrition-related side effects, and the nutrition status of cancer patients attending Texas Cancer Center, Kenya.
6. To assess the relationship between dietary practices and the nutrition status of cancer patients attending Texas Cancer Center, Kenya.

1.4 Research questions

1. What is the prevalence of cancer treatment nutrition-related side effects among cancer patients attending Texas Cancer Center, Kenya?
2. What are the dietary practices of cancer patients attending Texas Cancer Center, Kenya?
3. What is the nutrition status of cancer patients attending Texas Cancer Center, Kenya?

1.5 Study hypothesis

H₀1: There is no relationship between demographic and socioeconomic characteristics and the nutrition status of cancer patients attending Texas Cancer Center, Kenya.

H₀2: There is no relationship between cancer treatment nutrition-related side effects and the nutrition status of cancer patients attending Texas Cancer Center, Kenya.

H₀3: There is no relationship between dietary practices and the nutrition status of cancer patients attending Texas Cancer Center, Kenya.

1.6 Justification of the study

While many studies have been able to identify cancer patients as being vulnerable to getting malnourished, no relationships have been drawn to establish the various variables that promote this. There are about 36,000 new cancer cases in Kenya every year. Over 27,000 deaths occur yearly due to cancer, and this accounts for about 7% of total national mortality per year (NCI, 2017). With the increasing global, regional and national cancer rates, establishing these relationships is very key even as different measures are put in place to address this global crisis. With this research drawing any existing relationships between different variables that compromise the nutrition status of cancer patients, interventions and policies stemming out of this will help in reducing cancer induced malnutrition. This will eventually translate to better outcomes as patients undergo cancer treatment, as muscle wasting during treatment contributes to poor disease prognosis.

1.7 Significance of the study

Given that the new cancer cases are constantly on the rise, it is essential for service providers, physicians and medical officers to understand the impact of dietary intake and nutrition status on cancer prognosis better, for effective management of the diagnosis. This will highly reduce cancer associated morbidity and mortality rates. Establishing the prevalence of nutrition related side effects of treatment with cancer patients will further

impact the treatment options opted for use for different patients. The study findings of this study will also add insights to the field of knowledge in nutrition and cancer and lay a foundation for future research for academics, researchers, and even policy makers.

1.8 Scope of study

This study majorly focused on assessing cancer treatment nutrition related side effects, and nutrition status of cancer patients attending Texas Cancer Center, Nairobi, Kenya. The study targeted the cancer patients receiving treatment at Texas Cancer Center, and more specifically those aged 18years and above, and not critically ill. It entailed those with any cancer type diagnosis and undergoing any of the cancer treatments as cancer in general has been on the rise globally. The sample size used was 384 study participants. It also entailed collection of data from respondents who were on any stage of cancer treatment. Texas Cancer Center was the site of the study given that it offers subsidized cost of cancer treatment, hence a wider cancer population reach. The study employed a cross sectional analytical study design. The independent variables in this study were sociodemographic characteristics, dietary practices and nutrition-related side effects of cancer patients, and data on these variables was collected using a semi structured questionnaire. The dependent variable in this study was the nutrition status of the participants and this was determined using the BMI score.

1.9 Limitations of the study

Given that the research employed a cross-sectional study design, the nutrition status and the various variables (dietary practice, sociodemographic characteristics, and nutrition-related side effects) were assessed simultaneously and thus may not have depicted a true

cause-effect relationship. This was mitigated by collecting a sufficient sample size for the study.

1.10 Assumptions

This study assumed that the information being given by the cancer patients attending Texas Cancer Center was accurate. The study also assumed that the current dietary practices and eating patterns of the patients were not different from their previous routines.

1.11 Conceptual framework

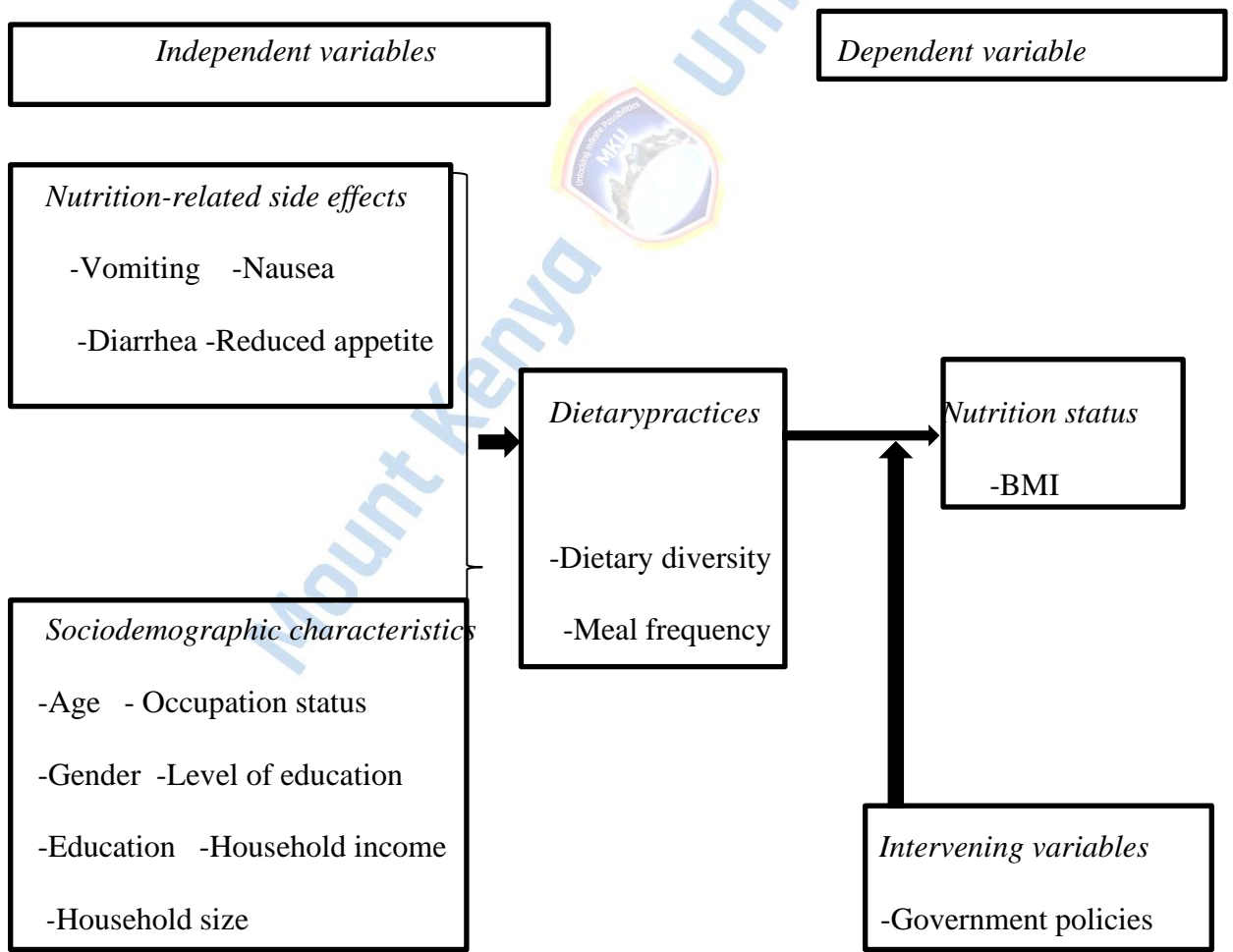


Figure 1.1. Factors associated with the nutrition status of cancer patients.

Source: Adopted and modified from UNICEF (1998).

Various cancer treatment options bring about side effects that impact nutrient intake, absorption and utilization. Due to this, dietary practices are affected in that the body's gastrointestinal tract is atrophied secondary to limited intake, thus translating to poor nutrition status. Sociodemographic characteristics of an individual may influence their dietary practices through affecting one's purchasing power, and meal consumption which eventually leads to a compromised nutrition status. Factors like guidelines put by the ministry of health and government policies also affect the nutrition status of cancer patients as they lead to limited infrastructure being set aside with an aim of promoting the health of these patients.



CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of cancer

The National Cancer Institute's cancer incidence and mortality statistics, among other sources, were used to compile a list of the most prevalent cancer types. The predicted yearly incidence for 2022 must be at least 40,000 cases for a cancer to be considered common for the list (Siegel et al., 2022). Breast cancer is the most prevalent type of cancer on the list in 2022. Prostate cancer and lung cancer are the next most prevalent malignancies. Estimated new instances of rectal cancer and colon cancer (colorectal cancers) for 2022 are 44,850 and 106,180, respectively, therefore colorectal cancer new cases being 151,030 (Fuchs et al., 2022). Cancer patients frequently struggle with malnutrition, which brings about increased morbidity, lower quality of life, shortened survival, and high mortality rates. Malnutrition has also been shown to exacerbate treatment adverse effects, alter consecutive treatment schedules, lengthen hospital stays, and impair patient functionality and immunity, all of which have been shown to reduce patients' survival rates.

Twenty to eighty percent or more of cancer patients have malnutrition and weight loss. This brings about despair, weariness and general body weakness which also greatly influence the wellbeing of patients and in turn impacts the healthcare costs. Under nutrition is a common occurrence brought on by a variety of circumstances, such as decreased food intake, negative side effects from cancer therapy, and metabolism changes brought on by the tumor. Consequently, early identification and detection of malnutrition risk through nutrition assessment, accompanied by nutrition evaluation and prompt nutrition interventions, should be seen as a helpful component in the general management

of cancer patients (Opanga et al., 2017). Malnutrition in cancer patients is thought to affect between 40 and 80% of patients worldwide, while the prevalence is unclear in Kenya (Muniu et al., 2018). Malnutrition, which is characterized by both under- nutrition and over-nutrition in cancer patients, is still a common issue because of the pathophysiology of the tumor, the response of the host to the tumor, and anticancer therapies, all of which contribute to a generally poor prognosis and quality of life. For cancer patients to receive the proper nutritional care, early detection of malnutrition is essential. The integration of proactive nutrition interventions in cancer therapy with the objective of enhancing clinical outcomes and quality of life is made possible by nutrition screening and, disease evaluation and treatment (Opanga et al., 2018).

A multimodal strategy is required for cancer management. Understanding and using nutritional science and integrative healthcare strategies will improve cancer survivorship. It is better to start early rather than late because a multidisciplinary team is required to account for the ramifications beyond the patient's nutritional demands. Supporting patients' nutritional and functional needs should be prioritized throughout the protracted course of anti-cancer treatment rather than only at the end-stage. To lower the risk of recurrence, maximize energy balance, and enhance quality of life for cancer patients and survivors, trustworthy, individualized, team-generated dietary guidance must be given (Gavazzi et al., 2016).

2.2 Nutrition-Related Side Effects of Treatment among Cancer Patients

Getting enough protein and calories is only one aspect of nutrition during cancer and cancer treatment. The foods you select also assist you in coping with side symptoms such as decreased appetite, nausea, vomiting, diarrhea, difficulty swallowing and chewing, and

altered tastes. Each person's medical history, diagnosis, and response to treatment are unique; so, are they. There may be severe, minor, or no side effects. Before the start of the therapy, make sure to go over all potential side effects with your cancer care team (Nolan et al., 2020). Various nutrient-related side effects of cancer are experienced by these patients, and they include, such as diarrhea, altered taste and odor, discomfort when eating, nausea and appetite loss. These eventually influence the nutritional status and quality of life of these patients. Most patients (72%) who report adverse effects from their treatment have an impact on their ability to eat and drink. Among the adverse effects of cancer treatment are dry mouth, fatigue and constipation (Zaloga, 2018).

Major qualitative motifs currently discovered are the spiraling of side effects, the burden and pain of eating, taste loss or change, and symptom management and solutions. Good practice of food and nutrition, not only comprise of the conventional advice of foods to eat and those to avoid, but also factors in the total experience of the patient and caregiver. Cancer therapies, particularly chemotherapy, can result in abrupt and noticeable changes in taste and smell, as well as exhaustion, nausea, diarrhea, vomiting, sore mouth, and ulcers in the mouth and throat. A person with cancer has a high chance of experiencing at least one treatment-related adverse effect. In a survey of cancer patients in the US receiving chemotherapy or radiotherapy, 88% of the participants reported experiencing at least one adverse effect (Tubert et al., 2021). From a study carried out in the United States, more than half the study sample (67%) receiving cancer treatment reported odor or taste changes, whereas 40% of the participants reported loss of appetite since the start of treatment. In another study in Australia, 86% of the patients in the study had experienced at least one side effect, 67% had experienced six or more of the side effects, and more

than a third of them reporting life threatening circumstances whereby urgent intervention was needed.

Caretakers have a vital but frequently underappreciated role in reducing the negative effects of cancer treatment on diet and nutrition. Furthermore, nothing is known about how caring for someone who has nutritional side effects affects that person's diet and health. Cancer caregivers, who are people who look for family members or friends who have been initially diagnosed with the disease, play a crucial role in delivering essential care. Skilled care, which include cleaning ports, treating wounds, managing adverse effects of treatment, and offering functional, emotional and informational assistance are among the services offered by the caregivers. The obligations and responsibilities of a cancer caregiver start when the disease is diagnosed, and they can endure for months or even years depending on the kind, stage, and severity of the disease (Hunter et al., 2021). Even though research has recorded the frequency and severity of the adverse effects reported by patients associated with cancer therapy, there is limited input on the interactions when managing and living with the cancer treatment side effects. Therefore, the goal of this study is to investigate nutrition related side effects of cancer treatments among cancer patients, as well as how these side effects are managed and how these changes in side effects affect dietary practices and behavior which translated into their nutrition status. These observations about the real-life experiences of families dealing with cancer treatment offer more advice on how to design supportive care interventions to lessen side effects and lessen eating-related discomfort for patients and their families (Ramadhani et al., 2021).

Cancer treatment is also a multifaceted journey that involves various therapeutic modalities aimed at eradicating or controlling the disease. While these treatments are crucial for improving patient outcomes, they often come with a plethora of side effects, many of which can significantly impact a patient's nutritional status. Understanding the nuances of these nutrition-related side effects is crucial for healthcare providers to develop tailored strategies that support patients through their cancer treatment journey (Krull et al., 2013 & Rodgersa et al., 2013). Surgery is a primary and foundational approach to treating cancer, involving the physical removal of tumors and surrounding tissues to eliminate cancerous cells. This process alters the gastrointestinal tract, leading to changes in appetite and digestion. Reduced appetite and disruptions in digestive processes can affect the absorption of essential nutrients, including vitamins and minerals. Malabsorption issues may arise, complicating the nutritional balance. Weight loss often follows surgery due to reduced food intake, altered metabolism during recovery, and increased energy expenditure (Pound et al., 2012).

