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Original Article

Nutritional Status, Calorie Intake and Food Modification Among Esophageal, Head and Neck Cancer Patients Utilizing Gastrostomy Tube at Kenyatta National Hospital

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Nutritional Status, Calorie-intake, Food Modification, Esophageal, Head and Neck Cancers.

ABSTRACT

Esophageal, head and neck cancers (EC and HNC) significantly impair swallowing and ingestion. These cancers affect the upper digestive and respiratory tracts and might make caloric intake and nutrition status difficult to maintain. Gastrostomy tubes are crucial for managing dysphagia, allowing delivery of modified food for optimal nutrition. Malnutrition affects 40-80% of patients, with 15% losing over 10% of body weight, contributing to a 20% mortality rate. This study aimed to determine nutritional status outcomes, calorie intake and food modification among EC and HNC patients utilizing gastrostomy tube at Kenyatta National Hospital (KNH). The study design used a prospective institutional-based cross-sectional study with an analytical component. It was carried out from October 2023 to March 2024 with a sample size of 103 respondents and determined the relationship between the study variables. The study was conducted in KNH at the Cancer Treatment Centre and Radiotherapy Clinic. It's the largest referral hospital in East and Central Africa and handles all types of cancers. Data collection used a 24-hour recall and PG-SGA. Analysis used Statistical Package for Social Sciences software Version 25.0. Most participants (84.5%) were on modified food and 81.6% had low-calorie intake of < 500 Kcals. The mean age was 56.2 years, 61.2% were male, while 38.8% were female. The majority (56.3%) were underweight, 40.8% normal, and 2.9% overweight. The calorie intake was inadequate. It was evident that food modification was highly correlated with the poor nutritional status of the EC and HNC gastrostomy-fed clients. These findings highlight the need for enhanced nutrition support protocols and individualised dietary interventions in clinical practice. While purposive sampling enhanced relevance and accuracy, there was a possibility of recall bias from the 24-hour dietary recall, though questions were exhaustively asked to minimise this limitation.

APA CITATION

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INTRODUCTION

Esophageal and head and neck cancers pose significant challenges in nutritional management due to the anatomical and functional impairments they cause, both from the malignancies themselves and their treatments. Patients with esophageal cancer (EC) and head and neck cancer (HNC) frequently encounter oral feeding difficulties such as dysphagia, which severely affects their nutritional status (1). Upon diagnosis, many of these patients exhibit signs of malnutrition, which are compounded by the side effects of multimodal treatments, increasing their risk for nutritional deficiencies. Feeding challenges arise from dysphagia, upper gastrointestinal obstruction, and anorexia, alongside the inability to tolerate a normal diet (2).

These malignancies disrupt the upper digestive and respiratory tracts, impairing essential functions such as swallowing and caloric intake, which further compromises their nutrition. Nutrition refers to the process by which these patients using gastrostomy tubes receive adequate food that maintains their health, supports recovery, and prevents malnutrition. In managing dysphagia, gastrostomy tubes play a crucial role, necessitating modified food to facilitate easier swallowing and digestion. The stark reality is that cancer-related mortality remains a pressing global health issue, with malnutrition impacting 40-80% of patients, leading to significant weight loss in 15% of cases and a mortality rate of up to 20% (3).

While these challenges are well documented globally, their impact within low- and middle-income countries such as Kenya requires further contextualization. In Kenya, the incidence of esophageal cancer is particularly alarming, with rates reaching 17.6 per 100,000 citizens. Additionally, head and neck squamous cell carcinoma ranks as the sixth most prevalent malignancy worldwide, contributing to the staggering 890,000 new cases and 450,000 deaths recorded in 2018 (4,5). This transition from global epidemiological trends to the Kenyan cancer burden illustrates the urgency of addressing nutritional care within this setting.

Food modification, which encompasses adjustments of the texture and consistency through blending of cooked food for patients with dysphagia and those affected by cancer treatments that impact the oral and pharyngeal cavities, for passage via gastrostomy tube. Insufficient protein and caloric intake can exacerbate weight loss and muscle wasting, further jeopardizing patients' nutritional status and their ability to tolerate cancer treatments (6). Therefore, ensuring adequate caloric and protein intake is vital, given the elevated metabolic demands associated with cancer and its treatment (7).

