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Research article

Evaluation of the Association between Unhealthy Lifestyle and Colon Cancer among the Patients Treated in the Oncology Unit of Benghazi Medical Center

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ABSTRACT

Colorectal cancer is one of the most common types of cancer around the world and is related to an unhealthy lifestyle. A retrospective case-control study, of 95 colorectal cancer patients and 95 matched controls investigated the association between lifestyle factors and colorectal cancer at Benghazi Medical Centre from June to July 2024. Data were collected via interviews and questionnaires. A binary logistic regression test was used to evaluate the relationship between each lifestyle variable and colon cancer. BMI was statistically significantly related to colon cancer ($P = 0.045$; odd ratio = 0.927, 95% CI (0.861 to 0.998)). Several dietary factors showed significant associations with colon cancer risk. Healthy diets were inversely associated (OR 0.379, $P = 0.045$), while vegetable consumption was positively associated (OR 4.619, $P = 0.001$). Red meat consumption also showed a positive association (OR 2.479, $P = 0.042$), whereas increased sugar consumption was inversely associated (daily: OR 0.243, $P = 0.007$; >daily: OR 0.222, $P = 0.004$). Adoption of health education interventions by health educators in Libya to promote healthy lifestyles is recommended. Future studies will be needed for further evaluation of the relationship between lifestyle factors and colorectal cancer in Libya.

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1. Introduction

Colorectal cancer is the cancer of the colon and rectum [1]. It is the third most common cancer in men after prostate cancer and lung cancer [1]. It is the second most common cancer in women (The first common cancer is breast cancer) [1]. Based on the World Health Organization, there are 1.9 million new cases diagnosed with colorectal cancer and almost 1 million deaths from colorectal cancer around the world in the year of 2020 [1]. Additionally, colorectal cancer is the second most common cancer in Libya [2]. Colorectal cancer was the most common GIT cancer in Libya with 1123 new cases and 701 deaths in 2020 [3]. Furthermore, the country with the highest rate of colorectal cancer across North Africa is Libya [2]. Moreover, colon cancer was the most common cancer in the eastern part of Libya based on the hospital-based registry of Benghazi Medical Center in the year of 2012 [4].

The risk factors of colon cancer can be modifiable risk factors or non-modifiable risk factors [1]. Non-modifiable risk factors include age, gender, and a family history of colon cancer [1]. People older than 50 years, male, and have a family history of colon cancer at a high risk of colon cancer [1].

The modifiable risk factors of colon cancer include unhealthy lifestyle factors like being overweight or obese, sedentary lifestyle, smoking, excessive drinking of alcohol, consumption of too much red meat, consumption of a low amount of vegetables and fruits, and consumption of sugars [1]. Moreover, people with inflammatory bowel disease are at a high risk of colon cancer [5]. The risk of colon cancer can be decreased by following a healthy lifestyle [1].

The symptoms of colon cancer include abdominal pain, change in bowel habits, weight loss, nausea, vomiting, malaise, abdominal distension, hematochezia, and anemia [1].

Since many patients with colon cancer are asymptomatic during the early stage of the disease, this cancer is considered a silent cancer. Thus, the screening test for colon cancer is recommended for people ages older

than 50 years to detect colon cancer in the early stage [1].

Even though smoking was not statistically significantly related to the development of colorectal cancer as indicated by a previous study conducted in Oman, published in 2018 [6], other studies conducted in the United Kingdom, Egypt, and Poland, published in 2004, 2014, and 2022, respectively, have indicated that smoking increases the risk of colon cancer [7, 8, 9]. Although physical activity was not statistically significantly related to the development of colorectal cancer based on previous studies conducted in Oman and the United Kingdom, published in 2018 and 2004 respectively [6, 7], other studies conducted in Egypt, Poland, and the United States of America, published in 2014, 2022, and 1999, respectively, have indicated that there is an inverse relationship between physical activity and colon cancer [8, 9, 10]. Although obesity was not statistically significantly related to the development of colorectal cancer according to a previous study conducted in the United Kingdom, published in 2004 [7], other studies conducted in Oman and Poland, published in 2018 and 2022, respectively, have indicated that overweight and obesity increase the risk of colon cancer [6, 9]. Though the consumption of fruits and vegetables was not statistically significantly related to the development of colorectal cancer as indicated by a previous study conducted in the United Kingdom, published in 2004 [7], other studies conducted in Oman and Egypt, published in 2018 and 2014, respectively, have indicated that there is an inverse relationship between the consumption of fruits and vegetables and the development of colon cancer [6, 8]. It has been shown that the consumption of red meat increases the risk of colorectal cancer based on previous studies conducted in Egypt. 2014 and Poland, 2022 [8, 9].