Chemotherapy, a systemic treatment using drugs to destroy cancer cells, is known for side effects like nausea, vomiting, and altered taste perceptions. These symptoms make maintaining a regular and balanced diet challenging. Mucositis, inflammation of the digestive tract's mucous membranes, may occur, causing painful sores that hinder eating (Savage, Riordan & Hughes, 2008). Immune system suppression increases vulnerability to infections, necessitating dietary modifications. Long-term considerations include addressing nutritional deficiencies that may arise during treatment (Raymond, 2007). Radiation therapy, using high doses of radiation to target and kill cancer cells, introduces challenges such as swallowing difficulties, diarrhea, abdominal discomfort, and fatigue. Swallowing issues impact solid food consumption, altering dietary habits. The irradiation

of the digestive tract contributes to nutrient loss and dehydration. Fatigue, a common side effect, diminishes energy levels, affecting the motivation to prepare and consume nutritious meals. Nutritional support during radiation therapy is crucial for managing symptoms and promoting overall well-being. Immunotherapy leverages the body's immune system to target and destroy cancer cells. Stimulation of the immune system can lead to inflammation, particularly affecting the gastrointestinal tract. This disrupts normal digestive processes, impacting nutritional intake and absorption. Fatigue, similar to chemotherapy, contributes to decreased energy levels. Some immunotherapies influence the endocrine system, leading to hormonal imbalances affecting appetite and metabolism. Proactive nutritional support and close monitoring are essential due to the evolving nature of immunotherapy;(Kaleyias, Manley & Kothare, 2012).

To navigate the intricate landscape of cancer treatment and its associated nutritional challenges, a holistic and individualized approach to nutritional support is crucial. Collaboration between nutritionists and healthcare professionals is essential to create personalized dietary plans tailored to the patient's specific cancer type, treatment stage, and nutritional needs. In some cases, nutritional supplements may be recommended to address deficiencies and support overall well-being. Hydration assumes paramount importance throughout the treatment process, especially when nausea, vomiting, or diarrhea are prevalent. Maintaining adequate fluid balance is essential for preventing dehydration and supporting the body's various physiological processes. The frequency and size of meals can be adjusted to accommodate the challenges posed by treatment-related side effects. Eating smaller, more frequent meals may be easier for patients experiencing digestive issues or loss of appetite. Protein intake becomes a focal point, crucial for tissue repair and immune function, particularly during and after surgery

(Kaleyias, Manley & Kothare, 2012). Regular monitoring of the patient's weight, nutritional status, and side effects allows healthcare providers to make timely adjustments to the dietary plan. This dynamic approach ensures that nutritional support remains aligned with the evolving needs of the patient throughout the cancer treatment journey. Nutritional support is not a one-size-fits-all approach, and healthcare providers should consider the unique circumstances and preferences of each patient. Patient education and involvement in the decision-making process are crucial components of successful nutritional support during cancer treatment.

In conclusion, the nutrition-related side effects of cancer treatment are multifaceted and require a comprehensive, multidisciplinary approach. Oncologists, nutritionists, and other healthcare professionals collaborate to address these challenges, providing personalized and timely support to enhance the overall well-being of cancer patients. As research progresses, the understanding of these side effects and the strategies to mitigate them continues to evolve, offering hope for improved outcomes and a better quality of life for individuals undergoing cancer treatment. The emphasis on individualized care and ongoing research in the field of oncology underscore the commitment to improving the overall patient experience during their cancer journey.

2.3 Dietary practices of cancer patients

Even though it is acknowledged that dietary intervention is crucial, not all patients have easy access to nutritional care. Given the prevalence of nutritional risk, nutrition wasting, and difficulties of managing cachexia, multidisciplinary approach should be utilized while ensuring nutrient optimization in cancer patients (Pedrazzoli et al., 2021). Inadequate protein intake is a major contributing factor to cancer, and recent

recommendations recommend consuming more protein due to the benefits this may have on treatment tolerance and effectiveness. Vitamin and mineral dosages should be kept close to the RDAs and greater amounts should be avoided. Lack of vitamin D has been linked to cancer and may be necessary to maximize the efficiency of protein supplements (Corbella et al., 2021). Central nervous system-directed therapy (e.g., cranial irradiation therapy and/or intrathecal chemotherapy) can directly damage the hypothalamic-pituitary region, impairing signaling reception from hormones that regulate hunger, appetite, and body fat homeostasis, such as ghrelin and leptin (Samaan et al., 2013). These hormonal changes may affect food intake and appetite control via food craving (Marissa et al., 2015).

Based on a study conducted at Kenyatta National Hospital, the most frequently consumed foods among cancer patients included green leafy vegetables, beans, fruits and beef. The average Individual Dietary Diversity Score was four, with the most consumed food group being starchy staples- accounting for 92%. There was a significant positive correlation between the nutrition knowledge and the dietary diversity score of patients, but nutritional knowledge only influenced the score up by 3%. Patients with average to above average nutrition knowledge were nine times more likely to consume fruits compared to those with below average nutrition knowledge. Patients with average and above average nutritional knowledge were four times more likely to consume vegetables than that below average nutritional knowledge. Consumption of plant proteins was very poor (Muthike, 2013). Establishing the relationship between dietary practices and nutrition status of cancer patients in this study will help bridge the nutrient deficit encountered by cancer patients as a result of limited food diversification which has a negative impact on cells degeneration.

Cancer, a formidable disease, permeates various facets of individuals' lives, leaving an indelible mark on their dietary practices. The intricate interplay between cancer and nutrition assumes paramount importance, underscoring the significant role dietary habits play in buttressing patients throughout their arduous treatment journey. This connection necessitates a comprehensive exploration of various factors, including nutritional needs, the labyrinth of challenges encountered, and the nuanced strategies employed to optimize well-being during and after treatment (Marissa et al., 2015). Understanding the nutritional needs of cancer patients requires a nuanced approach, considering factors such as cancer type, stage, treatment modalities (surgery, chemotherapy, radiation, immunotherapy), and individual characteristics like age, gender, and overall health. This comprehension becomes the linchpin for a holistic and personalized approach to cancer care.

Cancer and its treatments often induce an elevation in the body's energy needs, leading to potential weight loss or muscle wasting. Counteracting these effects demands a vigilant focus on elevated caloric intake, a crucial element to thwart malnutrition and bolster the body's resilience in the face of the stresses induced by treatment.

Protein, being pivotal for tissue repair, immune function, and the preservation of muscle mass, emerges as a focal point in the dietary regimen for cancer patients. The heightened protein needs, particularly during surgical procedures or conditions precipitating muscle wasting, underscore the importance of incorporating protein-rich foods such as lean meats, dairy, eggs, and plant-based sources into the dietary plan Marissa et al., (2015). Certain cancer treatments can disrupt the absorption and utilization of vital vitamins and minerals. Ensuring an adequate intake of micronutrients, including vitamins (such as D,

B12) and minerals (like iron, calcium), assumes critical importance for overall health and in addressing potential deficiencies exacerbated during treatment.

The landscape of dietary practices in the realm of cancer is riddled with challenges, mirroring the dynamic nature of the disease and its treatments. Factors such as changes in appetite, digestive issues, weight fluctuations, and dietary restrictions collectively contribute to the complexity of maintaining optimal nutrition during this demanding period. Cancer and its treatments often exert a profound influence on appetite, manifesting as a loss of appetite, nausea, or alterations in taste perception. Negotiating these challenges demands a thoughtful approach, with strategies ranging from consuming smaller, more frequent meals to selecting foods that are well-tolerated (Lis, Gupta, Lammersfeld, Markman & Vashi, 2012). The gastrointestinal repercussions of cancer treatments, particularly those affecting the digestive tract, can manifest as nausea, vomiting, diarrhea, or constipation. The dietary landscape undergoes significant modifications to accommodate these symptoms, necessitating adjustments to manage these challenges effectively. Weight fluctuations, encompassing both loss and gain, are commonplace among cancer patients. While some treatments precipitate unintentional weight loss, others may contribute to weight gain. Nutritionists collaboratively work with patients to forge tailored dietary plans that adeptly address specific weight management needs (Nourissat et al., 2008; Borges et al., 2010).

Certain cancer treatments impose dietary modifications or restrictions. For instance, individuals undergoing head and neck radiation may encounter difficulties in swallowing, prompting the adoption of a soft or liquid diet. Adhering to these dietary restrictions becomes instrumental in minimizing treatment-related side effects.

Navigating these dietary challenges mandates personalized strategies and continuous support. Nutritionists emerge as pivotal players in this narrative, crafting individualized nutrition plans that account for the patient's specific needs, treatment regimen, and any dietary challenges they may encounter. Adequate hydration stands as a fundamental pillar of cancer care, especially for patients contending with side effects like vomiting or diarrhea. Maintaining proper fluid balance is not only crucial for preventing dehydration but also instrumental in supporting various physiological processes (Marín, Laviano & Pichard 2007). Nutritional supplements come into play when meeting nutritional needs through regular dietary intake proves challenging. These supplements, providing additional calories, protein, vitamins, and minerals, serve as crucial reinforcements to address specific deficiencies exacerbated during the course of treatment. Effective communication among patients, nutritionists, and the broader healthcare team assumes a pivotal role in navigating the complexities of cancer-related dietary challenges. Regular monitoring of nutritional status, weight changes, and treatment-related side effects enables the timely adaptation of dietary plans to suit the evolving needs of the patient. Integrative therapies, such as acupuncture or herbal supplements, may find a place in the comprehensive cancer care plan. Tailored to manage specific symptoms like nausea or fatigue, these complementary approaches seamlessly intertwine with conventional cancer treatments, offering a holistic approach that caters to each patient's unique needs. The journey does not culminate with the completion of cancer treatment. Post-treatment nutrition and survivorship herald a transition to a more regular diet, coupled with an emphasis on addressing lingering challenges or nutritional deficiencies.

Ongoing nutritional counselling and education become imperative in the post-treatment phase. Patients benefit from guidance on sustaining a balanced diet, managing potential

long-term side effects, and adopting a lifestyle conducive to overall well-being. Regular physical activity assumes a central role in post-treatment life. Essential for maintaining muscle mass, bone health, and overall fitness, physical activity intertwines with nutritional strategies. Nutritionists collaborate with patients to develop lifestyle strategies that complement their physical activity goals. Regular monitoring and follow-up appointments with healthcare providers and nutritionists serve as a cornerstone in post-treatment care. This ongoing support ensures that any emerging nutritional issues are promptly identified and addressed, offering valuable guidance to cancer survivors as they navigate the challenges of post-treatment life (Malihi et al.,2013).

In conclusion, the dietary practices of cancer patients embody a multifaceted journey, encompassing a spectrum of nutritional needs, challenges, and strategies aimed at optimizing well-being. Nutrition emerges as a linchpin throughout the cancer trajectory, from diagnosis and treatment to post-treatment survivorship. Tailored nutrition plans, collaboration with healthcare professionals, and continuous support coalesce as integral elements in promoting optimal dietary practices and overall health for individuals affected by cancer. As research and clinical practices evolve, the steadfast focus on personalized and comprehensive nutritional care remains a cornerstone in enhancing the quality of life for cancer patients.

2.4 Nutrition status of cancer patients

Lack of prior knowledge regarding the causes of cancer, preventative nutrients, healthy cooking techniques, the food pyramid, and healthy cooking recipes are contributors of poor nutrition status. An individual's eating preferences are influenced at several levels. Taste, sex, and age are among the biological and cultural factors which impact the

consumed food quantity. This implies that eating habits may not always be related to price (Patel A, et al., 2018). Older persons' dietary practices and nutritional understanding are positively affected by nutritional education. It should be remembered that nutrition literacy helps individuals to use textual health-related information, therefore raising one's level of dietary awareness helping one to avoid being sick through improved eating choices (Rock et al., 2020). In most oncology units, the significant cancer-related malnutrition rates and its big effect is brushed off. Based on nutritional assessments, 25% and 70% were the ranges of malnutrition prevalence attained from studies carried out in some of the developed countries (Patel A, et al., 2018).

Cancer patients are, in fact, among the most undernourished patient populations. In employing tomography as a tool to assess body composition, malnutrition in cancer patients seems to be particularly obvious; 50% to 80% of patients presented with low lean body mass, an indication of malnutrition in such studies. Clinicians, patients and their carers frequently overlook the risk of malnutrition in cancer patients. Malnutrition risk may not even be properly handled even when it is acknowledged. A minimal fraction of about one third of cancer patients at risk of malnutrition eventually get any nutrition interventions, according to hospital studies in Europe (Muscaritoli, 2017). Untreated cancer-related malnutrition can have devastating repercussions. Impact of malnutrition in cancer patients receiving treatment was seen among sarcopenia patients who were at risk of chemotherapy toxicity, while those with colorectal cancer under treatment tolerated less chemotherapy cycles. Additionally, individuals with oral cancer who were undernourished had lower ratings on the quality of life relating to physical function as opposed to those who were well nourished and maintained optimum weight or experienced weight gain.

Additionally, malnutrition contributed to higher caring expenses which translated to prolonged hospital admissions, as well as greater complications post cancer related operations. Various studies, both short and long duration ones showed that patients with severe malnutrition had an increased risk of about two to five times of dying in comparison to those who cancer patients who had little or no indication of malnutrition (Bozzetti et al., 2017). Anorexia, cachexia, and sarcopenia are hardly cured or treated among cancer patients as most oncologists miss early intervention efforts, due to the overall lack of knowledge of cancer-associated malnutrition. Compared to malnutrition brought on by mere starvation, malnutrition in cancer patients is very different. Cancer disease associated malnutrition is caused and bring about anorexia, cachexia and sarcopenia. Inadequate dietary intake contributes to malnutrition in cancer patients, which can limit physical function by depleting body fat and lean mass reserves. Change in taste signals causes appetite loss in cancer patients. Mouth ulcers, nausea or vomiting are also among the physical limitations that bring about loss of appetite or inhibition in nutrient absorption (Maasberg et al., 2017). Tumors and immune cell generated pro-inflammatory cytokines result into systemic inflammation in cancer patients. The body's metabolic requirements could rise as a result of this inflammation, which could also reduce hunger and trigger an accelerated breakdown of muscle protein. Significant weight loss and wasting syndrome depict pre cachexia which is determined using metabolic markers or the clinical signs. (Jann, et al., 2018). Anorexia, cachexia or increased inflammation brings about loss of muscle mass, leading to the classic cachectic phenotype of the disease's latter stages.

