RESEARCH ARTICLE

Knowledge, Awareness, and Practices of University Students Toward the Role of Dietary and Lifestyle Behaviors in Colorectal Cancer: A Cross-Sectional Study from Sharjah/UAE

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Abstract

   Background: The incidence of colorectal cancer (CRC) has risen worldwide, with increasing prevalence in the UAE and GCC during the last few decades. Dietary and lifestyle behaviors play a pivotal role in the development and prevention of sporadic, with knowledge and awareness considered the first line of defence. Knowledge, awareness, and practices have been examined in different parts of the world, with scarce research have been conducted in the GCC countries and the UAE in particular. This study explored the UAE university student's knowledge and awareness toward the role of dietary and lifestyle behaviors in CRC. **Methods:** A cross-sectional study was conducted, using an online multi-component self-reported questionnaire. Descriptive and analytical statistics were used. **Results:** A total of 1213 students participated in the study, with the vast majority (92.7%) of the surveyed students reported good knowledge scores toward CRC risk factors. Significant differences (P<0.05) were found between the two sexes regarding dietary and lifestyle factors associated with CRC. Females consumed more vegetables compared to males, had lower intakes of red and processed meats, and were found to be fewer smokers. Being single (P= 0.0001), undergraduate (P=0.005), with medium to low income (P=0.026) all were significantly associated with increased risk of having poor knowledge about CRC, while being a medical student was significantly associated (P= 0.0001) with a 55% lower risk of having poor knowledge. **Conclusion:** Despite the good knowledge, university students' dietary and lifestyle behaviors necessities improvement, with barriers that require to be addressed.

Keywords: Awareness- dietary behaviors- knowledge- lifestyle behaviors- university students

Introduction

   Colorectal cancer (CRC) incidence has escalated and is considered a major cause of morbidity and mortality throughout the world (Rawla et al., 2019). It is the fourth most common cause of death from cancers worldwide, estimated to be responsible for almost 700,000 cancer deaths. Colorectal cancer in the UAE is ranked the second most common cancer and the second-highest cause of cancer deaths (GLOBOCAN, 2020).

   The world cancer research fund (WCRF) and the American Institute for Cancer Research (AICR) Continuous Update Project report identified several risk factors for developing CRC (International, 2018). Dietary and lifestyle behaviors were identified as playing a pivotal role in the development and prevention of sporadic CRC, these international reports have identified knowledge and awareness about the role of dietary and lifestyle behaviors in sporadic CRC as among the first defense line against the development of CRC. The reports also identified genetic predisposition as presented in the family history, diabetes, increasing age, physical inactivity, smoking, and diets low in fruits and vegetables, low intake of whole grains and dietary fibers, or diets high in red meats, processed meats, fats, and excessive alcohol intake as possible risk factors for developing CRC.

   In the Gulf Corporation Countries (GCC) and Middle East region, several studies have pointed out the lack of

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knowledge and awareness regarding CRC etiology and prevention among the general population (Su et al., 2013; Qadir and Ghalia, 2018; Al-Azri et al., 2019; Althobaiti and Jradi, 2019; Tfaily et al., 2019). A recent study from Saudi Arabia revealed moderate knowledge of the clinical manifestations and risk factors toward CRC, but a low percentage of participants acknowledged the role of fatty foods as a risk factor (AlSulaim et al., 2021). In a study among adults in the UAE, a poor knowledge score was reported among older adults (≥ 50 years old) about the risk factors and screening of CRC, while having a personal or family history of cancer was directly associated with the level of awareness (Al-Sharbatti et al., 2017). This notion highlighted the need for conducting awareness campaigns to develop a better understanding of CRC and its relation to dietary and lifestyle behaviors and to address the barriers and correct the misconceptions around it and drives the community to perceive the risk factors contributing to CRC to avoid faulty behaviors and prevent disease progression.