While literature globally has extensively examined the role of food modification in the management of dysphagia, there is a notable paucity of region-specific empirical evidence from sub-Saharan Africa. This study offers a novel contribution by specifically evaluating the

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interrelationship between caloric intake, food modification practices, and nutritional status outcomes among esophageal and head and neck cancer patients receiving gastrostomy feeding in the Kenyan context. By bridging this knowledge gap, the study contributes uniquely to the literature in sub-Saharan Africa and supports the development of culturally appropriate nutrition support strategies.

This study aimed to assess the nutritional status outcomes, calorie intake, and food modifications among esophageal and head and neck cancer patients utilizing gastrostomy tubes at Kenyatta National Hospital. The findings are important in informing healthcare professionals including oncologists, nutritionists, and nurses, as well as researchers and policymakers from the Ministry of Health in the delivery of optimal during through modified foods.

METHODOLOGY

Study Area and Population

The study was conducted in the KNH Cancer Treatment Centre and Radiotherapy clinic. The hospital was chosen because it is the largest teaching and referral hospital in Kenya and serves clients from the East and Central African countries. The study population involved EC and HNC outpatients, above 18 years of age, feeding either on modified or normal foods and with a gastrostomy tube in place. These cancers are common among adults. The Eastern Cooperative Oncology Group (ECOG) Performance Status is a scale used to assess a cancer patient's level of functioning and ability to carry out daily activities. The ECOG scale ranges from grade 0 (fully active) to grade 5 (death). Grades 1–4 indicate increasing levels of physical limitation: Grade 1 involves mild activity restriction; Grade 2, inability to work but independent in self-care; Grade 3, limited self-care and mostly bedridden; and Grade 4, complete disability and total confinement to bed or chair. The study enrolled patients with ECOG performance status grade 1, 2 and 3, which classified those patients who had some restriction, but were able to do light tasks, those whose self-care was possible, but unable to work and lastly active over half the day, respectively. These grades were selected to ensure the inclusion of clinically stable patients who could attend outpatient clinics and participate reliably in the study procedures. Patients with ECOG grades 4 were excluded because they are typically bedridden, severely debilitated, or nearing end-of-life, and therefore unable to attend outpatient services or provide consistent responses. Additionally, the study utilised a 24-hour dietary recall, which is subject to recall bias. To minimize this, trained interviewers used structured probing techniques and food models to aid accurate recall, and in some cases, caregivers or family members assisted in verifying the dietary information provided.

Study Design

The study used a prospective institutional-based cross-sectional study with an analytical component design. This design was adopted to determine the nutritional status outcomes, calorie intake and food modification outcomes of EC and HNC patients using gastrostomy tube for feeding.

Sample Size

A sample size of 103 participants was calculated using Fisher's *et al.*, 1983 formula after adjusting for finite population size.

Sampling Strategy

The sampling frame consisted of all esophageal, head, and neck cancer patients currently registered and receiving treatment at the Cancer Treatment Centre and Radiotherapy Clinic at KNH. The study then enrolled 103 patients who had a diagnosis of EC and HNC utilizing a gastrotomy tube during clinic days for six months. The researchers recorded all the names of the respondents in the clinic in a coded registration form. Consent was sought, and the data were collected until the required number of respondents was acquired.

Data Collection Methods

A semi-structured questionnaire was used to collect data on the food modification and calorie intake of the participants.

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Nutritional status: Using the SECA scale, anthropometric and data for nutritional status were collected by measuring the height and weight to the nearest 0.1cm and 0.1 kg respectively. The height was taken without shoes with a stadiometer, and the weight was taken with light or minimal clothing. The body mass index (BMI) was analysed using the WHO Anthro software. In oncology and other chronic catabolic conditions, the Patient-Generated Subjective Global Evaluation (PG-SGA) is the best-proven interdisciplinary patient nutritional evaluation tool. PG-SGA was used to categorise patients as normal, mild or severely malnourished.