Patients who are overweight or obese may also experience muscle wasting and sarcopenia, which compromises their physical health while maintaining the look of fat. This makes sarcopenia in the rising number of cancer patients with over nutrition extremely challenging to identify. Loss of skeletal muscle is a significant risk factor for cancer, particularly for persons with cancer. Increased risk of chemotherapy side effects, shorter tumor growth time, poorer surgical success, impairment of physical functioning, and increased mortality rate have been linked to skeletal muscle loss in cancer patients (Weylandt et al., 2017). Despite all these known aspects of malnutrition among the cancer patients, prevalence of malnutrition remains unknown, with no distinguished prevalence of the nutrition status of cancer patients in Kenya.

The nutrition status of cancer patients is a critical facet of their overall health and well-being, playing a pivotal role in their ability to cope with the disease and its demanding treatments. Cancer, a complex and multifaceted condition, can significantly impact various aspects of a patient's nutritional health, leading to changes in weight, dietary habits, and the body's ability to absorb essential nutrients. Understanding and effectively addressing these nutritional challenges are paramount for optimizing treatment outcomes and improving the overall quality of life for individuals undergoing cancer care (Borges, Paiva, Silveira, Assunção & Gonzalez, 2010; Bauer et al., 2011; Monyeki et al., 2015). Weight changes are a common and significant aspect of the nutritional landscape for cancer patients, often influenced by the type of cancer, its stage, and the specific treatment modalities employed. Unintentional Weight Loss is a prevalent concern, particularly in advanced stages of cancer. Cancer-related cachexia, characterized by severe weight loss and muscle wasting, compromises the patient's physical well-being and negatively impacts their ability to tolerate and respond to treatment effectively.

Conversely, some cancer treatments, such as specific chemotherapy regimens or hormonal therapies, may contribute to weight gain. Lifestyle changes and reduced physical activity during and after treatment can also play a role in weight fluctuations. Understanding and managing these weight changes require a nuanced approach that considers the underlying factors contributing to the patient's nutritional status (Bauer et al., 2011). Dietary Intake is another aspect significantly affected by cancer and its treatments, leading to changes in food preferences, nutritional choices, and overall dietary intake. A reduced appetite is a common consequence of cancer-related fatigue, certain medications, and the psychological impact of a cancer diagnosis. Patients may struggle to consume an adequate amount of calories and nutrients, contributing to the risk of malnutrition. Chemotherapy, in particular, is known to alter taste and smell perceptions, making certain foods less appealing (Steinbach et al., 2009; Malihi et al., 2013). This alteration in sensory experiences can impact the variety and quantity of foods consumed, potentially affecting the overall nutritional status of the patient. Understanding the impact of cancer on dietary habits is crucial for implementing strategies that address specific challenges and ensure adequate nutritional support. Malnutrition is a pervasive concern in the context of cancer care, resulting from a combination of factors, including reduced dietary intake, metabolic changes, and increased nutrient requirements (Nieuwoudt, 2011, Khalil et al., 2013). Inadequate intake of calories and protein can lead to protein-energy malnutrition, a condition characterized by deficiencies in both energy and protein. This state of malnutrition compromises the body's ability to function optimally, affecting various physiological processes.

Cancer patients are at an increased risk of micronutrient deficiencies, encompassing essential vitamins and minerals. These deficiencies may arise due to decreased intake, impaired absorption, or increased utilization of nutrients by the body during the course of treatment. Addressing malnutrition necessitates a comprehensive approach that includes nutritional interventions tailored to the individual patient's needs. Certain cancer treatments, especially those targeting the gastrointestinal tract, can give rise to digestive problems that impact nutrient absorption and digestion. Chemotherapy and radiation therapy commonly cause nausea and vomiting, significantly affecting a patient's ability to maintain a regular diet. If not effectively managed, these symptoms can compromise adequate nutrition and lead to further complications. Gastrointestinal side effects, such as diarrhea or constipation, can disrupt normal nutrient absorption. Changes in bowel habits may interfere with the body's ability to absorb essential nutrients, potentially exacerbating nutritional challenges (Zalina, Suzana, Rahman & Noor, 2009; Bauer et al., 2011). Understanding and proactively managing gastrointestinal issues are crucial components of ensuring optimal nutrition for cancer patients. Addressing the nutritional needs of cancer patients often requires a multidisciplinary approach, involving collaboration among oncologists, nutritionists, and other healthcare professionals.

Nutritionists play a crucial role in assessing the dietary needs of cancer patients and providing personalized counselling. Tailored dietary plans aim to address individual nutritional requirements and overcome challenges related to treatment side effects, changes in appetite, and alterations in taste preferences. Nutritional supplements, including oral nutritional supplements and intravenous nutrition (parenteral nutrition), may be prescribed to ensure that patients receive essential nutrients when dietary intake is insufficient. These supplements serve as a valuable adjunct to regular meals, providing

additional calories, protein, and micronutrients. In cases where oral intake is not feasible, enteral nutrition, commonly delivered through tube feeding, may be considered. This method ensures that patients receive necessary nutrients directly into the gastrointestinal tract, maintaining or improving nutritional status. The implementation of nutritional support strategies is tailored to the unique needs and circumstances of each cancer patient. Regular monitoring of nutritional status and timely interventions are crucial components of comprehensive cancer care (Schoeman et al., 2010; Maciel et al., 2012). Oncology teams routinely assess the nutritional status of cancer patients during treatment. Regular assessments involve monitoring weight changes, evaluating dietary intake, and identifying any signs of malnutrition. Continuous surveillance allows healthcare professionals to make informed decisions regarding nutritional interventions. The emotional and psychological aspects of cancer can significantly impact a patient's appetite and nutritional habits (Bauer et al., 2011). Psychosocial support, including counselling and participation in support groups, can help address these aspects and improve overall well-being. Emotional well-being is intertwined with nutritional health, and a holistic approach considers both aspects in cancer care.

In conclusion, the nutrition status of cancer patients is a dynamic and multifaceted aspect of their overall care. Weight changes, alterations in dietary intake, malnutrition, and gastrointestinal issues are common challenges that necessitate careful consideration and proactive management. A comprehensive approach, encompassing nutritional counselling, supplementation, and ongoing monitoring, is essential to support the overall health and treatment outcomes of individuals navigating the complexities of cancer and its treatments. By addressing nutritional needs as an integral part of cancer care, healthcare professionals can contribute significantly to enhancing the quality of life for

cancer patients throughout their journey. Tailored nutritional interventions, combined with a supportive and collaborative healthcare approach, empower individuals to maintain optimal nutritional status, withstand the rigors of treatment, and strive for improved overall well-being (Linga, Shreedhara, Rau & Rau, 2012) As research advances and clinical practices evolve, the focus on personalized and comprehensive nutritional care remains a cornerstone in improving outcomes and quality of life for individuals affected by cancer.

2.5 Socio economic and demographic characteristics among Cancer patients

It is well established that a lower socioeconomic level (SES) is linked to a higher cancer incidence and worse survival. This is due to the discrepancies in survival rates between social groups, including variations in tumor biology, patient comorbidity, disease stage at diagnosis, accessibility to medication, and treatment methods (Arends et al., 2017). One frequently mentioned potential explanation for the connection between SES and cancer outcomes is a difference in disease stage. While numerous studies from high-income countries (HICs) have explored the relationship between SES, cancer stage at diagnosis, and survival, there is little research on these topics in low- and middle-income nations (LMICs). A 2006 systematic analysis of the socioeconomic disparities in cancer survival included 39 papers, none of which were from LMICs.

When one thinks about the possible mechanisms linking educational attainment to disease stage, these findings make sense on the surface. Patients with higher levels of education who experience early warning signs of breast cancer, cervical cancer, or oral cancer (such as a mouth lesion), may be more aware of the condition and have easier access to medical care, leading them to seek treatment earlier and be diagnosed with the disease earlier than

patients from lower educational levels. However, lung cancer patients' disease is already advanced by the time symptoms appear. Since patients in LMICs are more likely to receive an advanced cancer diagnosis than those in HICs, cancer has become a major source of morbidity and mortality in these countries. Understanding current illness, treatment, and outcome patterns in LMICs is necessary for the development and implementation of cancer control programs in the best possible way. Cancer registry data can be used in health services research to offer special insights into the performance of the health system in LMICs. There are few findings from LMICs, in contrast to the extensive descriptions of the relationship between SES, cancer stage, and survival in HICs. In order to reduce delays in seeking medical care for people in Kenya, future health awareness, preventive, and treatment activities need to focus especially on less educated areas. In study to assess the socioeconomic and demographic status of cancer patients, cancer prevalence among those with only primary education was higher than those with tertiary education at a ratio of 3:2. Those with family income of less than 12,500 dollars had a higher incidence rate of more than 1.7 times than those whose income was more than 50,000 dollars (Limin et al., 2018).

This study fills a major gap in knowledge due to the LMICs' exploding cancer burden, their health system issues, and the socioeconomic, cultural, and demographic contrasts between their people and those in HICs.

It is crucial to comprehend which subgroups within the general population might profit the most from educational and preventive initiatives when LMICs establish cancer care health systems. There hasn't been a population-based study that has examined the relationship between SES, cancer stage at diagnosis, nutrition status, and cancer survival among LMICs, so far (Calder et al., 2017). In this study, assessment of the relationship

between sociodemographic variables and nutrition status will be determined. Study findings from HICs show a strong correlation between poor educational attainment and advanced cancer stages upon diagnosis in patients with breast, cervical, and oral malignancies. In lung cancer patients, this connection was not seen (Calder et al., 2017).

2.6 Gaps in the reviewed literature

Cancer develops gradually thus interfering with the normal growth and functioning of body cells. Adequate nutrition in cancer greatly impacts treatment response outcome. However, the benefits of nutrition in patients with cancer is still underestimated. Cancer treatments have nutrition impact symptoms such as decreased appetite, early satiety, diarrhea, constipation, nausea, vomiting among others which interferes with food intake resulting to malnutrition which has been associated with increased morbidity and poor quality of life, thus high mortality rates. Despite the impact cancer causes on oral nutritional intake, associations have rarely been systematically assessed. The importance of assessing sociodemographic, dietary practice, and nutrition status of cancer patients has been acknowledged, as this information could influence decision-making regarding choices between alternative treatments or initiating appropriate intervention. In as much as there are suggested associations between worse overall wellbeing, morbidity and nutritional deterioration, interaction between nutrition and cancer treatments remains underestimated.

Identifying nutrition related side effects of cancer treatments among cancer patients, as well as how these side effects are managed, and how these changes in side effects affect the dietary practices and behavior of cancer patients which translates into their nutrition status is major gap from the reviewed literature. Establishing these will fill major

knowledge gaps in relation to the LMICs' exploding cancer burden, their health system issues, and the socioeconomic, cultural, and demographic contrasts of their people and those in HICs. Establishing the relationship between dietary practices and nutrition status of cancer patients will also help bridge the nutrient deficit encountered by cancer patients as a result of limited food diversification which has a negative impact on cells degeneration and establish distinguished prevalence of the nutrition status of cancer patients in Kenya.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study site

This research was carried out at Texas Cancer center. It was selected based on the characteristics of the study population and the objectives of the study. This location was purposively selected because the facility offers subsidized costs of cancer treatment thus it is accessible to a wide population. This facility has also reported increasing number of patients through the years, as it acts as the main private cancer referral facility in Kenya, thus serves a lot of cancer patients. The estimated number of patients treated monthly in this facility is 900 patients. Texas cancer center is located at Mbagathi way, Nairobi west in Nairobi County (Appendix G). Currently the center offers laboratory and diagnostic procedures, cancer screening, prevention, treatment services and palliative care. Treatment services include surgery, physiotherapy, chemotherapy and radiotherapy. Moreover, this facility comprises of all medical cadres thus provides a holistic multidisciplinary approach to patient care.

3.2 Research design

The study was conducted using an analytical cross-sectional study design to examine the relationship between cancer treatment nutrition-related side effects, sociodemographic characteristics, dietary practices and nutrition status of cancer patients. This research design was employed as it not only collects data at a single point in time, but also answers the research objectives satisfactorily.

3.3 Target population

The target population for this research was cancer patients, whereas the accessible population were adults (18 years old and above) cancer patients, with cancer of stage I, II, III& IV, attending Texas Cancer Center. This sample population consisted of patients undergoing any cancer treatment, with the aim of assessing their nutrition status in relation to other variables.

3.3.1 Inclusion criteria

All adult out-patients and in-patients diagnosed with cancer attending Texas cancer center. Only those who gave consent for participation were included in the study.

3.3.2 Exclusion criteria

Critically ill patients were excluded from the study. I also excluded those who met the criteria for inclusion but could not be part of the study based on individual's alternative commitments.

3.4 Sample size

The sample size was calculated using Cochran's formula for sample size calculation in an infinite population.

$$n_0 = Z^2PQ / e^2$$

Z denotes statistical constant (1.96)

P denotes prevalence (undetermined population -0.5)

Q denotes (1-P)

e² denotes error of margin (0.05)

$$n_0 = (1.96^2 \times 0.5 \times 0.5) / 0.05^2$$

= 384 participants

3.5 Sampling technique

Purposive sampling was used to select the study site.

Systematic random sampling method was employed to select cancer patients who participated in the study. The sample members of the study population were selected at a random starting point followed by a fixed periodic interval of every second participant, until the sample size was achieved. This interval of 2 was arrived at through the following technique:

Sample size= 384

Daily patients seen by the facility= 30

Duration of data collection= 30 days

Daily participants to be interviewed= $384/30= 13$ patients

To get the interval for the systematic random sampling= daily patients seen in the facility/daily patients to interview

$$=30/13= 2 \text{ participants interval}$$

3.6 Data collection instruments

A semi-structured questionnaire was used in data collection (Appendix: B). The questionnaire assessed the food frequency, meal frequency, and dietary diversity scores of the study participants. It consisted of questions on the sociodemographic and economic characteristics and nutrition-related side effects of treatment. Weight measurements were obtained through the weighing scale, while the height was obtained using a height board.