For young adults as an especially important population, adequate awareness and knowledge level among this population is an important preventive measure against the occurrence of this illness in the future. Also, the food habits of this population have recently shifted to be less healthy, indicating an increased risk for such illnesses. Concurrent undesirable food habits are encountered among western university students whose diets are prescribed as "poor"; rich in sugar-sweetened beverages and deficient in vegetable, fruit, and dairy product intake (Irazusta et al., 2007; Shinde et al., 2021). Noticeably, the westernized lifestyle and diet have prevailed among the young generations in the Arab and the Middle East region due to the nutrition transition (Ng et al., 2011; M Abdel-Rahman et al., 2017) accompanied by several forms of health disorders. Therefore, cancer, in general, is becoming nowadays more prevalent among young adults (Gupta et al., 2020), thus, targeting the young generation will invest in primary preventive measures against mortality and morbidity in general and cancer in particular.

Generally, unhealthy dietary habits and lifestyle behaviors characterize university life (Schmidt, 2012), owing to stress and lack of time typically which might sustain in later adulthood life. Unfortunately, failure to adopt healthier behaviors coupled with any genetic predispositions might contribute as major risk factors of CRC. Studies among university students in UAE have reported poor dietary and lifestyle behaviors that are associated with an increased prevalence of obesity (Bin Zaal et al., 2009). In light of the probable relation of unhealthy dietary and lifestyle habits and CRC incidences, with a paucity of published data regarding CRC knowledge and awareness in the UAE, particularly among the university students and young adults, the present study aimed to investigate the knowledge, awareness, and practices related to CRC and its risk factors among a sample of university students. Besides, the study aimed to investigate the correlates of poor knowledge toward CRC and its related dietary and lifestyle behaviors among this group of people.

Materials and Methods

Study protocol

A cross-sectional research design was followed to assess the level of knowledge and awareness regarding CRC among students attending the University of Sharjah (UOS), UAE. The inclusion of the participants was done primarily through a non-probability convenience sampling technique. The study included all accessible undergraduate and post-graduate students attending UOS and during the period from January 2020 to the end of April 2020. Recruitment was done online by circulating an invitation letter to all university students electronically. Within the invitation letter, a link to the online questionnaire was embedded. The first page of the electronic questionnaire provided information to participants about the study and took their consent to participate before they can proceed in completing the electronic questionnaire.

Data collection tools

An online electronic questionnaire (Supplementary file 2) was developed to assess the knowledge and awareness toward CRC and the related risky dietary and lifestyle behaviors. Participants were given a brief explanation of the study and its main purposes. The questionnaire was pretested before administration pilot testing with 15 students from the same targeted group and it was edited according to the feedback obtained.

The questionnaire included three domains: (1) sociodemographics of the study participants, (2) participants' dietary and lifestyle behaviors that are considered associated risk factors, (3) knowledge about CRC and its related risk factors. The participants' sociodemographics involved data about age, sex, marital status, nationality, college, university level, living place, and monthly income of the participants. Description of the assessed risk factors lifestyle behaviors was obtained from information about smoking and physical activity (PA) level. The physical activity questions included how often participants engage in physical activities (walking, swimming, gymnastics, football, aerobics) and the options described sedentary behavior (Less than 30-60 min once a week) to options reflecting recommended levels of at least 30 min of moderate activity on at least 5 days, (30-60 min 1-3 times per week) (30-60 min 4-6 times per week). The duration was adopted from the WHO global recommendations for adults' physical activity for health (2010) were adults aged 18–64 years should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week (WHO, 2010) This could not only improve cardiovascular health but also prevent chronic illnesses such as cardiovascular disease, hypertension, type-2 diabetes, and cancer. While insufficient physical activity, includes not doing at least 150 min of moderate-intensity, or 75 min of vigorous-intensity physical activity per week, or any equivalent combination of the two (Guthold et al., 2018).

The dietary information included fruits, vegetables, dietary fibers, fats, onion, dairy products, red meats, processed meats, and French fries (e.g., Serving of onion equals one medium fresh onion, chopped or sliced. See

Supplementary file 2 for the study questionnaire). Alcohol consumption was not asked due to cultural constraints, considering alcoholic drinks are prohibited and illegal in Sharjah, UAE. Moreover, the usual portion sizes of these food items were assessed using the options "*1 serving*", "*2-3 servings*", "*4 or more servings*". Examples of the food group portion size were elaborated after each question (See Supplementary file 2 for the study questionnaire). The knowledge and awareness about CRC and risk factors were based on the responses to specific questions, how much the participant knows, and agree or disagree on the role of specific risk factors associated with CRC. Knowledge assessment was based on the responses to specific questions and each correct response was given a score of 1 while each incorrect response was given a score of zero.

