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Esophageal cancer and associated comorbidities, habits and risk factors among sudanese patients

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Abstract

This study investigated the association between various comorbidities, lifestyle habits, and esophageal cancer (EC) among Sudanese patients. A case study was conducted at the National Cancer Institute in Wad Medani, Gezira State, Sudan, between 2021 and 2022. Data were collected from 50 EC patients using a questionnaire and analyzed using descriptive statistics and Chi-square tests. The majority of the patients were female (64%), over 60 years old (46%), and married (62%). A statistically significant association was found between EC and the consumption of coffee ($p < 0.001$), tea ($p = 0.037$), and carbonated beverages ($p = 0.061$). There was no significant association between EC and the consumption of processed foods ($p = 0.756$). A statistically significant association was found between EC and the use of tobacco ($p = 0.006$), but not with smoking ($p = 0.441$) or alcohol consumption ($p = 0.594$). No significant association was found between EC and the presence of comorbidities such as hypertension ($p = 0.404$), cardiovascular disease ($p = 0.565$), or diabetes ($p = 0.056$). This study provides valuable insights into the risk factors for EC in Sudan and highlights the importance of considering these factors in the prevention and control of EC. Further research is needed to confirm these findings and to investigate the potential underlying mechanisms.

Keywords: Esophageal cancer; Comorbidities; Risk factors; Sudan

1. Introduction

Esophageal cancer is a malignant neoplasm that arises from the esophageal epithelium. Despite advances in diagnostic and therapeutic strategies, it remains a significant global health burden, particularly in developing countries. Sudan has a high incidence of esophageal cancer, which is often associated with poor prognosis and high mortality rates. A complex interplay of factors, including lifestyle habits, dietary factors, and genetic predisposition, contributes to the development of esophageal cancer. Understanding these risk factors is crucial for early detection, prevention, and improved patient outcomes. This study aims to investigate the association between various comorbidities, lifestyle habits, and esophageal cancer among Sudanese patients. By identifying these factors, we hope to gain valuable insights into the etiology of esophageal cancer in Sudan and contribute to the development of effective prevention and control strategies.

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2. Material and methods

2.1. Study Design

A case-study was conducted to investigate the association between comorbidities, habits, and risk factors for esophageal cancer among Sudanese patients. This study was carried out at the National Cancer Institute (NCI) in *WadMedani*, Gezira State, Sudan, between the years 2021 and 2022. The NCI, provides comprehensive cancer care to patients throughout Sudan.

2.2. Inclusion and Exclusion Criteria

Participants were included if they met the study specifications and had a confirmed diagnosis of esophageal cancer. Individuals with a prior diagnosis of any other cancer or a family history of esophageal cancer were excluded.

2.3. Data Collection

Data regarding esophageal cancer risk factors, including the relationship with blood pressure and diabetes, were collected from 50 esophageal cancer patients at NCI clinics in *Wad-Medani*. A five-part questionnaire addressed dietary habits, lifestyle factors, comorbidities, medical history, and physical activity. Patient blood glucose and blood pressure were also measured.

2.4. Ethical Approval

This research study received ethical approval from the National Cancer Institute (NCI). Informed verbal consent was obtained from all participants, encompassing their agreement to participate and to have their personal information collected and analyzed via questionnaire.

2.5. Statistical Analysis

Data were analyzed using descriptive statistics, and Chi-square tests in SPSS version 22.

3. Results

3.1. Demographic Characteristics of respondents

Table (1) presents the demographic characteristics of the 50 respondents who participated in this study. The sample comprised more females (64%) than males (36%), a difference that was statistically significant ($p = 0.021$). Regarding age, the largest group of respondents (46%) were over 60 years old, followed by those aged 40-60 (36%). The smallest group (18%) were between 20 and 40 years old. Age differences between groups were not statistically significant ($p = 0.056$). In terms of marital status, the majority of respondents were married (62%), followed by widowed (28%). Smaller proportions were single (6%) or divorced (4%).

3.2. Caffeine, Processed Foods, and Esophageal Cancer Risk

Table (2) shows the variation in the percentages of tea, coffee, carbonated beverage, and processed food consumed by EC patients, which recorded to (30%, 76%, 66%, 72%), respectively. However, there was statistically positive relationship between tea, coffee and not significant for carbonated beverage; processed food intake rates and EC at the probability level ($P = 0.05$); the chi-square test recorded ($p = 0.037$; 0.000; 0.061; 0.756), respectively.