3.7 Data collection procedures

Questionnaires, weighing scales, and height boards were used to collect data. The research assistant and the researcher administered the questionnaires. The interviewers also took the anthropometric measurements together. The researcher would take the measurements and share the data with the research assistant who would do the recording.

3.7.1 Sociodemographic and economic characteristics

This was collected using the semi-structured questionnaire. In this section, the age, gender, level of education, average household income, household size, and occupation of the participants were captured.

3.7.2 Nutrition related side effects

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

3.7.3 Dietary practices

This was assessed using food frequency, dietary diversity, and meal frequency score. Meal frequency was captured by assessing the number of meals one had in a day-inclusive of any snacks taken in between the meals, which was obtained through unquantified 24-hour recall. Times in which the meal was consumed was also obtained.

Food frequency and dietary diversity focused on collecting data on the consumption of foods from all the food groups that is cereals, white tubers and roots, vitamin A-rich vegetables, dark leafy vegetables, vegetables, fruits, organ meats, flesh meats, eggs, fish and sea foods, milk and its products, legumes, oils, sweets and beverages (FAO, 2011). The food frequency comprised of foods taken in the past 7 days, while the dietary diversity was obtained through the standardized Food and Agriculture Organization guideline for measuring household and individual dietary diversity for the general population. The results obtained from the food frequency were used to establish the dietary diversity.

3.7.4 Nutrition status

This was determined using BMI. BMI examined the weight in relation to the height of the participants. Weight was determined using a seca scale to the nearest 0.1kg. Participants had minimal clothing on and were barefooted. Three measurements were taken, and an average of this was obtained. Height was determined using a height board whereby participants stood facing straight, and their back, buttocks, and back of their heels were in contact with the wall. Three measurements were taken and an average of this was obtained.

3.8 Validity and reliability of data collection tools

All data collection tools were tested with a test group who were cancer patients who fit the characteristics from the sampling criteria but would not participate in the study. Pre-testing of the tool was done to a group with similar characteristics attending Kenyatta National Hospital, to assess the validity and reliability of the tools. The pilot study comprised 39 participants (10%) of the sample size. KNH was used as it acts as the main

referral public health facility for cancer patients. This allowed modifications on the questionnaires to be done, by correcting mistakes and, eliminating ambiguous questions, and ensuring clarity to elicit the required information therefore enhancing reliability.

3.8.1 Validity of the data collection tools.

The validity of the data collection tool was assessed by a panel of experts including oncologists and university supervisors. All aspects of validity such as face validity and content validity, were considered.

3.8.2 Reliability of the data collection tools.

The reliability of this tool was tested using the test-retest method. The questionnaire was administered twice to non-participating cancer patients who fall in the inclusion criteria but attending Kenyatta National Hospital. The interval between the two tests was two weeks and the questionnaire were reliable given that the results from the two tests by the same individuals had a correlation coefficient (r) greater or equal to 0.70 i.e., $r \geq 0.70$ (Cortina, 1993).

3.9 Data analysis and presentation

The data obtained from the respondents was reviewed to check if all items in the questionnaires were answered. Questionnaires that were not well answered, as well as incomplete ones, were termed as spoilt. The nutrition status was categorized as either normal, underweight, overweight, or obese based on the scores. Normal nutrition status was a BMI of 18.5-24.9kg/m². Underweight was a BMI of less than 18.5kg/m². Overweights had a BMI of 25-30kg/m², while obese participants had a BMI of over 35kg/m². Data was presented in the form of percentages through tables and Graphs that facilitated

description and explanation of the study findings. Quantitative data was entered and analyzed using STATA version 17. Inferential analysis (Pearson’s chi square), and logistics regression was used to test for associations. A P value of <0.05 was used as the criterion for statistical significance.

Table 3.1 Data analysis and presentation

Objectives	Variables	Instruments	Statistical test
To determine the demographic and socio-economic characteristics of cancer patients attending Texas Cancer Center	Sociodemographic characteristics	-Researcher administered questionnaire	proportions
To determine the prevalence of cancer treatment nutrition related side effects among cancer patients attending Texas Cancer Center	Cancer treatment nutrition related side effects	-Researcher administered questionnaire	proportions
To determine the dietary practices of cancer patients	Dietary practices	-24hrs recall to obtain meal frequency	proportions

attending Texas Cancer Center		-Dietary diversity questionnaire -Meal frequency questionnaire	
To establish the nutrition status of cancer patients attending Texas Cancer Center	Nutrition status	-Weighing scale -Height board	proportions
To assess the association between demographic and socio-economic characteristics, cancer treatment nutrition related side effects, dietary practices, and nutrition status of cancer patients attending Texas Cancer Center	Association between sociodemographic characteristics, nutrition related side effects of cancer treatment, dietary practices, and nutrition status	-Weighing scale -Height board -Researcher administered questionnaire	-Pearson's correlation (chi square) -Regression analysis

3.10 Ethical considerations

The study sought ethical approval from Mount Kenya Institutional, Scientific and Ethical review Committee-MKU/ISERC/2685 (Appendix G). Besides, I sought permission from Texas Cancer Center management, to give an approval to conduct the research on patients seeking treatment from their facility. I also sought the NACOSTI Research Permit to carry health-related research (Appendix F). Informed written consent (Appendix A) was sought from the respondents and confidentiality of the respondent's information was maintained throughout the research process by use of serial numbers on the questionnaires to maintain anonymity and employing standard data protection guidelines. Names and other means of identity was not used during the data collection process. The study was voluntary, and respondents had the right to withdraw at any point of the study if they wished to. The use of any unacceptable language was avoided in the formulation of research interview guides. I acknowledged the works of other users by referencing appropriately. The research assistant was trained prior to the research activities so that she maintained the highest level of objectivity in the data collection period.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Response rate of the respondents

The response rate of this study was 100% (n=384) of the minimum expected sample size without non-response adjustments.

4.2 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 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., 2016 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% (Wong, 2014). 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 (Gupta et al., 2017). In a study by Persson et al., (2002), 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 (Zaloga, 2018).

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 (Tubert et al., 2021). 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.

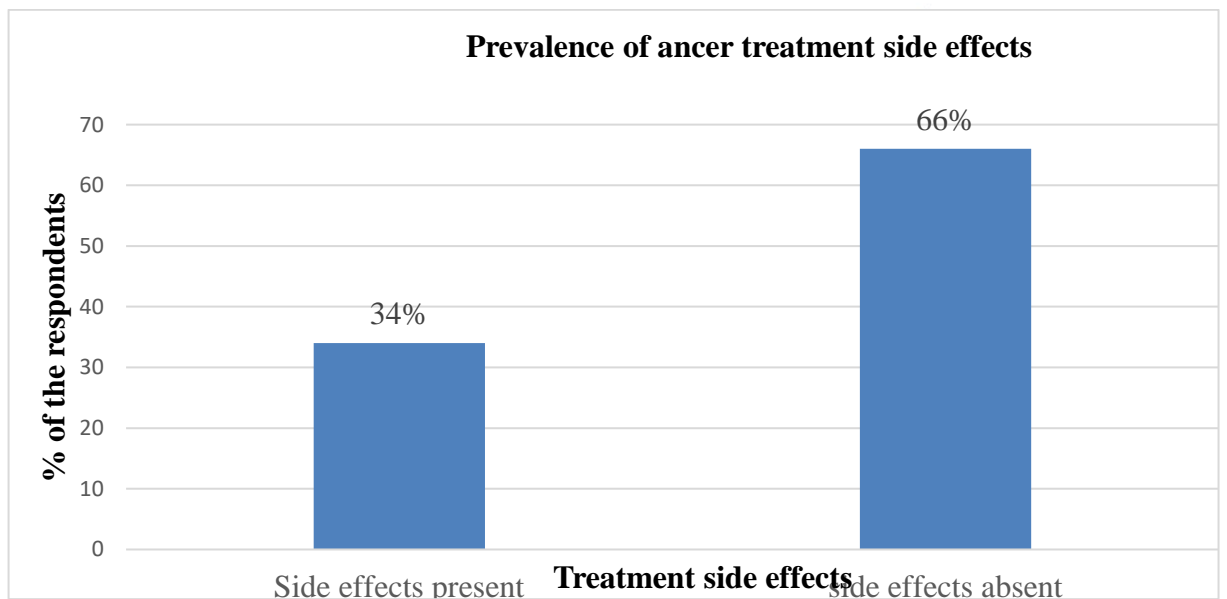


Figure 4.1. Prevalence of cancer treatment nutrition-related side effects of the respondents

The main side effects of the respondents were further classified into decreased appetite, vomiting, diarrhea, and nausea as shown in Figure 4.2.

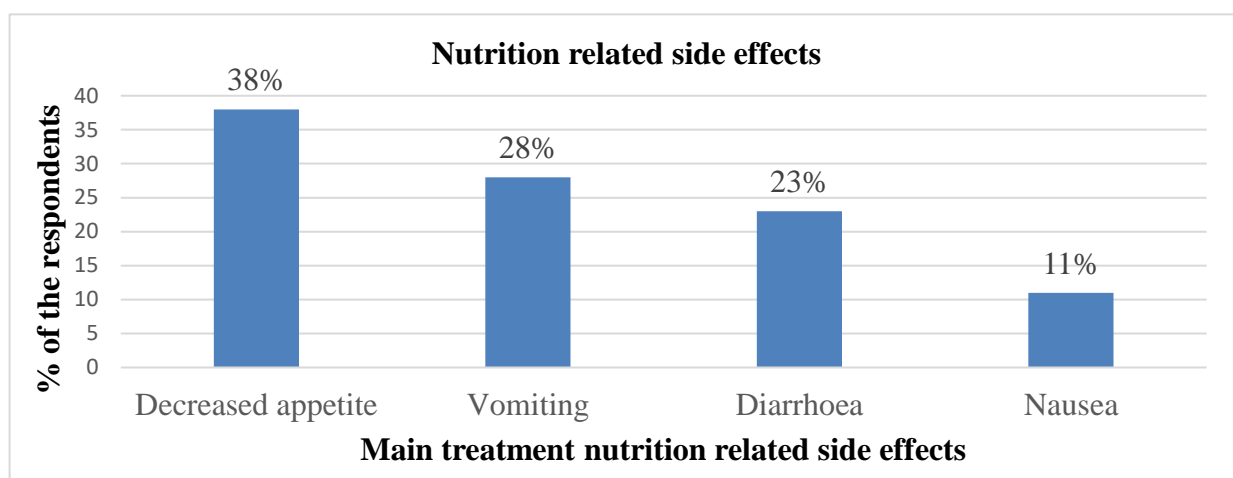


Figure 4.2. Prevalence of main treatment nutrition-related side effects of the respondents

4.3 Dietary practices of the respondents

4.3.1 Meal frequency

Respondents had varied meal patterns whereby the majority of the respondents 89% (n=341) had three meals a day. Only 1% (n=5) of the respondents had one meal a day and this was the least representation. The average meal frequency was 3 meals \pm 1SD. The majority of the respondents in this study had better eating patterns compared to those in a survey done by Blanchard et al. among cancer patients who found that 40% of the respondents consumed three main meals per day, while 35% reported having three main meals along with two snacks between meals. Similarly, eating patterns in this study were better in comparison to Zeng et al. findings which investigated eating patterns and quality of life in cancer patients undergoing chemotherapy. Their findings revealed that 30% of patients adhered to traditional three-meal patterns, 50% reported consuming three main meals along with snacks between meals, and 20% had irregular eating habits

characterized by variations in meal frequency and timing. These results differed in comparison to a study carried in Ghana (Oti et al., 2020) which found that most of the cancer study participants (50.2%) had two meals in a day, with only 14% having 3 meals a day.

Most of the study participants were likely adhering to three meals a day to meet their nutritional needs, accommodate medication schedules, stabilize blood sugar levels, ensure digestive comfort, and provide structure to their daily routine. This regular eating pattern facilitates the intake of essential nutrients necessary for healing and maintaining energy levels, while also supporting the effectiveness of cancer treatments that often require medication administration with meals. By spacing out meals, the study participants could be able to manage symptoms such as digestive discomfort and maintain a sense of normalcy amidst the disruptions caused by cancer and its treatment (Pedrazzoli et al., 2021).

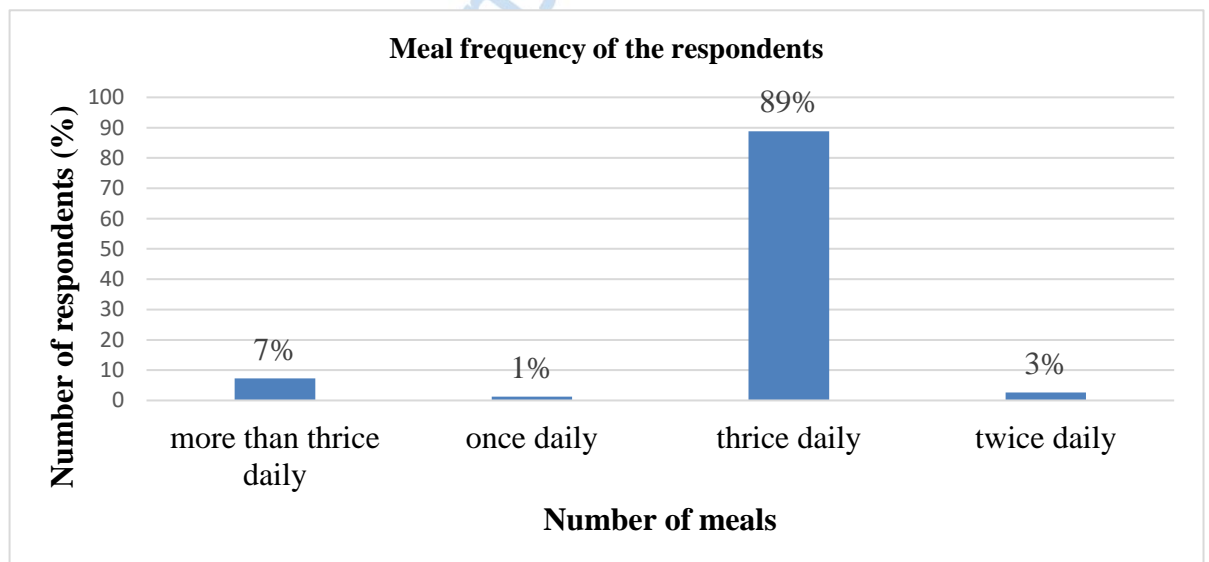


Figure 4.3. Meal frequency of the respondents

4.3.2 Dietary diversity of the participants

A dietary diversity score was attained following the number of food groups consumed by the study participants. Low dietary diversity score represented <3 food groups consumed, medium dietary diversity score represented 4-5 food groups consumed, while high diversity score represented six or more food groups consumed (FAO, 2011). Nearly half of the respondents 48% (184) had a high diversity score, the least representation being ninety-six participants (25%) who had a medium dietary diversity score. The mean dietary diversity score was $3 \pm 1SD$. Closely to a study by Jones et al., 2019 that found 20% of cancer patients had less than 3 food groups consumed, indicating a low dietary diversity score, those with a low dietary diversity score were formed by 27% of the study participants.