For example, one question asked," *Which group of individuals do you think is at greater risk for developing CRC?*" Only the correct response of both males and females was given a score of 1, while all other responses were given a score of 0. In determining the knowledge about risk factors associated with CRC, fourteen risk factors were given using a Likert scale of strongly disagree, disagree, undecided, agree, and strongly agree. Responses to agree or strongly agree were given a score of 1 for the right answers, and all other responses were given a score of 0. An overall score of knowledge and awareness was calculated by summing all scores from all questions in the section, after which, for improved interpretability, a percentage of the overall score was calculated (Rocke, 2019).

Statistical analyses

Analyses were reported based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2007). Scores for the CRC knowledge were presented as continuous variables and were normally distributed, therefore mean values were obtained. The categorical variables were described using frequencies and percentages of observed values. The overall score was defined as follows; poor knowledge was considered for a total point of <9 that is obtaining less than 50 out of 18 questions as correct responses. The risk assessment test and the Pearson Chi-Squared test were performed to find the odds ratio (OR) and 95% confidence interval (CI) of the associations between all categorical variables and the total knowledge score. Sociodemographic variables were transformed into two categories. Participants' responses data were encoded and analyzed using IBM SPSS statistics, version 24.0 (USA). All the data significance level was set at a P <0.05.

Study ethics

Ethical approval was obtained from the research ethics committee (REC) of the UOS (REC-20-05-26-03-S). Participation was voluntary, only students from both sexes aged 18 years and above, from both medical and non-medical colleges who were willing to participate and agree on the consent form, were included in the study. No monetary or non-monetary incentives were given to participants.

Results

The sociodemographic characteristics of the study participants are presented in Table 1. A total of 1213 students participated in the study, with a dominant larger number of female students (875, 72.1%) as compared to males (338, 27.9%). The majority of the participants were from the age group of 18-24 years (86.6%). About half of the participants (55%) were Arab non-GCC residents. The majority of the participants were single and living in-campus (89.4% and 74.5%, respectively). About two-thirds (63.5%) of the study participants were in the lower-income group. More than half of the participants were from medical colleges (55.6%), while about one quarter was in their first (24.2%) and fourth (22.4%)

Table 1. Sociodemographic Characteristics of the Study Participants (N=1213)

Variable	Frequency	Percent %
Sex		
Female	875	72.10
Male	338	27.90
Age group (year)		
18-24	1050	86.60
25-30	119	9.80
>30	44	3.60
Nationality		
UAE	223	18.40
Arab, GCC	231	19.00
Arab, non-GCC	668	55.10
Non-Arab	91	7.50
Marital status		
Single	1084	89.40
Married	98	8.10
Divorced	21	1.70
Widowed	10	0.80
Living place		
In-campus (dorms)	251	20.70
Out-campus with family	904	74.50
Out campus with friends	58	4.80
Monthly income (AED/month)		
< 5,000	770	63.50
5,000 – 10,000	246	20.30
> 10,000	197	16.20
College category		
Medical	675	55.60
Non-medical	538	44.40
College level		
1st year	294	24.20
2nd year	205	16.90
3rd year	189	15.60
4th year	272	22.40
5th year	83	6.80
Postgraduate	170	14.00

Table 2. Participants' Lifestyle and Dietary Behaviors Related CRC Risk Factors (n=1213)