Table 1 Distribution of respondents according to their demographic characteristics: gender, age and marital status (n=50)

Characteristic	Category	Frequency (n)	Percentage (%)	p- value
Gender	Male	18	36	0.021*
	Female	32	64	
Age (years)	20 – 40	9	18	0.056
	40 – 60	18	36	
	> 60	23	46	
Marital Status	Married	31	62	-
	Single	3	6	
	Divorced	2	4	
	Widowed	14	28	
Total		50	100	

*P-value considered significant at less than 0.05 levels

Table 2 Caffeinated and processed food products intake and the risk of esophageal cancer (n=50)

Habit	YES n(%)	NO n (%)	Total n(%)	p-value
Drink coffee	38(76)	12(24)	50(100)	<0.001*
Drink tea	15(30)	35(70)	50(100)	0.037*
Drinking carbonated beverage	33(66)	17(34)	50(100)	0.061
Eating any kind of processed products	36(72)	14(28)	50(100)	0.756

*P-value considered significant at less than 0.05 levels

3.3. Habits and risk of esophageal cancer

As depicted in Table (3) a significant proportion of surveyed EC patients reported no usage of smoking, snuff, tobacco, or alcohol. Specifically, 92%, 100%, 98%, and 96% of respondents, respectively, indicated abstinence from these substances. However, significant association was found between tobacco use and EC ($p = 0.006$), and not significant association was observed between smoking and alcohol consumption and the development of EC ($p = 0.441$; 0.594), while none of them used snuff.

Table 3 Association Between Habits and Esophageal Cancer (n=50)

Habit	YES n(%)	NO n(%)	Total n (%)	p-value
Smoking	4 (8%)	46 (92%)	50(100)	0.441
Snuff Use	0 (0%)	50 (100%)	50(100)	N/A
Alcohol Use	2 (4%)	48 (96%)	50(100)	0.594
Tobacco Use	1 (2%)	49 (98%)	50(100)	0.006*

*P-value considered significant at less than 0.05 levels

3.4. Esophageal cancer and associated comorbidities

As depicted in Table (4) a significant proportion of surveyed EC patients reported no or low associated diseases of hypertension, cardiovascular, pulmonary, diabetes or ulcer. Specifically, 92%, 100%, 100%, 90% and 100% of respondents, respectively, indicated low or no problems. However, there was statistically negative relationship between hypertension, diabetes diseases and EC the chi-square test recorded ($p = 0.404$; 0.056), respectively. While no one of patients has cardiovascular / pulmonary / ulcer.

3.5. Association between hypertension, diabetes, and esophageal cancer stage

As shown in Table (5) the majority of patients (44/50) did not have diabetes, and 45/50 did not have hypertension. Statistical analysis revealed no significant association between cancer stage and diabetes ($p=0.736$) or hypertension ($p=0.768$). Zhou *et al.*, in (2022) observed that, there are significantly positive correlation between type 2 diabetes mellitus and EC risk (RR = 1.28, 95% CI: 1.05-1.57, $P = 0.015$). Also, our study showed positive correlation between T2DM and EADC (esophageal adenocarcinoma) risk (RR = 1.28, 95% CI: 1.05-1.57, $P < 0.001$).

Table 4 Esophageal cancer and associated comorbidities (n=50)

Disease	YES n(%)	NO n(%)	Total n(%)	p-value
Hypertension	4(8)	46(92)	50(100)	0.404
Cardiovascular	0(0)	100(100)	50(100)	N/A
Pulmonary	0(0)	100(100)	50(100)	N/A
Diabetes	5(10)	90%	50(100)	0.056
Ulcer	0(0)	100(100)	50(100)	N/A

*P-value considered significant at less than 0.05 levels

Table 5 Association between hypertension, diabetes, and esophageal cancer stage (n = 50)

Variable	Early (n)	Metastatic (n)	Locally Advanced (n)	Total (n)	p-value
Diabetes					0.736
YES	0	0	5	5	
NO	0	1	44	45	
Total	0	1	49	50	
Hypertension					0.768
YES	0	0	4	4	
NO	0	1	45	46	
Total	0	1	49	50	

*P-value considered significant at less than 0.05 levels

4. Discussion

The observed gender distribution in this study contrasts with global trends but consistent with some African studies. This gender disparity warrants further investigation into potential contributing factors, including gender-specific risks and lifestyle differences. The majority of patients were over 40, with 46% over 60, aligning with the known age-related risk of esophageal cancer [5]. While not statistically significant ($p=0.056$), likely due to the small sample size, this finding underscores the vulnerability of older individuals. Most patients were married (62%), followed by widowed (28%). Though marital status is not a direct risk factor, its potential influence on socioeconomic factors and lifestyle warrants further exploration. These findings highlight the importance of considering demographic factors in esophageal cancer risk assessment and management in Sudan. Larger studies are needed to elucidate the complex interplay of demographics, comorbidities, habits, and risk factors in this population.