Among the 384 respondents who were interviewed, cereals and white tubers and roots were the most consumed food groups (97%), with fish and seafood being the least consumed as represented by 38%. These results were similar to those obtained by Hall et al., 2019 who observed women undergoing epithelial ovarian cancer chemotherapy consuming more cereals, white tubers, and roots. Results in this study were different from those obtained by Gori et al., 2020 in an Italian cross-sectional study to assess the eating habits of oncology patients, who found the intake of fruits, vegetables, cereals, and grains to be ranging from 18-38%.

Increased consumption of fruits, vegetables, cereals, tubers, and roots than fish and seafood by the study participants could be due to availability and accessibility, ease of digestion, perceived nutritional value, and concerns about food safety. These staple foods,

fruits, and vegetables are often readily available, bland, and easily digestible, making them more tolerable for individuals experiencing gastrointestinal symptoms associated with cancer and its treatments. Additionally, cultural dietary habits and preferences, as well as perceptions about the nutritional benefits of certain foods, could have influenced their dietary choices. While fish and seafood offer rich sources of protein and essential nutrients, some cancer patients may opt for foods they perceive as safer or more nourishing during treatment, leading to a preference for cereals, tubers, and roots as dietary staples. Overall, dietary choices among cancer patients are often influenced by a combination of factors including taste changes, nutritional considerations, treatment-related side effects, and individual dietary preferences and recommendations.

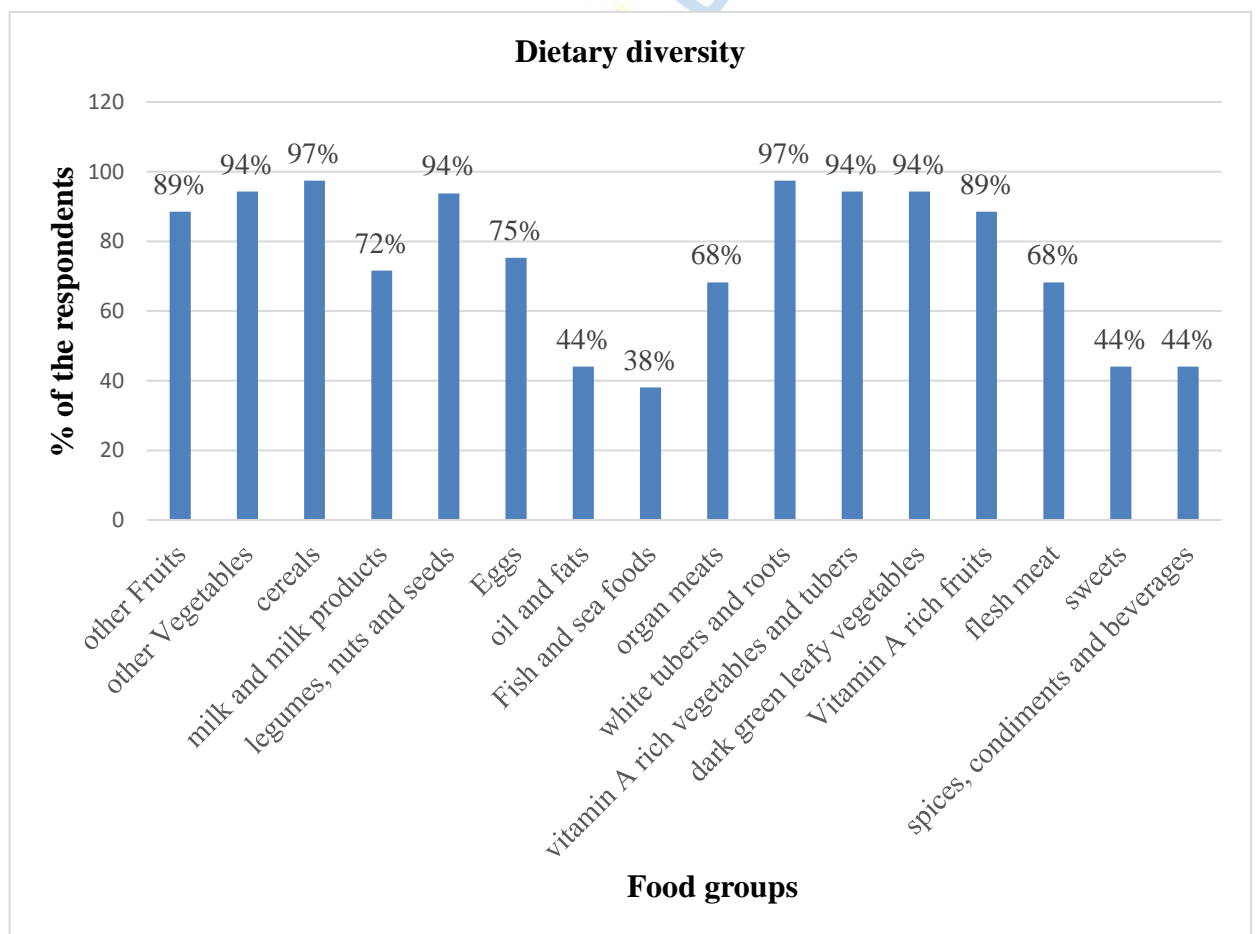


Figure 4.4. Dietary diversity of the respondents

Data obtained from the food groups consumed by the respondents was further used to establish the dietary diversity scores of the respondents. The dietary diversity scores were either low, medium, or high dietary diversity score as displayed below (Figure 4.5).

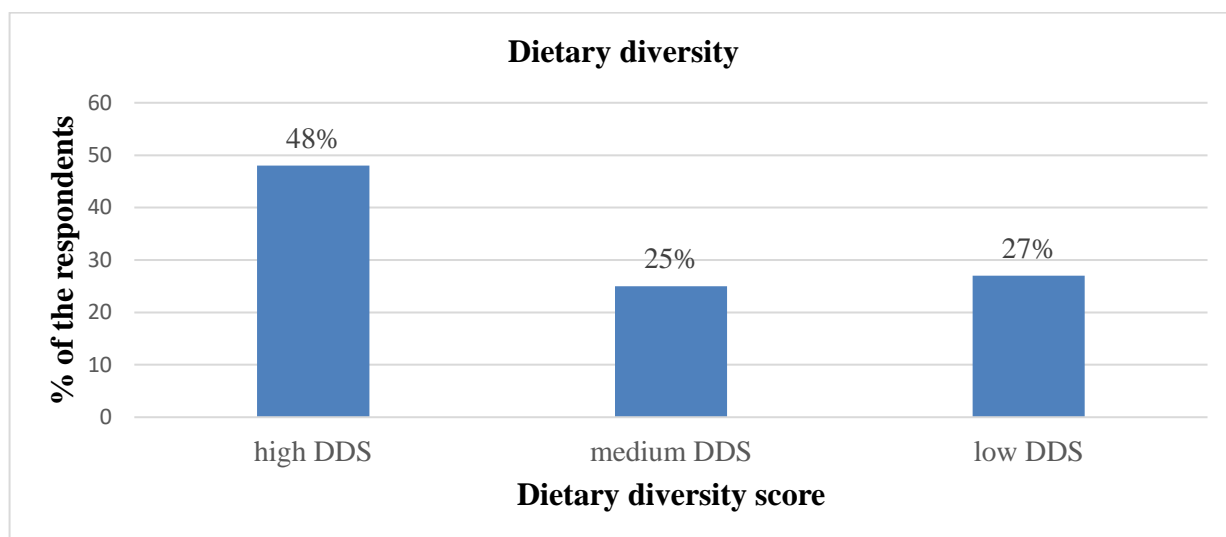


Figure 4.5. Dietary diversity score of the respondents

4.4 Nutrition status of the respondents

Most of the study participants 59% (n=227) were malnourished. The mean BMI was 25.0kg/m² ± 4.25SD. The malnutrition rate in this study was similar to those obtained by Norshariza et al., 2017 in a cross-sectional study carried out in Ethiopia to establish the prevalence and risk factors of malnutrition among adult cancer patients receiving chemotherapy treatment in a cancer center (58.4%). However, these results were higher when compared to a study done by Maciel et al., 2012 where he found malnutrition rates among cancer patients to be 29.4%. These rates were also higher when compared to results obtained from a study carried out in Ghana, Apprey et al., 2014, to assess the rate of malnutrition in a study population suffering from cancer, as the study established malnutrition rates to be at 34% within the Ghana study population. However, the results in this study were more or less similar to those obtained in 2015 by Hijiya et al., who found the rate of wasting to be at 16.4%.

These high rates of malnutrition among the study population could be because of cancer itself and the aggressive treatments employed against it, such as chemotherapy, radiation therapy, and surgical interventions, which often unleash multiple side effects that directly impact nutritional intake (Patel, et al., 2018). These side effects commonly include loss of appetite, alterations in taste perception, nausea, vomiting, and difficulty swallowing, collectively undermining a patient's ability to consume and retain essential nutrients. Moreover, the metabolic demands of cancer, coupled with potential malabsorption issues arising from the disease process or treatment-related gastrointestinal disturbances, can further compromise nutritional status (Rock et al., 2020).

Beyond the physiological challenges, cancer patients frequently experience unintended weight loss, partly attributable to increased energy expenditure and partly to the body's response to the tumor burden. Psychological factors, including anxiety, depression, and the emotional toll of confronting a life-threatening illness, can also influence dietary behaviours, potentially leading to decreased food intake and poor nutritional choices (Muscaritoli,2017). Furthermore, financial constraints may limit access to nutritious foods and specialized dietary support, exacerbating the risk of malnutrition. Additionally, the presence of tumors can directly interfere with nutrient utilization and metabolism, exacerbating the challenge of maintaining adequate nutrition (Bozzetti et al., 2017).

Addressing malnutrition in the context of cancer care necessitates a broad approach. This approach should encompass nutritional counselling tailored to individual patient needs, dietary modifications to accommodate taste changes and gastrointestinal issues, and the provision of appetite stimulants or antiemetics to alleviate treatment-related side effects.

Furthermore, supportive care interventions, including psychosocial support and financial assistance programs, play a crucial role in addressing the complex interplay of factors contributing to malnutrition in cancer patients. By prioritizing comprehensive nutritional support as an integral component of cancer treatment, healthcare providers can help optimize patient outcomes, and enhance quality of life.

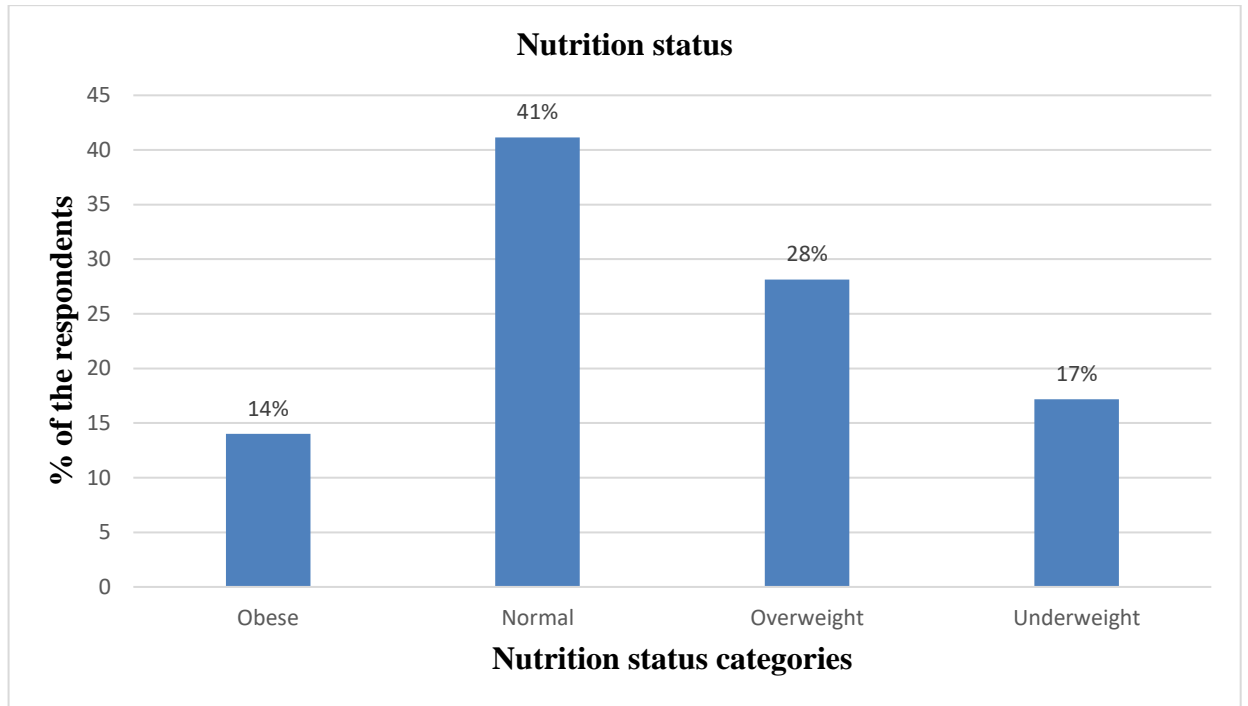


Figure 4.6. Nutrition status categories of the respondents

The nutrition status was also broadly classified as normal and malnourished as in the figure below (figure 4.7).