Calorie Intake Data: The 24-hour recall was used to gather information on calorie intake for respondents on modified and normal food. The tool gathered quantitative data on all foods and beverages consumed in the last 24 hours, probing on cooking methods and estimates of amounts consumed using Kenyan photographic food atlas. This was analysed using the Nutri-survey software table to determine the caloric and protein intake.

Data Analysis

Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyze descriptive and inferential statistics of the quantitative data collected using questionnaires. Anthropometric data was analyzed using WHO Anthro software for anthropometric nutritional status indicators, while the data on calorie intake were analyzed using Nutri-survey software. The association between the different study variables was determined using multivariate analysis at a 0.05 significance level for statistical analysis.

Ethical Considerations

The study adhered to the ethical guidelines and principles from Kenyatta National Hospital and University of Nairobi (Ref. No. KNH-ERC/A/126) and the National Council for Science, Technology and Innovation (NACOSTI/P/23/25076). Informed consent was obtained from the participants, and participation was on a voluntary basis. Privacy and confidentiality of the information and data collected from the participants were maintained. The study did not cause any harm to the participants since the procedures involved the use of questionnaires, equipment for height and weight measurements. Confidentiality was observed, and the data collected was stored in a safe lock-and-key cabinet. Those who needed urgent medical and nutrition care were identified and referred accordingly, then once stable, the researcher enrolled them for the study.

RESULTS

Food Modification and Calorie Intake Status of EC & HNC Patients Utilising Gastrostomy Tube.

As displayed in Figure 1, majority of the patients (84.5%) were on modified food while 15.5% not on modified food. The overall calorie intake was low, with majority of the participants 81.6% (n=84), having a very low-calorie intake of < 500 Kcals, 16.5% (n=17) having a calorie intake of 500-1,000 Kcals and 1.9% (n=2) with >1,000 Kcals. The Mean±SD of the net kilocalories consumed in patient's meals was 329.12±274.4, with a minimum and maximum of 310 and 2,000 kilocalories, respectively.