It has been shown that the consumption of carbohydrates increases the risk of colorectal cancer, as indicated by previous studies [7, 8, 11]. The majority of previous studies in the literature review have indicated that there is a relationship between lifestyle factors like poor

diet, physical inactivity, being overweight or obese, and smoking increase the risk of colorectal cancer. Accordingly, these findings have been significant to the public health field in terms of how to prevent colorectal cancer in people. The Health educators and primary healthcare providers across the world have adopted health education interventions in order to prevent colorectal cancer in people by encouraging them to change their unhealthy behavior to healthy behavior. Despite many studies around the world that have evaluated the relationship between unhealthy lifestyles and colon cancer, there are very few published studies in Libya to evaluate the relationship between unhealthy lifestyles and cancer of the colon.

Thus, the study aims to evaluate the relationship between unhealthy lifestyles and colon cancer in Benghazi.

2. Methodology

2.1 Study Design:

This quantitative, retrospective study was designed to address a specific research question. To ensure the validity and reliability of the findings, the study's questionnaire was developed based on a validated instrument used in previous studies [6, 7, 8 9, 10, 11].

2.2 Study Population:

The participants in the study were 95 cases and 95 controls. Selection of cases: inclusion criteria include the patients that were diagnosed with colon cancer and treated in the Oncology Unit of Benghazi Medical Centre from June to July of 2024, with either males or females of any age. Exclusion criteria include cases with a family history of colon cancer.

Selection of controls: inclusion criteria include people were recruited randomly from the University of Benghazi during June to July of 2024 who do not have colon cancer and matched with cases based on gender and age categories (frequency matching). Exclusion criteria include individuals or relatives who have a family history of colon cancer.

2.3 Data collection and management:

Interviews were conducted, and a written questionnaire was used to collect data from the participants in the study. Since the study is a case-control study, the data were collected retrospectively. The data were collected from the cases and controls during June to July of 2024. The controls were selected from the community and not from the hospitals to avoid control selection bias. The patients were instructed to answer a questionnaire for some time before the disease was diagnosed. The data collected include:

- Socio-demographic data: age, gender, educational level, and employment status.
- Colorectal cancer disease awareness and medical information data: disease awareness, periodic medical checkups, disease stage detection, and diseases other than colon cancer.
- Data about lifestyle factors: body mass index, smoking status, physical activity, and diet habit. To avoid the responder bias (recall bias) due to the self-reported height, weight, and BMI, the height and weight were collected (at the time of admission to the hospital) from the patient files in the hospital. The BMI was computed for each patient by the BMI calculator from the CDC [12]. Age and gender are potential confounding variables in the study based on previous studies [8, 11] and the biologically believable facts. Thus, the cases and controls were matched according to age and gender during data collection to remove the confounder effect and to ensure the accuracy of the results in the study. Additionally, the family history of colon cancer is a potential confounding variable based on a previous study [8] and the biologically believable facts. Thus, the participants in the study were restricted to participants with no family history of colon cancer during data collection to ensure the accuracy of the results in the study.

1.3 Data Analysis:

The SPSS software (statistical package for the social sciences) was used to analyze data in the study. First of all, the collected data were entered in the SPSS by creating the variables in

the variable view and entering data in the data view. Secondly, the data cleaning process was performed before data analysis on SPSS to ensure the findings of the study were accurate. Finally, the data were analyzed by performing the descriptive analysis in SPSS to use the cross tabulation to calculate the counts and percentages. The graphical representation of data was performed by the clustered bar graphs. The assumptions for binary logistic regression were tested before using a binary logistic regression test for the inferential analysis in SPSS. The assumptions of a binary logistic regression test include the sample size, the normality of the distribution, and multicollinearity. The data of the study met the assumptions for the binary logistic regression test. The binary logistic regression test was used and the polychotomous variables were recoded as dummy variables.

The statistically significant results were for p values less than 0.05. As a part of the binary logistic regression test, the odd ratio was calculated to evaluate if the relationship between each independent variable (lifestyle variables) and dependent variable (colon cancer) is a causative or a protective relationship. The 95% confidence interval of the odd ratio was calculated to evaluate if the relationship is statistically significant (if the range of the confidence interval passes through 1, it is not significant).