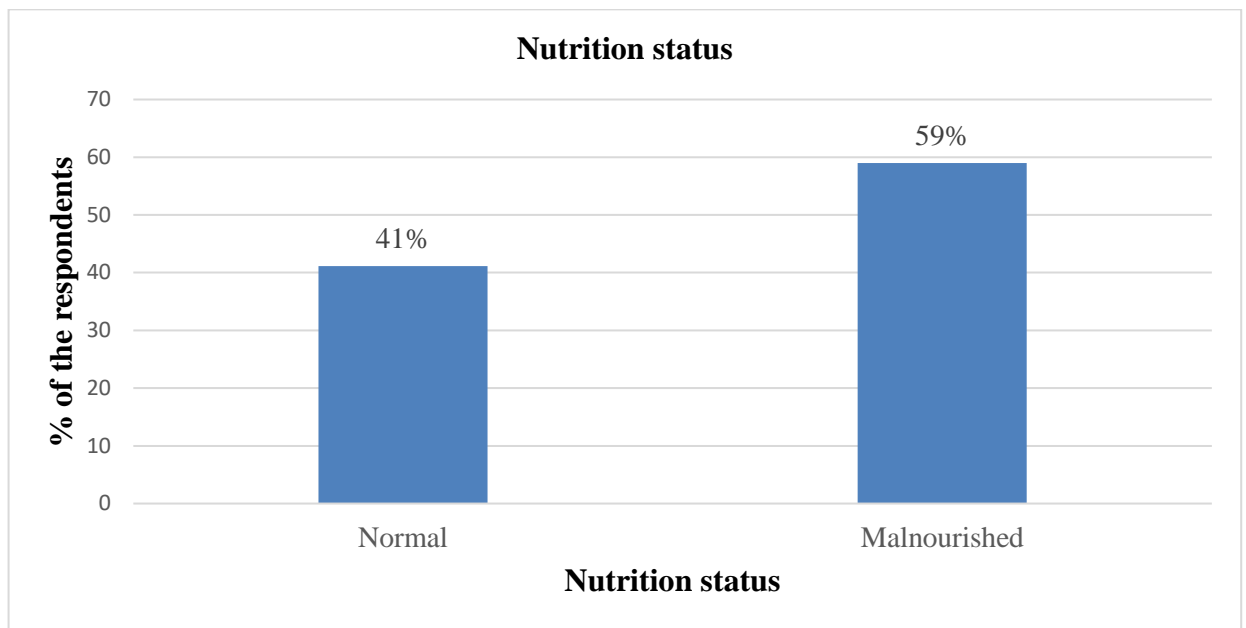


Figure 4.7. Nutrition status of the respondents

4.5 Demographic and socio-economic characteristics of the study population

The majority of the participants in this study were aged 36 years and above and they represented 89% (n=343) of the study population. The mean age was 44 years \pm 2.5SD. These results were similar to those obtained in a cancer study by Fitzmaurice et al.,2017, where they also found that, with age, one's probability of being diagnosed with cancer increased. However, they also found that this was the reverse with oesophageal cancer, whereby more younger people were diagnosed with cancer as opposed to the elderly ones. Bray et al., 2018 also found that cancer was common among those aged 55 years and above and the incidence rates increased with increasing age. Longer exposure to environmental factors and weaker immune systems could have been the contributing factor to having more participants aged 36 years and above having cancer compared to their younger counterparts (Limin et al., 2018). This could be a result of older individuals

having had more time exposed to environmental factors such as carcinogens, toxins, and infectious agents that can contribute to cancer development. Prolonged exposure to these factors over many years may increase the likelihood of cancer initiation. Besides, the immune system plays a crucial role in detecting and eliminating abnormal cells, including those that could become cancerous. As people age, their immune system may weaken, making it less effective at recognizing and destroying cancer cells.

More than half the respondents were female (n=254) and represented 66% of the study population. Similarly, Yang et al., 2019 found that men generally have lower prevalence and incidence rates of cancer in comparison to their female counterparts, due to the sex differences that eventually affect cancers of all types. However, contrary to the findings in this study, when Bray et al did a study in 2018, they found that the rate of men who had bladder cancer was up to four times more than that of the number of women with the same, whereas Siegel et al., 2017 found that gender differences do not have an impact on cancer prevalence as this is highly dependent on the type of cancer. The high cancer rates among women compared to men could be attributed to the health-seeking behaviours of women compared to their male counterparts. Women tend to seek healthcare more proactively than men (Calder et al., 2017). They are often more likely to schedule regular check-ups and screenings, which can lead to earlier detection of health issues. Other than that, women may tend to be more open about their health concerns and more likely to discuss symptoms with friends, family, or healthcare providers. This openness can lead to earlier recognition and diagnosis of health issues.

Those with lower levels of education- primary education and no formal education- were found to be more (n=164; 43%), compared to those with higher levels of education-

secondary and tertiary education- among the study respondents (n=220; 57%). This could be a result of lower levels of education often being associated with lower health literacy, which may result in a lack of awareness about cancer risk factors, symptoms, and preventive measures. Limited health literacy can affect individuals' ability to understand and follow medical advice. Given that educational attainment is associated with higher rates of certain behavioral risk factors for cancer, such as smoking, poor diet, and lack of physical activity, individuals with higher education levels may be more informed about healthy lifestyle choices and have better access to resources that support those choices (Arends et al., 2017).

The monthly household income category with the highest number of respondents was 1000-15000 shillings (n=196; 51%), while >45000 shillings was the least household income category received by the study participants as represented by 9% (n=33). The mean household income was 17000 ± 3000 shillings. Contrary to the findings in this study, Morgan et al.,2017 found that those with higher income rates had a higher prevalence and incidence rate of cancer compared to those who had lower income in Japan. This could be because economic instability among those with lower income is often associated with a lack of health insurance or limited access to healthcare services which can result in delayed diagnosis, limited preventive care, and reduced access to cancer screenings. On the other hand, those with higher income tend to adopt healthier lifestyles, with access to nutritious food, fitness resources, and education about the risks of unhealthy behaviors, in addition to living in cleaner environments with reduced exposure to carcinogens (Siegel et al., 2017).

Most of the study participants had household sizes of 4-6 as represented by 54% (n=209) of the respondents, while the least represented household size was >9 (n=2; 1%). Household members provide crucial social support to patients. Family members or housemates may offer emotional support, assistance with daily tasks, and companionship during treatment. It provides an opportunity for more individuals to be available to take on caregiving responsibilities (Fuchs et al., 2022). This can be especially beneficial for cancer patients who may require assistance with activities of daily living, transportation to medical appointments, and emotional support. The lower representation of family sizes more than nine could be attributed to the fact that the financial impact of cancer treatment can be significant.

The majority of the study respondents 55% (n=212) were self-employed, with the least, 18% (n=69) being unemployed. Most of the respondents could have been self-employed as this often provides greater flexibility in work hours and schedules. This flexibility can be crucial for cancer patients who may need to accommodate medical appointments, treatment sessions, and periods of rest or recovery. Being self-employed allows individuals to have more control over their work environment. This can be particularly important for cancer patients who may have specific needs related to their health, such as the ability to work from home or create a workspace that suits their comfort and well-being. Additionally, self-employment offers the opportunity to tailor work arrangements to fit individual needs. Cancer patients may find it easier to adapt their workload, take breaks as needed, and manage their workload in a way that supports their health. The fraction of respondents who are not working (18%) could be because cancer and its treatments can result in physical health challenges such as fatigue, pain, and side effects that make it difficult for individuals to maintain regular work schedules and perform job

duties. However, due to their unemployment status, they are likely to be faced with challenges of cancer management such as lack of access to treatment and drugs due to limited finances.

Table 4.1 Socioeconomic and demographic characteristics of the respondents

Characteristic	Frequency (N=384)	Percentage (%)
Sex		
Female	254	66
Male	130	34
Age category		
18-35	41	11
≥36	343	89
Mean age ± SD (years)	44±2.5	
Education status		
No formal education	33	9
Primary	131	34
Secondary	158	41
Tertiary	62	16
Household monthly income		
1000-15000	196	51
15001-30000	127	33
30001-45000	28	7
>45000	33	9
Mean ± SD (Kshs)	17000±3000	
Household size		

1-3	128	33
4-6	209	54
7-9	45	12
>9	2	1

Occupation status

Employed	103	27
Self-employed	212	55
Unemployed	69	18

4.6 Relationship between the study variables

4.6.1 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 (AOR=1.66; 95% CI=0.73,3.75). Similarly, Wei et al.,2018 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 (Wei et al., 2018). 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, 2017, 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.,2016 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 (Pedrazzoli et al., 2021). 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 (Marissa et al., 2015). 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.

Table 4.2. Relationship between nutrition status and nutrition-related side effects of cancer treatment

Variables	Malnutrition		COR(95 % CI)	P value	AOR(95 % CI)	P value
	Yes	No				
Main						
Treatment side effects						
Reduced appetite	137	14	1.00		1.00	
Vomiting	68	121	1.20(0.48,3.03)	0.696	1.66(0.77,3.58)	0.196
Diarrhea	17	13	1.33(0.50,3.57)	0.570	1.66(0.73,3.75)	0.002
Nausea	5	9	0.93(0.30,2.86)	0.903	1.21(0.47,3.09)	0.692

4.6.2 Relationship between nutrition status and dietary practices

In terms of dietary practices, an association was established when dietary diversity was assessed. A significant association was found between nutrition status and consumption of dark green vegetables (AOR=0.55; 95% CI=0.15,1.13), other fruits (AOR=0.51; 95% CI=0.21,1.09), fish and sea foods (AOR=1.59; 95% CI=1.13,3.02), legumes, nuts and seeds (AOR=2.47; 95% CI=1.02,4.28), and sweets (AOR=1.59; 95% CI=1.13,3.02) at p-values of 0.032, 0.051, 0.009, 0.003, and 0.035 respectively. An association was also established between dietary diversity score and nutrition status (AOR=0.46; 95% CI=0.46,1.44). These study findings were similar to those of a study carried out in Tanzania, whereby the prevalence of stunting was 31%, wasting 6%, and underweight 14%, and the

majority of the cancer study population (74%) had a minimum dietary diversity. Therefore, Consumption of a diverse diet was significantly associated with a reduction of stunting, wasting, and being underweight (Abeshu et al., 2016). Similarly, the prevalence of underweight, stunting, and wasting was 38, 41, and 22 %, respectively in a study carried out in India found an association between undernutrition and minimum dietary diversity (Pokhrel et al.,2016). However, these results differed in comparison to a study by Chang, 2018, whereby food insecurity was not significantly associated with nutritional status. The relationship between the nutrition status and dietary practices of the respondents is essential for assessing the overall well-being of cancer patients undergoing treatment. A balanced diet rich in essential nutrients is crucial for maintaining a normal nutrition status. In contrast, poor dietary practices can lead to undernutrition or contribute to overweight and obesity, both of which can have profound implications for the well-being and treatment outcomes of cancer patients. Given that all these studies were carried out in Africa, they depict that dietary practices have an impact on one's nutrition status.

Dietary patterns serve as pivotal determinants of the nutrition status of cancer patients, exerting various impacts on nutrient intake, energy balance, and overall health. A comprehensive understanding of dietary choices is crucial, as they play a vital role in providing essential nutrients necessary for immune function, tissue repair, and overall well-being. A diverse and balanced diet not only supports the body's ability to combat cancer but also helps patients endure the rigors of treatment (Samaan et al.,2013). Dietary patterns can significantly influence body weight management, with implications ranging from preserving muscle mass to mitigating malnutrition-related complications and bolstering treatment tolerance. Moreover, dietary choices extend their reach to gastrointestinal health, hydration status, immune function, and the management of

treatment-related side effects. For instance, a diet rich in immune-boosting nutrients like vitamins, minerals, antioxidants, and phytochemicals can fortify the body's defense mechanisms, potentially reducing the risk of infections and treatment-associated complications (Corbella et al., 2021). By offering personalized dietary counselling, nutritional interventions, and comprehensive supportive care measures, healthcare providers can empower cancer patients to make informed dietary choices that not only optimize their nutrition status but also foster resilience, improve treatment outcomes, and elevate overall well-being throughout their cancer journey

Table 4.3. Relationship between nutrition status and dietary practices- dietary diversity

Food group	Malnutrition		COR(95%CI)	P Value	AOR(95%CI)	P Value
	Yes	No				
Cereals	22	14	1.00		1.00	
White tubers and roots	24	4	0.66(0.41,2.02)	0.079	0.58(0.36,1.40)	0.197
Vit A rich vegetables and tubers	11	2	0.63(0.50,2.33)	0.409	0.94(0.49,1.91)	0.761
Dark green vegetables	37	16	0.68(0.33,1.30)	0.302	0.55(0.15,1.13)	0.032
Other vegetables	41	12	0.55(0.35,1.10)	0.157	0.51(0.21,1.09)	0.051

Vit A rich fruits	10	15	0.61(0.33,1.03)	0.132	0.77(0.31,1.34)	0.320
Other fruits	4	3	0.51(0.24,1.18)	0.188	0.54(0.23,1.15)	0.178
Organ meat	6	4	0.72(0.31,1.54)	0.469	0.63(0.36,1.46)	0.219
Flesh meats	1	2	0.88(0.45,1.66)	0.850	0.66(0.23,1.66)	0.418
Eggs	42	15	0.46(0.20,1.06)	0.054	0.41(0.15,1.02)	0.493
Fish and sea foods	1	9	1.51(1.01,2.33)	0.004	1.59(1.13,3.02)	0.009
Legumes, nuts and seeds	2	15	2.04(1.36,3.36)	0.001	2.47(1.02,4.28)	0.003
Milk and milk products	4	16	9.25(1.18,91.62)	0.023	2.54(0.46,33.72)	0.522
Oil and fats	7	4	1.67(1.17,3.38)	0.026	1.55(0.35,3.22)	0.119
sweets	6	9	1.51(1.01,2.23)	0.004	1.59(1.13,3.02)	0.035
Spices, condiments and beverages	9	17	1.20(1.12,2.34)	0.044	1.18(0.36,2.32)	0.446

No association was also established between meal frequency and nutrition status when assessed (Figure 4.4).