Behavior	Category	Total	Male n (%)	Female n (%)	P-value*
How often do you engage in physical activities (walking, swimming, gymnastics, football, aerobics)?	Less than 3 days of activity/week (Infrequent/Risky)	833 (68.7)	185 (15.3)	648 (53.4)	0.0001
	More than 3 days of activity/week (Frequent/Protective)	380 (31.3)	153 (12.6)	227 (18.7)	
What is your usual serving per day of fruits?	Less than 2 servings/day (Infrequent/Risky)	886 (73.0)	240 (19.8)	646 (53.3)	0.348
	More than/equal 2 servings/day (Frequent/Protective)	327 (27.0)	98 (8.1)	229 (18.9)	
What is your usual serving number of vegetables /day**	Less than 3 servings/day (Infrequent/Risky)	761 (62.7)	231 (19.1)	530 (43.7)	0.012
	More than 3 servings/day (Frequent/Protective)	452 (37.3)	107 (8.8)	345 (28.4)	
What is your usual serving number per day of fiber?	Less/equal to 1 serving/day (Infrequent/Risky)	674 (55.6)	182 (15.0)	492 (40.6)	0.479
	More than 1 servings /day (Frequent/Protective)	539 (44.4)	156 (12.9)	383 (31.6)	
What is your usual serving number per day of onion?	Less/equal to 1 serving /day (Infrequent/Risky)	1066 (87.9)	284 (23.4)	782 (64.5)	0.014
	More than 1servings /day (Frequent/Protective)	147 (12.1)	54 (4.5)	93 (7.7)	
What is your usual serving size per day of fat?	More/equal to 4 servings/day (Frequent/Risky)	121 (10.0)	36 (3.0)	85 (7.0)	0.669
	Less than 4 servings/day (Infrequent/Protective)	1092 (90.0)	302 (24.9)	790 (65.1)	
What is your usual serving size per day of red meats?	More than 1servings/day (Frequent/Risky)	272 (22.4)	118 (9.7)	154 (12.7)	0.0001
	Less/equal to 1 serving /day (Infrequent/Protective)	941 (77.6)	220 (18.1)	721 (59.4)	
What is your usual serving size per day of processed meats?	More than 1 serving/day (Frequent/Risky)	183 (15.1)	77 (6.3)	106 (8.7)	0.0001
	Less/equal to 1 serving/day (Infrequent/Protective)	1030 (84.9)	261 (21.5)	769 (63.4)	
What is your usual serving size per day of dairy products?	Less/equal to 1 serving/day (Infrequent/Risky)	605 (49.9)	183 (15.1)	422 (34.8)	0.073
	More than 1 servings/day (Frequent/Protective)	608 (50.1)	155 (12.8)	453 (37.3)	
What is your usual serving size per week of French fries?	More than 1 servings/week (Frequent/Risky)	399 (32.9)	115 (9.5)	284 (23.4)	0.633
	Less/equal to 1 serving/week (Infrequent/Protective)	814 (67.1)	223 (18.4)	591 (48.7)	
Smoking	Yes (Risky)	305 (25.1)	137 (11.3)	168 (13.8)	0.0001
	No (Protective)	908 (74.9)	201 (16.6)	707 (58.3)	

Table 3. Questions Related to the Knowledge Assessment for Colorectal Cancer and Related Risk Factors

Question related to knowledge about CRC	% Correct
Which group of individuals (males/females) do you think is at greater risk for developing colon cancer?	54.70%
Do you think that diet plays a role in causing CRC?	74.60%
Do you think diet plays a role in preventing CRC?	84.40%
Do you think that CRC is hereditary?	49.50%

academic years.

Participants dietary practices and lifestyle behaviors

Significant sex differences were observed for the PA level (P=0.0001) as the proportion of males who use to do PA more than three days /week was significantly higher than the females, while the proportion of males who were smokers was significantly (P=0.0001) higher than females (Table 2). Moreover, the consumption of onion (P=0.011), red meats (P=0.0001), and processed meats (P=0.00) were reported at significantly higher rates among males in comparison with females. On the other hand, the proportion of females who used to consume more than three servings of vegetables/day was significantly higher than males (P=0.011). Unhealthy dietary and lifestyle behaviors generally associated with increased risk of CRC were more predominant than healthy protective behaviors

among the study participants, in terms of the infrequent PA events in comparison to the frequent (68.7% vs. 31.3%), less frequency of consuming healthy protective foods such as fruits (73.0% vs. 27.0%), vegetables (62.7% vs. 37.3%), dietary fiber sources (55.6% vs. 44.4%), and onion (87.9% vs. 12.1%). Nevertheless, other dietary and lifestyle behaviors were less frequently reported among the study participants, such as smoking (74.9% vs. 25.1%), intake of dietary fats (90.0% vs. 10.0%), red meats (77.6% vs. 22.4%), processed meats (84.9% vs. 15.1%), and French fries (67.1% vs. 32.9%).