2.4 Ethical Considerations:

An approval was gotten from the oncology unit of the Benghazi medical Centre to collect data from the patients with colon cancer treated in the unit to make the collection process easier. Additionally, the ethical considerations were obeyed in carrying out the study, which include voluntary participation of the participants, informed consent from the participants to participate in the study, anonymity (the identifiable information was not collected from the participants in the study), and confidentiality (the information was kept protected and secured).

2. Results and Discussion

According to the socio-demographic variables, 52.6% of the cases were male, 38.9% of the cases were for ages less than 55 years, 28.4% of the cases were university level of education, and the most of the colorectal cancer cases were worked (47.4%).

As stated by the educational level, 28.4% of the cases were university-level, while 60% of the controls were university-level. However, the inferential analysis for the study indicated that educational levels were not statistically significantly related to colon cancer (p -value is 0.388 for middle school level, 0.545 for high school level, and 0.189 for university level of education, all compared to primary school level of education). As indicated by the disease awareness, most of the colorectal cancer cases had low colorectal cancer disease awareness (81.1%), while the controls with good colorectal cancer disease awareness were 35.8%. Thus, the descriptive analysis of the study indicated that low disease awareness increases the risk of colorectal cancer. It is reasonable since people with good knowledge about the risk factors of the disease (colorectal cancer) are at a lower risk of the disease.

Based on the periodic medical checkup, the percentage of the colorectal cancer cases that did not adhere to the periodic medical checkup was 74.7%. On the other side, the percentage of the controls that did not adhere to the periodic medical checkup was 68.4%. Thus, these findings show the importance of the medical checkup for the screening of colorectal cancer in order to prevent the development of colorectal cancer.

However, there is not much difference between the percentages of exposure in the cases and controls. (74.7%, 68.4%).

According to the disease stage detection, the majority of the colorectal cancer cases were detected in the late stage of the disease (50.5%). The most cases did not adhere to the screening test for colorectal cancer since the most of them were detected in the late stage of the disease.

Table 1. Colorectal Cancer Cases and Controls according to the Sociodemographic Variables

Socio-demographic Variables		Colorectal Cancer Cases		Controls	
		N	%	N	%
Age Groups	Less than 55 years	37	38.9%	37	38.9%
	55 to 65 years	34	35.8%	34	35.8%
	Older than 65 years	24	25.3%	24	25.3%
Gender	Male	50	52.6%	50	52.6%
	Female	45	47.4%	45	47.4%
Educational Level	Primary School	21	22.1%	9	9.5%
	Middle School	25	26.3%	13	13.7%
	High School	22	23.2%	16	16.8%
	University	27	28.4%	57	60%
Employment Status	Work	45	47.4%	40	42.1%
	Retired	21	22.1%	21	22.1
	Does not work	29	30.5%	34	35.8%
Total		95	100%	95	100%

Table 2 Colorectal Cancer Cases and Controls based on Colorectal Cancer disease awareness and Medical Information

Awareness and Medical Information		Colorectal Cancer Cases		Controls	
		N	%	N	%
Disease Awareness	Good	12	12.6%	34	35.8%
	Medium	6	6.3%	24	25.3%
	Low	77	81.1%	37	38.9%
Medical Checkup	Yes	24	25.3%	30	31.6
	No	71	74.7%	65	68.4%
Disease Detection Stage	Early Stage	47	49.5%	0	0%
	Late Stage	48	50.5%	0	0%
	No Disease	0	0%	95	100%
Diseases other than colon cancer	Diabetes	8	8.4%	8	8.4%
	Hypertension	11	11.6%	8	8.4%
	Diabetes and Hypertension	10	10.5%	14	14.7%
	Other Diseases	7	7.4%	10	10.5%
	No Other Diseases	59	62.1%	55	57.9%
Total		95	100%	95	100%

Thus, this result shows the importance of the screening test for early detection of colorectal cancer.

In accordance with the cases that have diseases other than colorectal cancer and controls that have any disease, the majority of the colorectal cancer cases were hypertensive (11.6%) and diabetics (8.4%). The most of the controls had both diabetes and hypertension (14.7%). As indicated by these results, controlling blood pressure and blood glucose level might decrease the risk of colon cancer. Notwithstanding, most cases did not have

diseases other than colorectal cancer and the most controls did not have any diseases.