Table 4.4. Relationship between nutrition status and dietary practices-meal frequency

Variables	Malnutrition		COR(95 % CI)	P value	AOR(95 % CI)	P value
	Yes	No				
Meal frequency						
Less than 3	10	54	1.00		1.00	
3 or more	217	103	0.70(0.24,1.26)	0.526	0.49(0.19,1.26)	0.138

Association was established between nutrition status and dietary diversity score

Table 4.5. Relationship between nutrition status and dietary diversity scores

Variables	Malnutrition		COR(95%CI)	P Value	AOR(95%CI)	P Value
	Yes	No				
Low DDS	47	57	1.00		1.00	
Medium DDS	31	65	0.63(0.27,1.47)	2.197	0.8(0.27,2.41)	1.984
High DDS	112	72	1.28(0.36,4.49)	1.835	0.46(0.46,1.44)	0.003

4.6.3 Relationship between Nutrition status and socioeconomic and demographic characteristics of the Respondents

Age (p value= 0.003), was found to be statistically significant (AOR=7.73; 95% CI=1.88, 24.11). Those aged 36-41 years were six times more likely to be malnourished than those

aged less than 36 years. These findings were similar to those of a cross-sectional study carried out by MacIntosh et al., 2019, which depicted an increased likelihood of cancer patients being malnourished as they aged given that body weight, body mass index, mid-upper arm circumference, haemoglobin, serum albumin, and plasma ascorbic acid lower in people aged seventy-five years and above compared with those lower than seventy-five years, though this was not statistically significant. In as much as the two studies varied in the establishment of statistically significant relationships, what they both brought forth is the association between age and nutrition status. Older adults might be at higher risk of malnutrition due to age-related changes in metabolism and muscle mass (Caillet et al., 2017). Different age groups may experience these side effects differently due to their unique physiological and lifestyle factors.

Gender ($p=0.006$) was found to have an association with nutrition status (AOR=2.64; 95% CI=1.33,5.26) among the respondents in this study. Females were twice as likely to be malnourished in comparison to their male counterparts. This was in line with a study carried out in Taiwan by Mathew et al. 2016 to determine the impact of sociodemographic factors on nutrition status, which found a positive correlation between gender and nutrition status. Given that the majority of my study population was female (66%), this could have translated to the aspect that more females had early interventions made about any nutrition-related side effects that they were facing, hence nutrient optimization.

Primary (AOR=10.81; 95% CI=1.29,90.66), secondary (AOR=11.12, 95% CI=1.78,69.68), and tertiary (AOR=12.29; 95% CI=2.07,72.92) levels of education had an association with nutrition status at 0.028, 0.010, and 0.006 p values respectively. These results were similar to those of a study in India which found that the prevalence of

underweight, stunting, and wasting to be 38%, 41%, and 22 %, respectively, and the rate of malnutrition was significantly higher among those who were illiterate and within the low-income group (Pokhrel et al.,2016). These two studies show that lack of knowledge and finances could lead one to make incorrect dietary choices as fifteen participants in my study were having either one or two meals in a day while undergoing treatment. Education plays a role in health literacy and understanding the importance of proper nutrition. Respondents with higher education levels may be more proactive in seeking and following nutritional advice, potentially leading to better nutrition status (Wardle et al., 2013). Respondents' educational backgrounds play a crucial role in shaping their understanding and management of nutrition-related side effects during cancer treatment. Individuals with a secondary education level, as noted by Wardle et al.,2013, tend to possess a moderate grasp of health and nutrition, making them more likely to access and comprehend information regarding the management of nutrition-related side effects in the context of cancer treatment. Nevertheless, this group can still benefit from targeted education and support to optimize their dietary choices during this challenging period. On the other hand, individuals with tertiary education may have greater access to resources and a more comprehensive understanding of nutrition, leading to proactive information-seeking and informed dietary decisions. However, this group may also face higher expectations regarding their ability to self-manage nutrition during cancer treatment. In contrast, respondents with only primary education, as per NHS (2018), may encounter limited access to health information and resources, emphasizing the need for additional support and education to navigate the challenges of nutrition-related side effects during cancer treatment. Finally, those without any formal education face significant barriers to understanding and managing such side effects, necessitating special attention to ensure they receive basic nutritional guidance and support throughout their cancer treatment

journey. Monthly household income was found to have no relationship with any of the categories of nutrition status. Monthly household income can significantly influence access to and affordability of nutritious food. Low-income households may face challenges in purchasing special dietary items or nutritional supplements, potentially impacting their nutrition status (Chapman et al., 2017).

Household size ($p=0.039$), had a significant relationship with nutrition status (AOR=1.79; 95% CI=1.03,3.12). This could be an indication of the potential role of family support or available resources in larger households. A different study in North-eastern Peninsular Malaysia found that household size ($P = 0.024$) was a significant risk factor for household food security and eventually nutrition status for cancer members of the household (Mohamadpour et al., 2018). This depicts the great impact that household size has on nutrition status, given that the two studies were carried out in a third-world country and a developed country respectively. Household size can have notable implications for the prevalence of nutrition-related side effects. Larger households may face resource constraints and require careful planning to meet the nutritional needs of both the cancer patient and the entire family. In contrast, smaller households may have more flexibility in accommodating the dietary needs of the cancer patient. Understanding the household size of respondents is crucial for tailoring interventions and support programs for cancer patients. Larger households may need assistance in budgeting and meal planning to ensure proper nutrition for all members, while smaller households could benefit from education and support specific to their unique situation.

Occupation status had a p-value of 0.002 thus an association with nutrition status (AOR=2.57; 95% CI=1.42,4.68). Those who were self-employed were twice as likely to

be malnourished than those who were either unemployed or employed. This suggests that the occupation of the respondents had a substantial impact on their nutrition status. Self-employed individuals may not have flexibility in managing their work schedules and taking time off for medical appointments or managing side effects due to the need to make higher profits for their businesses. They might face financial uncertainties, especially if their businesses are impacted by their cancer treatment or if they lack health insurance and paid sick leave (Kawakita et al., 2016). Self-employed cancer patients may also face a heightened risk of malnutrition compared to both employed and unemployed individuals due to a lack of access to employee benefits such as paid sick leave, health insurance, and employer-sponsored wellness programs, which can provide financial and practical support during cancer treatment. This can result in increased financial strain and limited resources to afford nutritious foods or access supportive services like nutritional counselling. Additionally, the flexible nature of self-employment may lead individuals to prioritize work commitments over personal health, potentially neglecting dietary needs or delaying seeking medical attention for cancer-related symptoms. Moreover, self-employed individuals may experience greater stress and anxiety about maintaining their livelihoods and business responsibilities while undergoing cancer treatment, which can further impact appetite and dietary habits. Overall, the combination of financial challenges, lack of benefits, and increased work-related stressors makes self-employed cancer patients particularly vulnerable to malnutrition compared to their employed and unemployed counterparts. Understanding the occupation of respondents is essential for tailoring interventions and support programs for cancer patients. For self-employed individuals, interventions could focus on financial support, such as access to health insurance or guidance on managing business responsibilities during treatment. For those who are employed, interventions may include educating employers about the specific

needs of employees with cancer and providing resources for employees to balance work and treatment. In addition, supportive workplace policies, such as flexible hours or remote work options, can benefit employed individuals managing cancer and its side effects (Sharp et al., 2019). For respondents who are not employed, interventions might focus on providing access to financial assistance programs and support systems to ensure they can manage their nutrition and treatment effectively. The occupation of respondents is a significant factor in assessing the prevalence of nutrition-related side effects of cancer treatment. It emphasizes the importance of recognizing the work-related challenges and resources that different occupational groups may have and tailoring interventions accordingly.

Table 4.6. Relationship between nutrition status and socioeconomic and demographic characteristics of the respondents

Variables	Malnutrition		COR(95 % CI)	P value	AOR(95 % CI)	P value
	Yes	No				
Age						
category						
18-23	8	2	1.00		1.00	
24-29	24	6	1.38(0.31,6.09)	0.659	1.08(0.19,6.23)	0.932
30-35	11	9	0.84(0.39,1.81)	0.670	0.38(0.03,3.99)	0.417
36-41	36	3	0.22(0.07,0.68)	0.008	6.73(1.88,24.11)	0.003
42-47	17	17	1.55(0.49,4.82)	0.448	0.58(0.20,1.71)	0.329
>47	131	120	0.09(0.08,0.98)	0.049	0.89(0.17,4.69)	0.897
Occupational						
status						

Unemployed	37	32	1.00		1.00	
Self -Employed	149	43	2.14(1.36,3.36)	0.001	2.57(1.42,4.68)	0.002
Employed	41	82	0.00(0.00,0.00)	0.000	1.88(0.80,4.44)	0.149
Level of education						
No education	16	10	1.00		1.00	
Primary	105	34	1.76(0.51,6.10)	0.373	10.81(1.29,90.66)	0.028
Secondary	73	85	0.49(0.19,1.29)	0.151	11.12(1.78,69.68)	0.010
Tertiary	33	28	0.77(0.31,1.96)	0.596	12.29(2.07,72.92)	0.006
Sex						
Male	106	93	1.00		1.00	
Female	121	64	0.47(0.24,0.91)	0.025	2.64(1.33,5.26)	0.006
Monthly income						
1000-15000	54	108	1.00		1.00	
16000-30000	50	28	0.42(0.15,1.21)	0.010	1.43(0.27,7.49)	0.672
31000-45000	15	13	1.19(0.20,7.08)	0.849	3.07(0.58,16.28)	0.189
>45000	108	8	0.29(0.11,0.81)	0.018	5.85(0.65,52.62)	0.115
Household size						
1-3	36	94	1.00		1.00	
4-6	112	47	1.71(1.11,2.63)	0.014	1.79(1.03,3.12)	0.039
7-9	77	16	5.06(4.82,5.81)	0.631	4.31(0.35,4.33)	0.693
>9	2	0	5.80(3.75,7.76)	0.675	0.78(0.22,2.34)	0.738

4.7 Hypotheses testing

The first hypothesis which stated that " There is no significant relationship between demographic and socioeconomic characteristics and nutrition status of cancer patients attending Texas Cancer Center, Kenya" was rejected since there were significant associations between age, gender, level of education, occupation status, and household size, and the nutrition status of the respondents. Hypothesis number two which stated that "There is no significant relationship between cancer treatment nutrition-related side effects and nutrition status of cancer patients attending Texas Cancer Centre, Kenya" was rejected since logistics regression showed that the relationship between nutrition-related side effects of cancer treatment and nutrition status among the study respondents. The third hypothesis which stated that, "There is no significant relationship between dietary practices and nutrition status of cancer patients attending Texas Cancer Center, Kenya" was rejected since logistics regression showed a significant relationship between dietary practices and nutrition status.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The majority of the study respondents were females, aged 36 and above, malnourished, and self-employed. The prevalence of nutrition-related side effects of cancer treatment was 34% as per the objective of this study, with the most common main symptom among the respondents being reduced appetite (38%). The mean dietary diversity score was $3 \pm 1SD$, with the majority of the study participants having a high dietary diversity score. Factors associated with nutrition status were age, sex, level of education, household size, occupation status, dietary practices, and nutrition-related side effects of cancer treatment.

5.2 Conclusions

The study makes the following conclusions:

1. Most of the respondents were females, with primary as their highest level of education, and within the low-income category.
2. The majority of cancer patients experienced reduced appetite as the main symptom following treatment, while the least experienced main symptom was nausea.
3. Most respondents had three meals or more in a day and had a high dietary diversity score.
4. Malnutrition among the cancer patients was high with the majority being overweight.
5. Cancer treatment nutrition-related side effects, dietary practices, occupation status, level of education, age, gender, and household size were factors associated with the nutrition status of cancer patients.

5.3 Recommendations of the study

5.3.1 Recommendations for Policy

Mandatory nutritional screening and assessment protocols for all cancer patients at the time of diagnosis and throughout treatment should be put in place. This will help identify patients at risk of malnutrition early.

5.3.2 Recommendations for Practice

This study has brought to light that majority of the cancer patients have a compromised nutrition status. Providing nutrition education to this group of patients is key to ensuring that they are well-nourished. In light of these findings, this study recommends that nutritionists and dietitians be at the forefront of carrying out weekly nutrition assessments on cancer patients to help curb malnutrition. This will help to minimize the risk of being malnourished following symptoms that may impact oral intake and nutrition absorption. Given that this study depicted a significant relationship between age and the nutrition status of cancer patients, elderly patients should also be encouraged to have multivitamins to help counter any nutrient deficiencies.

5.3.3 Recommendations for Further Research

Studies on drug-nutrient interaction will be key to assessing the effects of drugs used for cancer treatment on nutrition status. Interventional studies will also be key in ascertaining the impact of carrying out weekly nutritional assessments on cancer patients to identify those at risk of malnutrition.

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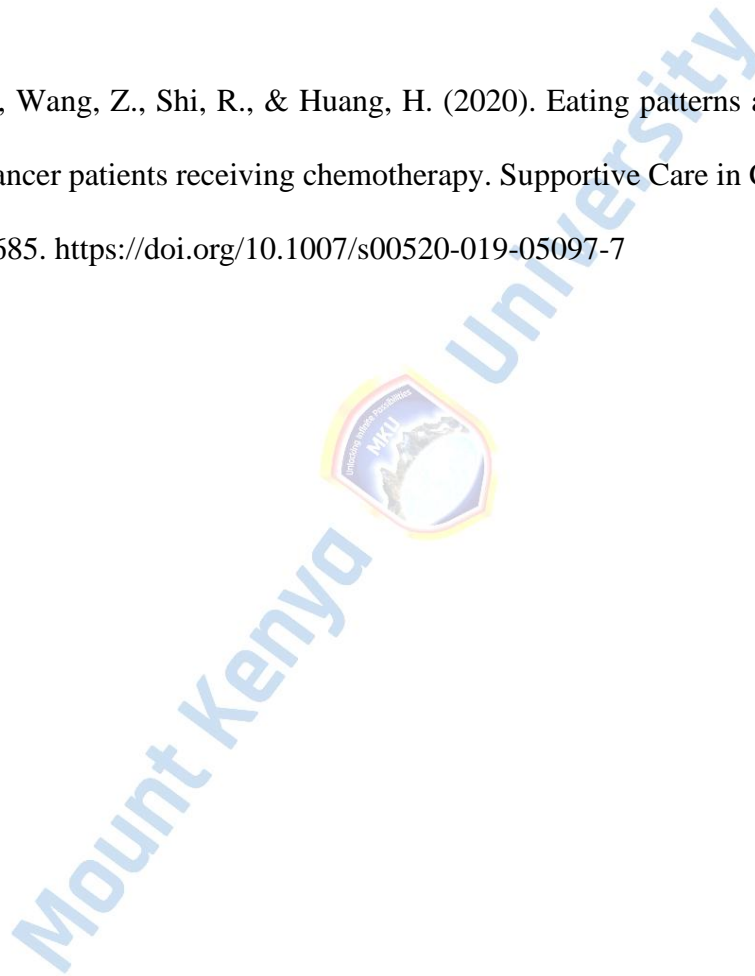
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APPENDICES

APPENDIX A: INFORMED CONSENT

Hello, I am Elizabeth Oduor, a student at Mount Kenya University, department of public health. I am undertaking research entitled “To assess cancer treatment nutrition related side effects and nutrition status of adult cancer patients attending Texas Cancer Center”.