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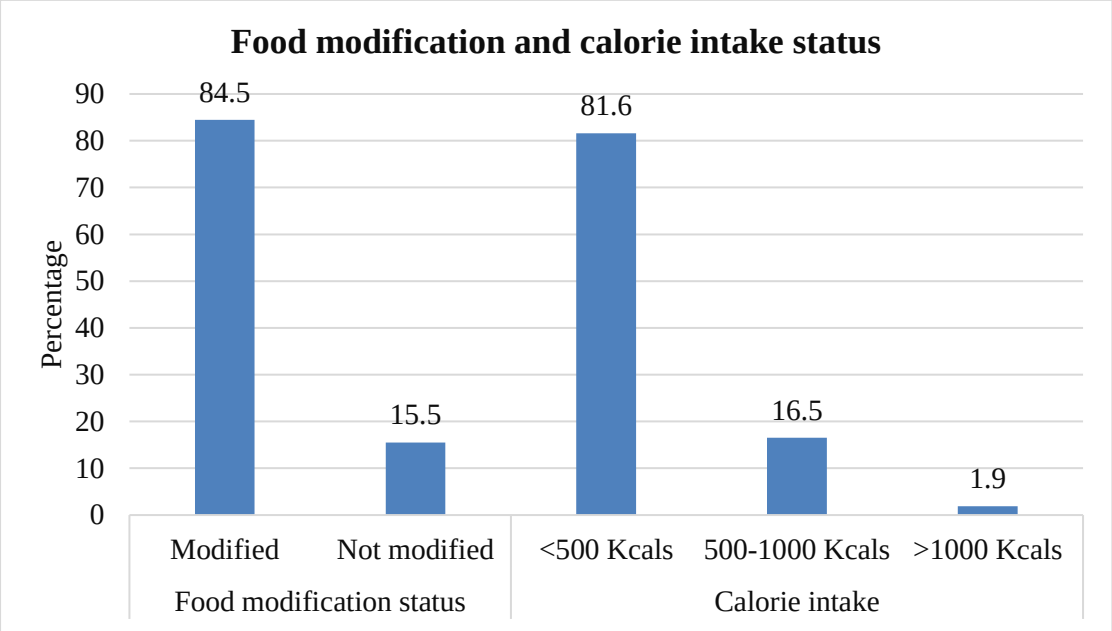
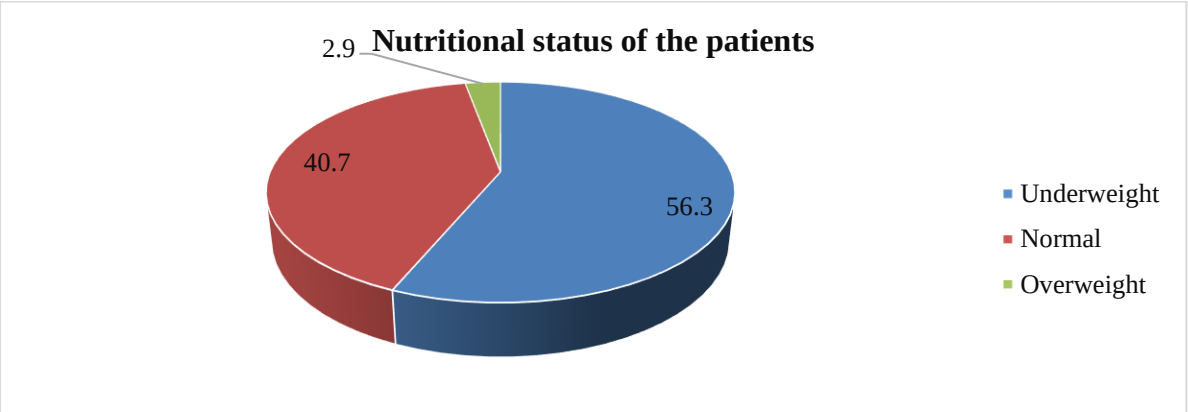
Figure 1: Food Modification and Calorie Intake Status



Nutritional Status of EC & HNC Patients Utilising Gastrostomy Tube.

Figure 2 shows that 56.3% (n=58) of the patients were underweight, 40.8% (n=42) had a normal BMI and a few 2.9% (n=3) were overweight. The patients had a mean BMI was 18.03 ± 3.39 kg/m^2 with minimum and maximum BMI of 14.02 kg/m^2 and 28.52 kg/m^2. These results correlate with current research done on the nutritional status, of patients with esophageal, head, and neck cancers, attributing this to their ability to swallow food and the catabolic state of cancer (10). Moreover, the Kenyatta National Hospital study mentioned that the mean BMI of patients was low, which actually magnifies the extent of nutritional emaciation among the studied patients. According to PGSGA, 34.0% had normal nutritional status, 45.6% mild and 20.4% were severely malnourished.

Figure 2: Nutritional Status of EC & HNC Patients Utilising Gastrostomy Tube.



Association between calorie intake and nutritional status

The findings summarized in Table 1 revealed a statistically significant positive association between calorie intake and nutrition status using BMI as indicated by a Pearson correlation coefficient (r) of 0.196, 95% confidence interval and a p-value of 0.047.

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Table 1: Correlation between Patient's Body Mass Index (BMI) and Amount of Kilocalories Consumed

		BMI	Kilocalories
BMI	Pearson Correlation	1	.196*
	Sig. (2-tailed)		0.047
	N	103	103
Kilocalories	Pearson Correlation	.196*	1
	Sig. (2-tailed)	0.047	
	N	103	103

**. Correlation is significant at the 0.05 level (2-tailed).*

Relationship between Food Modification and Nutritional Status of Esophageal, Head and Neck Cancer Patients

The results in Table 2 demonstrated a significant difference in BMI between patients consuming modified foods and those consuming normal foods. Specifically, the mean BMI of the group on a modified diet (M = 16.1, SD = 1.68) was considerably lower than that of the group on a non-modified (M = 20.7, SD = 2.10); this difference was statistically significant (t (101) = 8.95, p < 0.001), with a 95% Confidence Interval for the mean difference of [3.65, 5.38]. This indicates a substantial and reliable difference in nutritional status between the two dietary groups.