As indicated by the BMI, the most cases were normal weight (35.8%) while the most controls were overweight (40%). Additionally, the inferential analysis for the study indicated that BMI was statistically significant related to colon cancer ($P = 0.045$; odd ratio is 0.927, 95% CI of odd ratio (0.861 to 0.998)). Thus, the study indicated that high BMI is protective against the development of colon cancer. However, these findings are in contrast with previous studies (6, 9) which showed that

obesity and overweight increase the risk of colon cancer.

As stated by the coffee and tea addiction, 61.1% of the colorectal cancer cases were not addicted to the coffee and tea, while 54.7% of the controls were not addicted to the coffee and tea. Notwithstanding, the inferential analysis of the study indicated that coffee and tea addiction was not statistically significant related to colon cancer ($P = 0.681$). This result is in contrast with a previous study which showed that caffeine consumption is inversely related to colon cancer [11].

Based on smoking status, the colorectal cancer cases and controls among non-smokers were 72.6% and 67.4% respectively. 11.6% of the colorectal cancer cases were smokers. 11.6% of the controls were ex-smokers. Additionally, the inferential analysis of the study indicated that smoking was not statistically significant related to colon cancer ($P = 0.249$ for ex-smokers, $P = 0.108$ for smokers all compared to non-smokers). Although these results are in agreement with a previous study [6], other studies indicated that smoking is associated with the development of colon cancer [7, 8, 9]. According to the physical activity, the colorectal cancer cases and controls that were physically inactive were 68.4% and 50.5% respectively. The colorectal cancer cases and controls that were physically active were 31.6% and 49.5% respectively. Nevertheless, the inferential analysis of the study indicated that physical activity was not statistically significant related to colon cancer ($P = 0.062$). Though this result is in agreement with previous studies [6, 7], other studies were indicated that physical activity is inversely related to colon cancer [8, 9, 10].

As indicated by the healthy diet plan, the colorectal cancer cases and controls that did not follow a healthy diet plan were 83.2% and 77.9% respectively. The colorectal cancer cases that followed a healthy diet plan were 16.8%. The controls that followed a healthy diet plan were 22.1%. Additionally, the inferential analysis of the study indicated that there is a statistically significant inverse relationship between the healthy diet plan and colon cancer ($P = 0.045$, odd ratio 0.379, 95% CI of odd

ratio (0.147 to 0.977). Thus, the inferential analysis of the study indicated that the healthy diet plan is protective against colon cancer.

In accordance with the number of meals, the colorectal cancer cases that consumed more than two meals per day were 60%. The controls that consumed more than two meals per day were 75.8%. The colorectal cancer cases that consumed one meal per day were 3.2% while the controls that consumed one meal per day were 1.1%. However, the inferential analysis of the study indicated that the number of meals was not statistically significant related to colon cancer ($P = 0.200$ for two meals per day, 0.067 for more than two meals per day, all compared to one meal).

Based on carbohydrate consumption, the colorectal cancer cases and controls that consumed carbohydrates as one of the major content in the meals were 95.8% and 90.5%. Nevertheless, the inferential analysis in the study indicated that carbohydrate consumption was not statistically significant related to colon cancer ($P = 0.442$). This result is consistent with previous studies which indicated that the Consumption of carbohydrates increases the risk of the colorectal cancer [7, 8, 11].

As stated by vegetable consumption, the colorectal cancer cases and controls that consumed vegetables as one of the major content in the meals were 83.2% and 44.2%. Also, the inferential analysis in the study indicated that vegetables consumption was statistically significant related to colon cancer ($P = 0.001$; odd ratio is 4.619, 95% CI of odd ratio (1.912 to 11.161)). These findings indicated that the consumption of vegetables is a causative of colon cancer. Furthermore, these results are in contrast with previous studies which indicated that the consumption of fruits and vegetables decreases the risk of colon cancer (6, 8). According to red meat consumption, the colorectal cancer cases and controls that consumed red meat as one of the major contents in the meals were 76.8% and 54.7%. Moreover, the inferential analysis in the study indicated that there is statistical significant relationship between red meat consumption and colon cancer ($P = 0.042$; odd ratio is 2.479, 95% CI of odd ratio (1.035 to

5.933)). These findings indicated that the consumption of red meat is a causative of colon cancer which is in agreement with previous studies [8, 9].