I am interested in learning about the sociodemographic characteristics, dietary intake, and nutrition related side effects of treatment among cancer patients, and how these factors affect the nutrition status of cancer patients. I will be happy if you can spare some minutes to answer some questions. I would like to seek answers on your dietary practices, and any form of nutrition related effects that have come up since you started treatment. I will then take your weight, height and mid upper arm circumference measurements. Results from this study will be use in coming up with nutrition policies that will aim to improve the nutrition status of adult cancer patients seeking treatment. All the information that you will provide will be held in confidentiality, and only be shared with my supervisor. Your name will not be written in the questionnaires as serial numbers will be used instead, and the participation is voluntary. Kindly feel free to inform me when we get to a question that you would not like to answer.

For you to participate, you must give consent.

Study Procedure

I will ask you questions on dietary practices, demographic characteristics and nutrition related side effects of treatment. It will take about 45 minutes to complete the questionnaire. After this, I will request you to stand for me to take your weight, weight and mid upper arm circumference.

Risks

There are no risks involved in being a participant of this study.

Benefits

There are no direct benefits to you if you choose to be a participant in this study. However, findings from this study will contribute to the knowledge of cancer, and not only help in management of adult cancer patients but also in formulating policies that will help improve nutrition status of adults cancer patients.

Ethical issues and Confidentiality

Information shared will be kept confidential and not be shared with any other party other than my supervisor.

Contacts:

For any questions regarding this study, make enquiries anytime during the study period. You can also call me 0706381800 or email me at lizleahmuruka24@gmail.com. You can even contact the faculty advisor, the Dean of School, School of Public Health through publichealth@mku.ac.ke. If you have any question on how your information will be kept confidential in this research, or if you have been placed at risk, you can contact the Mount Kenya University, Institutional, Scientific and Ethical Review Committee (IERC) office at rsearch@mku.ac.ke.

Signature of interviewer: Date:

Signature of respondent:.....Date:.....

Contacts..... Email:.....

APPENDIX B: RESAERCHER ADMINISTERED QUESTIONNAIRE

Socioeconomic and demographic characteristics:

Questions	Responses
Sex	<ol style="list-style-type: none"> 1. Male 2. Female
Age	-----
Level of Education	<ol style="list-style-type: none"> 1. No formal education 2. Primary Education 3. secondary education 4. Tertiary Education
Average household income	
Household size	
Occupation	

Nutrition related side effects of cancer treatment:

Have you experienced any side effect which affected your dietary intake?

1. Yes
2. No

If yes , which side effect?

1. Reduced appetite
2. Vomiting
3. Diarrhea
4. Nausea

Duration?

Did you seek treatment?

1. Yes
2. No

Where did you seek treatment?

1. At TCC
2. Elsewhere

Nutrition status assessment:

Weight in kg:

- 1.
- 2.
- 3.

Height in cm:

- 1.
- 2.
- 3.

BMI:

- 1.
- 2.
- 3.



Dietary intake:

Modified food frequency questionnaire

Question		Answer			Points		Comments
Q1	How many portions of fruit do you have on an average day?	0 portions = 0 points	1 - 2 portions = 3 points	3 or more portions = 0 points			
	<i>1x portion = 80g, (1x handful fresh, tinned or frozen fruit (e.g. 1x apple, 2x kiwi fruits, 6 strawberries)), or 1/2 handful of dried fruit.</i>						
Q2	How many portions of vegetables do you have on an average day?	0 - 3 portions = 0 points	4 or more portions = 3 points				
	<i>1x portion = 80g, or ~2x handfuls fresh, frozen, tinned vegetables (e.g. 3x heaped tbsp. boiled vegetables, 8x cauliflower florets)</i>						

Q3	How many portions of cereals or grains (e.g. rice, corn, oats or wheat) do you have at every mealtime?	Not at every mealtime = 0 points	1 - 2 portions at every meal = 3 points	3 or more portions = 0 points			
	<i>1x portion = ~the size of your fist (e.g. medium 30g bowl of porridge, 1x Weetabix, 2tbsp rice, 1x slice of wholemeal bread)</i>						
Q4	How many portions of low fat dairy (e.g. low fat yoghurts, reduced fat cheese, skimmed/semi-skimmed milk) do you have on an average day?	0 - 1 portions = 0 points	2 portions = 2 points	3 or more portions = 0 points			
	<i>1x portion = 30g hard reduced fat cheese (~the size of a matchbox), 2tbsp low fat cream cheese,</i>						

	200ml milk or 1x small yoghurt pot						
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Q5	How many portions of legumes (lentils, chickpeas, beans of all types, pulses) do you have in an average week?	0 - 1 portions	2 or more portions		
	<i>1x portion = ~the size of your palm (e.g. 1x handful of chickpeas, 1x small tin of baked beans, 3tbsp kidney beans)</i>	<i>= 0 points</i>	<i>= 2 points</i>		
Q6	How many eggs do you have in an average week?	0 - 4 eggs	5 or more eggs		
		<i>= 1 point</i>	<i>= 0 points</i>		
Q7	How many portions of fish (all types, fresh, frozen or tinned) do you have in an average week?	0 - 1 portions	2 or more portions		
	<i>1x portion = ~the size of your whole hand (e.g. 1x medium fillet of white or oily fish, 2x small tins sardines or tuna, 3x fish fingers)</i>	<i>= 0 points</i>	<i>= 1 point</i>		

Q8	How many portions of oily fish (salmon, trout, mackerel, sardines, kippers, herrings) do you have in an average week?	0	1 or more portions		
	<i>1x portion = ~the size of your whole hand (e.g. 1x medium fillet of salmon, 2x small tins sardines)</i>	<i>= 0 points</i>	<i>= 1 point</i>		
Q9	How many portions of white meat (poultry, chicken, turkey) do you have in an average week?	0 - 2 portions	3 or more portions		
	<i>1x portion = ~the size of your hand (e.g. 1x chicken breast, 125g or 1/4 pack of turkey mince)</i>	<i>= 1 point</i>	<i>= 0 points</i>		
Q10	How many portions of red meat (pork, bacon, sausages, ham, beef, mince, lamb) do you have per week?	0 - 1 portions	2 or more portions		
	<i>1x portion = ~the size of your palm (e.g. 1x burger, 2x sausages, 125g or 1/4 pack of beef/lamb mince, 5x slices of ham, 1x pork medallion)</i>	<i>= 1 point</i>	<i>= 0 points</i>		

	TOTAL=
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Meal frequency score

24hour recall:

Food	Source			Time consumed	Food ingredients
Food description	Recipe if home made	Ready to eat	Restaurant		

FAO standardized dietary diversity questionnaire

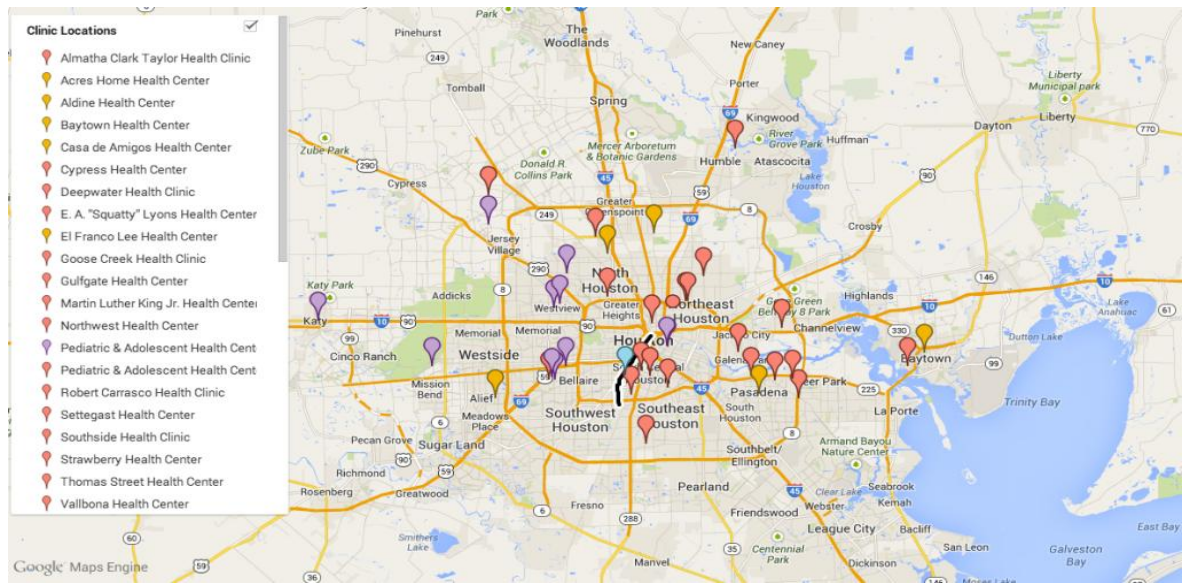
Question number	Food group	Examples	YES=1 NO=0
1	Cereals	Corn, maize, sorghum, millet	
2	White tubers and roots	White potatoes, white yam, white cassava	

3	Vitamin A rich vegetables and tubers	Pumpkin, carrot, red sweet pepper, sweet potatoes that orange inside	
4	Dark green leafy vegetables	Amaranth, spinach, kale, cassava leaves	
5	Other vegetables	Tomato, onion, eggplant	
6	Vitamin A rich fruits	Ripe mango, apricot, white papaya, dried peach, 100% fruit juice made from these	
7	Other fruits	Wild fruits, other fruits, 100% fruit juice made from these	
8	Organ meat	Liver, kidney, heart, other organ meats or blood based foods	
9	Flesh meats	Beef, pork, lamb, goat, rabbit, chicken, duck, insects	
10	Eggs	Eggs from chicken, duck, guinea fowl	
11	Fish and sea food	Fresh or dried fish or shellfish	
12	Legumes, nuts and seeds	Dried beans, dried peas, lentils, nuts, seeds or foods from these eh peanut butter	
13	Milk and milk products	Milk, cheese, yoghurt, any milk products	

14	Oil and fats	Oil, fats, or butter added to food or used for cooking	
15	Sweets	Sugar, honey, sweetened soda or fruit juice, sugary foods eg candy, chocolate	
16	Spices, condiments, beverages	Salt, black pepper, sauce, coffee, tea. Alcoholic beverages	



APPENDIX C: MAP- LOCATION OF TEXAS CANCER CENTER



APPENDIX D: NACOSTI APPROVAL


REPUBLIC OF KENYA

Ref No: 247263

RESEARCH LICENSE



This is to Certify that Ms. ELIZABETH ACHIENG ODUOR of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: ASSESSMENT OF CANCER TREATMENT NUTRITION RELATED SIDE EFFECTS AND NUTRITION STATUS OF ADULT CANCER PATIENTS ATTENDING TEXAS CANCER CENTER, KENYA for the period ending : 26/April/2024.

License No: NACOSTIP/23/25235

Applicant Identification Number 247263

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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APPENDIX E: MKU ERC APPROVAL



REF: MKU/ISERC/2685

Date: 05 April 2023

TO: ELIZABETH ACHIENG ODUOR

REG: MPH/2021/86733

Dear Sir/Madam,

RE: ASSESSMENT OF CANCER TREATMENT NUTRITION RELATED SIDE EFFECTS AND NUTRITION STATUS OF ADULT CANCER PATIENTS ATTENDING TEXAS CANCER CENTER, KENYA


This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1729**. The approval period is **05/04/2023 - 04/04/2024**.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including informed consents, study instruments, MTA will be used
- ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
- vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,



The Chairman
Mount Kenya University
Ethics Review Committee
P. O. Box 342 - 0100, Thika

Dr. Peter G. Kirira
Chairman, Mount Kenya University ISERC

APPENDIX F: MKU INTRODUCTION LETTER



DIRECTORATE OF GRADUATE STUDIES

MPH/2021/86733

5th April, 2023

*National Commission for Science Technology & Innovation (NACOSTI)
Off Waiyaki Way, Upper Kabete,
P.O Box 30623- 00100
NAIROBI, KENYA*

Dear Sir/Madam,

RE: ELIZABETH ACHIENG ODUOR - REGISTRATION NO. MPH/2021/86733

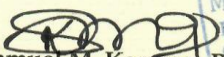
The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health** in the department of **Community Health Epidemiology and Biostatistics** in the school of **Public Health**.

The title of the research is "**Assessment of Cancer Treatment Nutrition Related Side Effects and Nutrition Status of Adult Cancer Patients Attending Texas Cancer Center, Kenya.**"

It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between **April, 2023 and June, 2023**.

Any assistance accorded to the student will be highly appreciated.

Thank you.


Dr. Samuel M. Karega Ph.D.
Director, Graduate Studies
Enc.

Mount Kenya University
P.O. Box 342 - 01000, THIKA
Office of the Director
Graduate Studies

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
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Unlocking Infinite Possibilities

APPENDIX G: SIMILARITY INDEX ENDORSED BY SUPERVISORS

Page 1

CANCER TREATMENT NUTRITION-RELATED SIDE EFFECTS AND THE NUTRITION STATUS OF ADULT CANCER PATIENTS ATTENDING TEXAS CANCER CENTER, KENYA

by Anne Edith

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Page 2

CANCER TREATMENT NUTRITION-RELATED SIDE EFFECTS AND THE NUTRITION
STATUS OF ADULT CANCER PATIENTS ATTENDING TEXAS CANCER CENTER, KENYA

ELIZABETHACHIENG ODUOR

A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE
OF
MOUNT KENYA UNIVERSITY