Table 2: T-test between Food Modification and Nutritional Status

	Diet modification				
	Modified (n=87)	**Not modified (n=16)**	**t**	**df**	**sig**
Nutritional status indicator (BMI)	16.1 ±1.68	20.7 ± 2.10	8.95	101	**0.000**

Consequently, the findings in Table 3 showed a strong and statistically significant relationship between food modification and BMI. The Pearson correlation coefficient indicated a strong positive association, $r(101) = 0.694$, $p < 0.001$, with a 95% confidence interval suggesting that patients on more modified diets tended to have lower BMIs, reflecting the impact of feeding route and diet texture on nutritional status.

Table 3: Correlation between Food Modification and Nutritional Status

		Food Modification	BMI
Food Modification	Pearson Correlation	1	.694**
	Sig. (2-tailed)		**0.000**
	n	103	103
BMI	Pearson Correlation	.694**	1
	Sig. (2-tailed)	**0.000**	
	n	103	103

*** Correlation is significant at the 0.01 level (2-tailed).*

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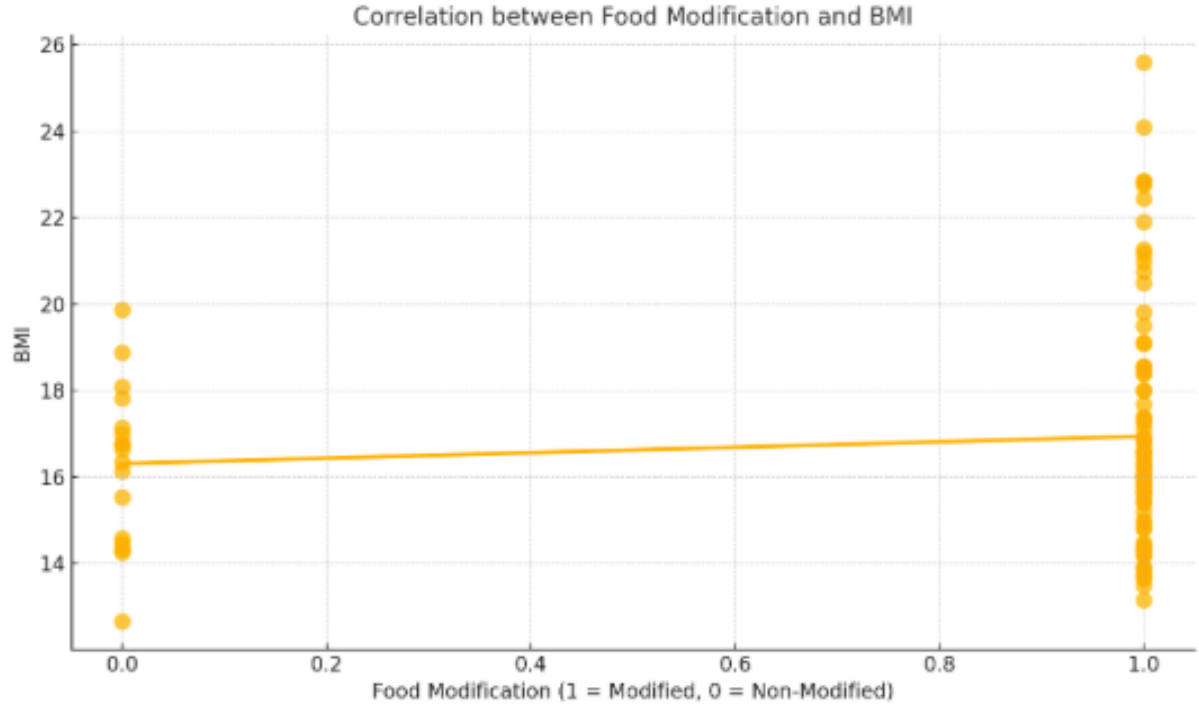
Figure 3: Positive Correlation between Food Modification (Modified vs. Non-modified) and BMI