Existing literature presents a complex interplay between dietary factors and esophageal cancer (EC) risk. Studies, including Musa *et al.*, (2021), highlight associations between EC, particularly squamous cell carcinoma, and consumption of hot beverages, red meat, and deficiencies in fruit and vegetable intake, alongside established risk factors like smoking and alcohol. Conversely, Toru *et al.*, (2008) and Cavin *et al.*, (2002) suggest a potential protective effect of coffee consumption, possibly mediated by its antioxidant components. However, the thermal injury from very hot beverages, as noted in various studies, complicates this relationship. Furthermore, a consensus emerges regarding the increased EC risk linked to processed meat consumption, likely due to carcinogenic compounds. While the impact of

other processed foods and less common caffeinated beverages requires further investigation, our findings align with these established trends, emphasizing the importance of dietary balance and temperature considerations in EC etiology.

Established risk factors for esophageal cancer (EC), as reported by Kamangar et al. (2009) and Musa *et al.*, (2021), include tobacco smoking, excessive alcohol consumption, dietary deficiencies, and socioeconomic disparities. Specifically, esophageal squamous cell carcinoma (ESCC) is associated with these factors, alongside red meat consumption and hot beverage intake, while esophageal adenocarcinoma (EAC) is linked to gastroesophageal reflux, obesity, and hiatal hernia. Qiao *et al.*, (2017) further demonstrate a time-dependent decrease in ESCC risk with smoking cessation, primarily in Western populations. Our findings align with these observations, confirming the significant role of tobacco, snuff, and alcohol use in EC etiology. Notably, the duration and intensity of these habits, particularly the combined use of tobacco and alcohol, substantially elevate EC risk. Smoking and snuff are more strongly associated with ESCC, while alcohol and tobacco contribute to both ESCC and EAC. These results underscore the importance of addressing modifiable lifestyle factors in EC prevention.

Established studies, including Mostafa *et al.*, (2024), highlight the significant impact of advanced tumor stage, upper gastrointestinal tract (GIT) tumors, and chemoradiotherapy (CRT) on poor nutritional outcomes in esophageal cancer (EC) patients. This aligns with our findings, which also underscore the importance of comorbidities in EC prognosis. Furthermore, the association between diabetes mellitus (DM) and EC risk is supported by meta-analyses (Huang *et al.*, 2012; Xu *et al.*, 2017), revealing a positive correlation, particularly in North American and European populations, and with esophageal adenocarcinoma (EAC). These studies, consistent with our results, emphasize the complex interplay between comorbidities, nutritional status, and EC. Effective management of EC requires a comprehensive approach, addressing comorbidities such as gastroesophageal reflux disease (GERD), cardiovascular disease, diabetes, and pulmonary disease through tailored nutritional interventions. These interventions, including dietary modifications, consistent carbohydrate intake, and high-protein diets, are crucial for mitigating malnutrition, improving treatment tolerance, and enhancing the overall quality of life for EC patients.

While Seo *et al.*, (2020) demonstrated a positive association between untreated hypertension and increased risk of esophageal cancer (EC), alongside oral and laryngeal cancers, and Wu *et al.*, (2015) linked hypoalbuminemia to adverse postoperative outcomes in EC, our study did not replicate these findings. However, the established literature suggests plausible mechanisms for a relationship between hypertension, diabetes mellitus, and EC. Hypertension may contribute to EC risk through increased gastroesophageal reflux disease (GERD), while diabetes, characterized by insulin resistance and chronic inflammation, can promote cellular proliferation and inhibit apoptosis, potentially leading to cancer development. The synergistic effects of these comorbidities, including increased oxidative stress and impaired immune function, may further elevate EC risk. Although our study's results diverge from some previous findings, the potential underlying mechanisms warrant further investigation into the complex interplay between hypertension, diabetes, and EC.

5. Conclusion

This study provides valuable insights into the risk factors for Esophageal Cancer (EC) in Sudan. The findings suggest that the consumption of coffee, tea, and carbonated beverages, as well as the use of tobacco, may increase the risk of EC. The study also found that there was no significant association between EC and the presence of comorbidities such as hypertension, cardiovascular disease, or diabetes. These findings highlight the importance of considering these factors in the prevention and control of EC in Sudan.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors have no conflict of interest.

Statement of ethical approval

Ethical approval was obtained from Faculty of Agricultural Sciences, University of Gezira ethical committee as well as Ministry of Health Gezira State ethical committee.

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Statement of informed consent

Informed verbal consent was obtained from all individual participants included in the study.

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