Knowledge of CRC and awareness regarding risk factors

The knowledge assessment of the participants regarding CRC and its risk factors is presented in Tables 3 and 4. About half of the participants correctly answered the question "*Which group of individuals do you think is at greater risk for developing CRC?*". The majority (74.6%) correctly answered the question "*Do you think that diet plays a role in causing CRC?*", and the vast majority (84.4%) correctly answered the question "*Do you think diet plays a role in preventing CRC?*". However, approximately half (49.5%) of the participants correctly answered the question "*Do you think that CRC is hereditary?*".

Regarding CRC risk factors, the following percentages represent the correct answers of the participants who

Table 4. Knowledge about Risk Factors of Colorectal Cancer

Risk factor for CRC	% Correct* (Agree, strongly agree)	% Incorrect (Disagree, strongly disagree, Undecided)
Family history of colon cancer	71.90%	28.10%
Not being physically active	73.20%	26.80%
Diabetes	56.00%	44.00%
Frequent alcohol intake	80.80%	19.20%
Frequent high fat intake	79.20%	20.80%
Increased age	64.80%	35.20%
Frequent low fiber intake	64.10%	35.90%
Being overweight	73.00%	27.00%
Smoking	77.30%	22.70%
High frequent intake of red meats	64.60%	35.40%
High frequent intake of processed meat	74.40%	25.60%
Low vegetable intake	71.60%	28.40%
Low fruit intake	68.30%	31.70%
Frequent high levels of stress	75.20%	24.80%

*Which group of individuals do you think is at greater risk for developing CRC?; Correct answer [Males and females have an equal risk to develop colon cancer]; Do you think that diet plays a role in causing CRC?; - Correct Answer [Yes]; Do you think that diet plays a role in preventing CRC?; Correct Answer [Yes]; Do you think that CRC is hereditary?;- Correct Answer [No]; -Knowledge scores characteristics; Overall score: 13.82 ± 3.21 (Out of 18 questions); Percentage score category; <50% (Poor knowledge) 7.3%; ≥50% (Good knowledge) 92.7%

strongly agreed/agreed: the vast majority (71.9%) agreed on the role of family history in CRC, while (73.2%) agreed on the idea that not being physically active increases the risk of developing CRC, more than half (56.0%) agreed on the impact of diabetes mellitus disease in increasing the risk. When asking the participants regarding some dietary behaviors and their association with CRC incidence, the following answers were reported; 80.8% agreed on the role of frequent alcohol intake, 79.2% on frequent high fat intake, 64.8% on increasing age as a risk factor, 64.1% on the negative impact of frequent low fiber intake, 73.0% on being overweight, 77.3% for smoking, 64.6% for the high frequent intake of red meats, 74.4% for the high frequent intake of processed meats, 71.6% for low vegetable intake, 68.3% for low fruit intake and 75.2% for frequent high levels of stress. Generally, the overall knowledge score mean was found to be 13.82 ± 3.2 out of 18. Overall, good knowledge was observed among the vast majority (92.7%) of the study participants, while poor knowledge was observed among 7.3% of the participants.

Associations of CRC knowledge and participants' characteristics

The risk assessment of CRC knowledge and sociodemographic data, dietary, and lifestyle behaviors are reported in Supplementary Table 1. Being single was significantly associated with a doubled risk of having poor knowledge about CRC while being a medical student was significantly associated (P= 0.0001) with a 55% lower risk of having poor knowledge. Besides, the undergraduate university level was associated with a 42% higher risk of having poor knowledge about CRC (P= 0.005) than the postgraduate level. Low monthly income was associated with a 35% higher risk of having poor knowledge (P= 0.026). Inadequate intakes of fruits, vegetables, onion, and dairy products were (P<0.005) associated with an increased risk of having poor knowledge by (41%, 71%, 90%, and 37%, respectively). Nevertheless, those who were smokers were more likely to have a higher risk of poor knowledge by 64% (P= 0.0001).

Discussion

Interestingly, the results of the current study showed the prevalence of a good level of knowledge and awareness related to CRC and its related dietary and lifestyle risk factors among the vast majority of the study participants of UOS students. This prevalence of good knowledge is higher compared with a study in the Caribbean University which reported a poor knowledge level among college students (36.23%) (Rocke, 2019), compared with university students in Jordan (36.1%) (Mhaidat et al., 2018), and adults and adolescents in the Gaza strip/ Palestine (Elshami et al., 2020), and also among Saudi undergraduate students whose knowledge score was not up to the mark (Imran et al., 2016) but similar to a recent study among University students in Pakistan (Hussain et al., 2020). Though the above-mentioned studies have utilized assessment tools that are not the same as the current study, however, the knowledge questions share the same concepts and contents. For example, the protective aspect of fruits and vegetable consumption, reduced alcohol intake, smoking, and PA.