DISCUSSION

A study by Arends *et al*., (8) emphasizes that cancer patients often experience significant nutritional challenges such as dysphagia, upper gastrointestinal obstruction and/or anorexia, along with an inability to tolerate normal food due to the disease and its treatment, leading to reduced food intake and subsequent malnutrition**.** The prevalence of modified diets, particularly liquid diets, is common among patients with head and neck cancers due to dysphagia and other eating difficulties. According to Cederholm *et al*. (9), inadequate calorie intake and malnutrition can exacerbate the adverse effects of cancer treatments, impede recovery, and increase morbidity and mortality rates. The mean calorie intake in the present study was substantially lower than the recommended dietary allowances, underscoring the need for nutritional interventions tailored to the specific needs of cancer patients.

There is evidence on the consequences which arise from the poor nutrition status in cancer patients, including poor tolerance to treatment, increased incidence of complications, and decreased survival rates (11).

The direct relationship between caloric intake and BMI in cancer patients supports a study by Zeidler *et al*., (4) wherein the authors observed that augmented calorie consumption positively affected the nutritional status of head and neck cancer patients receiving radiotherapy. In the same regard, Pham *et al*., (5) pointed out that adequate calorie interventions were successful in maintaining weight loss and enhanced the nutritional profile in esophageal cancer patients. Furthermore, the results of this research reflect the propositions made by the European Society for Clinical Nutrition and Metabolism (ESPEN) about the necessity to restore energy and protein intake during cancer cachexia and to enhance the survival and treatment outcomes of patients with this disease (8). This strong association, noticed in the present study, clearly points out the importance of disease-specific nutritional interventions in improving nutritional status and quality of life of cancer patients.

The presented results indicating the mean BMI of the group on a modified diet was considerably lower than that of the group on a non-food correlates with the findings of other scholars regarding nutritional issues encountered by cancer

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patients. Changes in food modification, which are common due to side effects of treatment such as dysphagia, mucositis, and changes in taste perception, leads to reduced calorie and nutrient intake, weight loss and a lower BMI (8). A study by Bossola (6) also noted that patients with cancer who undergo dietary changes have reduced nutritional status because the modified foods do not meet their energy and protein needs.

The observed association between texture-modified diets and lower body mass index (BMI) among patients can be attributed to several interrelated factors. First, texture-modified diets, particularly in pureed or liquid forms, are often characterized by lower energy and protein density, making it difficult for patients to meet their nutritional requirements. Second, such diets frequently lack palatability and variety, leading to reduced meal enjoyment and poor dietary adherence (11). Additionally, in patients with conditions such as cancer, symptoms including early satiety, nausea, fatigue, and painful swallowing further limit dietary intake despite adjustments in texture (1). Thus, the reduction in BMI may be attributed to a multifactorial interaction of inadequate energy intake, poor adherence to texture-modified diets, and disease-related metabolic alterations.

While the findings demonstrate a strong association between modified diets and reduced BMI, it is critical to acknowledge that this relationship may be influenced by potential confounding factors such as the stage of disease, cancer type, and treatment-related side effects. These variables were carefully considered in the present study. Clinical data, including diagnosis stage and treatment modalities, were collected during structured questionnaire administration to inform the interpretation of nutritional outcomes. Additionally, treatment-related complications such as dysphagia, mucositis, anorexia, and early satiety which are factors known to influence dietary intake were documented and accounted for during analysis. This comprehensive approach allowed for a more nuanced understanding of the relationship between dietary modification and nutritional status, ensuring that the observed associations were interpreted within the broader clinical context. As such, the study findings reflect not only the direct impact of modified diets but also the interplay between nutritional challenges and the underlying disease and treatment burden.