As indicated by sugars consumption, the colorectal cancer cases that consumed sugars one time per day consumption were 37.9%. The controls that consumed sugars one time per day were 44.2%. The controls that consumed sugars for more than one time per day were 43.2%. Additionally, the inferential analysis in the study indicated that sugars consumption was statistically significant inversely related to colon cancer ($P = 0.007$; odd ratio is 0.243, 95% CI of odd ratio (0.087 to 0.676) for one time per day sugar consumption compared to no consumption) and ($P = 0.004$; odd ratio is 0.222, CI 95% of odd ratio (0.079 to 0.624) for more than one time per day sugar consumption compared to no consumption). These results indicated that the consumption of sugars is a protective against colon cancer which is in contrast with previous studies [8, 11].

The study indicated that the relationship between lifestyle factors like (BMI, vegetables consumption, sugars consumption, carbohydrates consumption, physical activity, and smoking status) and the development of colon cancer is not in agreement with the majority of previous studies in the literature review, the general knowledge about the topic, and the hypothesis of the study.

Thus, future studies will be needed for further evaluation of the relationship between lifestyle factors and colon cancer in Libya. It is recommended to find strategies to avoid self-report bias and to decrease recall bias to improve the accuracy of the findings when they evaluate the relationship between lifestyle factors and colon cancer.

3. Conclusion and recommendations

As indicated by the results of the study, the hypothesis of the study is not supported except for the relationship between lifestyle factors (healthy diet plan, consumption of red meat) and colorectal cancer. The study indicates that following a healthy diet plan, sugars consumption, and BMI are inversely related to

Table 3. Binary logistic regression analysis for the educational levels

Educational level	P Value	Odds ratio (OR)	95% C.I for Odds ratio
Middle School Level	0.388	1.752	0.490 to 6.266
High School Level	0.545	1.476	0.418 to 5.209
University Level	0.189	0.473	0.155 to 1.445

Note: Primary School is the reference for other educational levels dummy variables in the Binary Logistic Regression.

Table 4. Binary logistic regression analysis of life style factors increase the risk of Colorectal Cancer

Variables	P Value	Odds ratio (OR)	95% C.I for Odds ratio
Vegetables Consumption	0.001	4.619	1.912 to 11.161
Red meat Consumption	0.042	2.479	1.035 to 5.933

Table 5. Binary logistic regression analysis of life style factors decrease the risk of Colorectal Cancer

Variables	P Value	Odds ratio (OR)	95% C.I for Odds ratio
BMI	0.045	0.927	0.861 to 0.998
Healthy Diet Plan	0.045	0.379	0.147 to 0.977
Sugars Consumption one time per day	0.007	0.243	0.087 to 0.676
Sugars Consumption more than one time per day	0.004	0.222	0.079 to 0.624

Note: No Sugars Consumption is the reference for Sugars Consumption one time per day dummy variable and Sugars Consumption more than one time per day dummy variable in the Binary Logistic Regression.

colon cancer. On the other side, red meat consumption and vegetables consumption are causative of colon cancer. However, other independent variables are not related to colon cancer.

Table 6. Binary logistic regression analyses of life style factors

Variables	P Value	Odds ratio (OR)	95% C.I for Odds ratio
Coffee and Tea Addiction	0.681	0.845	0.380 to 1.882
Ex-smoker	0.249	0.532	0.182 to 1.555
Smoker	0.108	0.428	0.152 to 1.203
Physical Activity	0.062	0.484	0.226 to 1.037
Consumption of two meals per day	0.200	0.181	0.013 to 2.467
Consumption of more than two meals per day	0.067	0.089	0.007 to 1.187
Carbohydrates Consumption	0.442	1.812	0.398 to 8.254

Note: Non-smoker is the reference for Ex-smoker dummy variable and smoker dummy variable in the Binary Logistic Regression. Consumption of one meal per day is the reference for Consumption of two meals per day dummy variable and Consumption of more than two meals per day dummy variable in the Binary Logistic Regression.

Future studies will be needed of further evaluation for the relationship between lifestyle factors and colorectal cancer in Libya.

The health educators should be recommended to encourage people to adhere to the screening test for colorectal cancer after 50 years of age, to increase awareness about cancer colon disease among the public, to encourage people to decrease the consumption of red meats, and to encourage people to follow a healthy diet plan in order to decrease the risk of colon cancer.

Limitations of the study

Since the participants of the study were restricted to the participants with no family history of colon cancer, the findings of the study cannot be generalized to people with a family history of colon cancer.

Since the study design was a case control study, it could be difficult for the cases to recall information for the time period before the disease was diagnosed. Thus, the study could be subjected to recall bias.

Since the height and weight were collected from the controls through self-report, the study could be subjected to self-report bias.

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Conflict of Interest

There is no conflict of interest was declared by the authors.

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