Although the good mean knowledge score of 13.82 ± 3.21, however, relatively low percentages of participants implemented protective dietary and lifestyle habits. For example, only 26.9% and 37.5% of the participants consumed more than two servings of fruits/ day and more than three servings of vegetables/day, respectively. Furthermore, only 31.3% exercised more than three days/week. This reflects that potential barriers render the participants unable to reflect their adequate

knowledge of their dietary and lifestyle behaviors, which calls for further research to explore. Consistent with our study, one study from Pakistan (Hussain et al., 2020) reported that there is a gap between the knowledge of university students and adopting preventive healthcare practices related to CRC. Previous studies showed high levels of consumption of refined foods and animal products as compared to fruits and vegetables among UAE and GCC populations (Elgaili et al., 2020). Healthy eating is affected by various individual and collective cultural, social, economic, and environmental factors. It also involves behaviors and eating habits that are consistent, which is beneficial for supporting and maintaining both physical and psychological health.

In the current study, more than half of the study population gave a correct response to the question "Which group of individuals do you think is at greater risk for developing CRC?", which is almost equal to the percentage of correct responses in the Caribbean study (55%)(Rocke, 2019). More than (71%) of the population agreed that a family history of CRC is a risk factor that was consistent with the Caribbean study (74.8%). The knowledge regarding the role of family history in CRC was higher in our study (71.9%) compared with similar studies in Saudi Arabia with 52% (Imran et al., 2016) and 20.9% (AlSulaim,2021). Indeed, family history could be a potential confounder in CRC (Jasperson et al., 2010).

Further, the findings revealed sex differences in unhealthy behaviors practiced among the male participating students, such as males consuming fewer vegetables compared to females. Moreover, males had a higher consumption of red meats and processed meats and a higher proportion of smokers. These findings were observed among Kuwaiti male and female college students (Alkazemi, 2019) and are compatible with previous research that suggests that women are more concerned about a healthy diet and lifestyle (Wolin et al., 2007). However, sex was not significantly associated with the poor knowledge level when this variable was further investigated in risk assessment.

Taking all these together, strategies are needed to achieve healthier food consumption among the male sex, as this is the most substantial means for enhancing health. This is also generalized for the whole population, especially that the role of diet and nutrition is well evidenced to explain as much as 30%–50% of the worldwide incidence of CRC (Martin Lipkin et al., 1999).

The present study showed smoking was more prevalent among male participants compared to females, which is like the population in Palestine (Elshami et al., 2020). Besides being a smoker increased the likelihood of poor knowledge by 1.5 times (OR: 1.64; 95%CI: 1.359 – 1.975, P<0.001). Smokers are more susceptible to CRC (Giovannucci, 2001), therefore there is a great need to highlight smoking as risky behavior, particularly among male college students whose attitudes are conducive to change at this period of life. However, male participants reported higher PA levels, a finding that is consistent with previous studies suggesting that males are more active than females (Telford et al., 2016). Low habitual PA is affirmed among adolescents and women in Arab Countries

and GGC in particular (Kahan, 2015). The WCRF /AICR recommends PA for cancer prevention (International, 2018), hence encouraging this behavior among young college students would not only protect against cancer but also improve overall wellbeing.

More than half of the participants 64.8% of the present study were aware that increasing age is a possible risk factor for CRC incidence in line with 59.4% in a Saudi Arabian study (Imran et al., 2016). Approximately 73% of the study participants identified overweight and low PA as contributing risk factors as compared with 66.5% in Saudi Arabia but higher than Lebanese study (37%). Our finding was also similar to the findings of Kirkegaard et al., (2010) that PA lowers the risk of CRC (Kirkegaard et al., 2010). The most recognized risk factor by the current study population was frequent alcohol intake as the majority (80.8%) of the participants were able to identify it as a possible risk factor compared with only 58% in the Caribbean study (Rocke, 2019), Lebanese and Omani study (Al-Azri et al., 2019; Tfaily et al., 2019) which reflects a better knowledge regarding the possible health implications of excessive alcohol consumption. Knowing that CRC can be prevented by the detection of early disease stage, awareness of modifiable related factors is considered vital to reducing the burden of the CRC disease and lessening the incidence of the cancer diagnosis among the general populations.