Moreover, reduced BMI observed in the modified diet group could be due to the disease progression at the time of treatment or more aggressive therapy that may interfere with the patient's appetite. This is supported by studies showing that patients with esophageal, head and neck cancers are usually malnourished, especially due to swallowing disorders and inadequate oral intake of food (2). These concerns mandate the use of texture-modified foods, while on the other hand might be low in caloric density. Additional studies also support the need for a personalised nutrition approach to mitigate these negative impacts. Silander *et al*. (7) stressed that individualized nutritional interventions, such as the administration of high energy density diets and enteral nutrition when appropriate, may reduce the risk and impact of weight loss in esophageal, head and neck cancer patients. In a similar study, Garutti et al., (8) also noted that it is possible for early and proactive nutrition intervention to enhance the clinical status of modified diet subjects with cancer considerably.

These findings of a positive relationship between food modification and nutrition status using BMI underline the essential significance of modified food in basic changes in the nutritional condition of cancer patients. Other related research has also shown how cancer patients struggle to achieve optimal nutritional status owing to feeding challenges and the effects of treatment**.** Susetyowati *et al*., (9) conducted a study on the nutritional status of head and neck cancer patients and established those dietary adjustments negatively influenced BMI and poor nutritional profiles. The need for texture-modified foods, which are generally low in calorie and nutrient density, also increases the patient's vulnerability to developing malnutrition.

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This is supported by a current study by Abu Zaid *et al*. (10) that shows that patients receiving treatment for head and neck cancer commonly undergo considerable weight loss and a reduced BMI owing to such a change in dietary habits. It was evident from the study that nutritional interventions and monitoring early in the process are crucial to prevent the negative impacts of dietary change. Also, the details obtained support the study by Martinovic et al. (3) where they explained that HNC patients who had to change their diet due to treatment-related side effects struggled to acquire adequate nutrients, which indicated poor nutritional status that affected their treatment outcomes.

CONCLUSION

The observed positive relationship between calorie intake and nutrition status in this study conveys the message that adequate calorie intake should be encouraged for better nutritional status of Esophageal, head, and neck cancer patients utilizing gastrostomy tubes. The mean BMI of the participants showed a considerable difference between the modified and non-modified foods, signifying the paramount importance of improving the caloric intake adequacy for patients with EC and HNC cancers who are subjected to food modification. It was evident that food modification is highly correlated with the poor nutritional status of the esophageal, head, and neck cancer patients.

RECOMMENDATIONS

The study recommends that Kenyatta National Hospital should consider increasing individualised nutrition consultations to monitor the calorie intake of gastrostomy-fed patients. There should also be nutrition status assessment regularly, as these patients continue with treatment, to promptly identify those at risk of malnutrition, and calorie intake gap, especially those on modified food to correct or maintain optimal nutrition status. There is need to consider the development of a specialized food modification regimen designed for EC and HNC patients utilizing gastrostomy tube feeding, with emphasis on calorie-dense foods, to help meet optimal energy demands. They should expand on food modification techniques by making a range of nutrient-rich, texture-modified foods that provide optimal caloric requirements. Specifically, the development of calorie-dense modified foods should involve clear guidelines on macronutrient composition—such as the inclusion of energy-rich fats (e.g., vegetable oils, avocado, or nut pastes), high-quality proteins, and complex carbohydrates—alongside fortification strategies targeting micronutrient deficiencies, including iron, zinc, vitamin A, and B-complex vitamins. The Ministry of Health should develop and implement national guidelines on nutritional management for EC and HNC cancer patients, integrating detailed cancer nutrition protocols into current policies, training healthcare professionals, and ensuring the availability of standardized medical nutrition therapeutic feeds in public hospitals especially when food modification is not feasible. Collaboration with healthcare facilities is essential to scale and sustain nutrition interventions effectively. There is need for further longitudinal research in order to explore the long-term effects of gastrostomy tube feeding on nutritional status outcomes and the effect of food modification in esophageal, head, and neck cancer patients.

Data Availability

Data for this study are available upon reasonable request from the Principal Investigator, in accordance with ethical guidelines and data sharing policies.

Conflict of Interest

The authors declare there was no conflict of interest in this publication.