The risk factor with the lowest correct response was diabetes, as only 56% were able to identify it as a possible risk factor, which is similar to what was reported by Nguyen et al (2020) that diabetes is one of the potential risk factors for CRC (Nguyen et al., 2020). However, the percentage of correct responses regarding the role of diabetes in CRC was higher than in the Caribbean study (33.9%) (Rocke, 2019). This distorted information about possible diabetes relation with CRC is critical knowing that diabetes mellitus and pre-diabetes prevalence are major public health issues in the UAE (Hamoudi et al., 2019). Consequently, public initiatives should be called to lessen the emerging incidence of both health hazards (CRC and Diabetes) in the UAE. Therefore, the first-line intervention to improve awareness can be applied among these young age groups successfully to decrease the burden of CRC.

Using risk assessment to investigate the likely predictors for the poor knowledge, the study results significantly showed that inadequacy in daily intakes of fruit, vegetables, onions, and dairy products (OR = 1.41, 95% CI: 1.09–1.86, P=0.016) and (OR = 1.71, 95% CI: 1.316 – 2.209, P < 0.000), and 1.90 95% CI: 1.323 – 2.715, P=0.001) OR (1.37, 95%:1.135 – 1.658) respectively. Being a student from a medical-related field of studies had a significantly lower likelihood to have poor knowledge (OR: 0.434 (0.331 – 0.570, P=0.000). Other possible predictors were "being single" which is also in line with previous findings from Oman where married participants recognized more the risk factors for stomach and CRC (Al-Azri et al., 2019).

Based on these findings together, predictors of poor knowledge are mostly associated with modifiable dietary behaviors. It is well-established that nutritional factors

can promote or inhibit the development of CRC and consequently control this disease (Martin Lipkin et al., 1999). Systematic literature reviews provide evidence that increased intake of some foods/nutrients such as dietary fats, red, and processed meats is associated with a significantly elevated risk of multiple organ cancers, including CRC, colon, and rectal cancers. On the other hand, evidence from epidemiological studies has associated high intakes of fiber, fruits and vegetables, fish, and dairy products to lower the risk of CRC.

Study limitations

This study used a self-report questionnaire, this type of data collection method is subject to reporting bias from participants. Some data recalled and provided by participants may not be so accurate.

Although the study included a large sample size, the convenient sampling methods used and the collection of data from one educational institution may have limited the generalizability of the study.

Conclusions and recommendations

In conclusion, a good level of knowledge and awareness regarding CRC and its risk factors was reported among the UOS university students. However, dietary and lifestyle practices need to be enhanced, and existing barriers toward change need to be properly addressed to improve the behaviors in a way that could help in preventing CRC in the future. The empowering of young adults with motivation about cancer prevention and related lifestyle issues is important. The study's findings necessities tailoring culture-specific intervention programs that enable students to improve their dietary and lifestyle behaviors toward CRC control.

Author Contribution Statement

MF, study conceptualization; MF and MH, study design and the development of the study-specific questionnaire; DA, data analysis; BA, JM, MY, MI, SA, data collection; MF, MH, drafting of the manuscript; FN DA, NA, SR contributed to revising and finalizing the manuscript.

Acknowledgments

Consent to participate

Only students who were willing to participate and agree on the consent form, were included in the study.

Availability of data and material

The data is available through contact with the corresponding author.

Conflicts of interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this work.

Data repository link

https://www.dropbox.com/s/zl9t58cue792zu8/Colon%20cancer%20Data%209.4.2020.sav?dl=0
• Supplementary Table 1.
https://www.dropbox.com/scl/fi/up1bb24zlg0veilyp444c/Supplementary-Table-1.docx?dl=0&rlkey=m6jx7n1g1hvtbjyjr0usvs6vi.
•Supplementary file 2: Study questionnaire link: https://docs.google.com/forms/d/1j8KCqFUzF-3ljlWSn_5yalVvTugjj6o6_4yC14mAoaE/prefill

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