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REFERENCES

1. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, Fearon K, Hütterer E, Isenring E, Kaasa S, Krznaric Z, Laird B, Larsson M, Laviano A, Mühlebach S, Muscaritoli M, Oldervoll L, Ravasco P, Solheim T, Strasser F, Preiser JC. ESPEN guidelines on nutrition in cancer patients. *Clin Nutr*. 2017;36(1):11- 48. https://doi.org/10.1016/j.clnu.2016.07.015

2. Cederholm T, Jensen GL, Correia MITD, Gonzalez MC, Fukushima R, Higashiguchi T, Baptista G, Barazzoni R, Blaauw R, Coats A, Crivelli A, Evans DC, Gramlich L, Fuchs-Tarlovsky V, Keller H, Llido L, Malone A, Mogensen KM, Morley JE, Muscaritoli M, et al. GLIM criteria for the diagnosis of malnutrition - A consensus report from the global clinical nutrition community. *Clin Nutr*. 2019;38(1):1- 9. https://doi.org/10.1016/j.clnu.2018.08.002

3. Martinovic D, Tokic D, Puizina Mladinic E, Usljebrka M, Kadic S, Lesin A, Vilovic M, Lupi-Ferandin S, Ercegovic S, Kumric M, Bukic J, Bozic J. Nutritional Management of Patients with Head and Neck Cancer-A Comprehensive Review. *Nutrients.* 2023;15(8):1864. https://doi.org/10.3390/nu15081864

4. Zeidler J, Kutschan S, Dörfler J, Büntzel J, Huebner J. Impact of nutrition counseling on nutrition status in patients with head and neck cancer undergoing radio- or radiochemotherapy: a systematic review. *Eur Arch Otorhinolaryngol*. 2024;281(5):2195-2209. https://doi.org/10.1007/s00405-023-08375-1

5. Pham Van B, Nguyen Thi Thanh H, Le Thi H, Nguyen Le Tuan A, Dang Thi Thu H, Dang Viet D. Nutritional Status and Feeding Regimen of Patients with Esophagus Cancer-A Study from Vietnam. *Healthcare (Basel)*. 2021;9(3):289. https://doi.org/10.3390/healthcare9030289

6. Bossola M. Nutritional interventions in head and neck cancer patients undergoing chemoradiotherapy: a narrative review. *Nutrients*. 2015;7(1):265-276. https://doi.org/10.3390/nu7010265

7. Silander E, Nyman J, Bove M, Johansson L, Larsson S, Hammerlid E. Impact of prophylactic percutaneous endoscopic gastrostomy on malnutrition and quality of life in patients with head and neck cancer: a randomized study. *Head Neck*. 2012;34(1):1-9. https://doi.org/10.1002/hed.21700

8. Garutti M, Noto C, Pastò B, Cucciniello L, Alajmo M, Casirati A, Pedrazzoli P, Caccialanza R, Puglisi F. Nutritional Management of Oncological Symptoms: A Comprehensive Review. *Nutrients.* 2023;15(24):5068. https://doi.org/10.3390/nu15245068

9. Susetyowati S, Kurniasari FN, Sholikhati AS, Hardianti M, Ekaputra E. Assessment of Nutritional Status in Patients with Head and Neck Cancer Before Radiotherapy: A Single-center, Cross-sectional Study. *Medeniyet Med J*. 2024;39(1):24- 32. https://doi.org/10.4274/MMJ.galenos.2024.02448

10. Abu Zaid Z, Kay Neoh M, Mat Daud ZA, Md Yusop NB, Ibrahim Z, Abdul Rahman Z, Jamhuri N, Abdul Azim AZ. Weight Loss in Post-Chemoradiotherapy Head and Neck Cancer Patients. *Nutrients.* 2022;14(3):548. https://doi.org/10.3390/nu14030548

11. Wu, X. S., Miles, A., & Braakhuis, A. (2020). Nutritional intake and meal composition of patients consuming texture modified diets and thickened fluids: A systematic review and meta-analysis. *Healthcare (Basel), 8*(4), 579. https://doi.org/10.3390/healthcare8040579

12. Fisher, R.A., van Belle, G., & Martin, D.C. (1983). *Biostatistics: A Methodology for the Health Sciences.* Wiley-Interscience.

