

Background

Colorectal cancer (CRC) is the third most prevalent cancer globally, with incidence rates particularly high in developed countries. However, these rates are rising in developing nations as their lifestyle and diets increasingly mirror those of wealthier countries [1].

Lifestyle factors such as the consumption of processed meat, dietary fiber intake, body mass index (BMI), physical activity levels, and smoking significantly influence the risk of developing CRC. Population-attributable risk estimates suggest that approximately 60% of CRC cases in males and 50% in females could be prevented through healthy diet and lifestyle choices [2].

CRC typically presents with symptoms such as abdominal discomfort, changes in bowel habits, bloody stools, fatigue, and weight loss. However, these symptoms often manifest only in the advanced stages of the disease, where mortality rates are significantly higher [3].

Early detection through screening is crucial, as it identifies CRC and precancerous polyps in asymptomatic stages, thereby improving survival rates. The American Cancer Society recommends that average-risk adults begin CRC screening at age 45 and continue through age 75, with the frequency of screening depending on the method used. After age 75, the decision to continue screening should be individualized. Special guidelines apply to individuals at increased risk, such as those with a personal or family history of CRC, genetic conditions like Lynch syndrome and familial adenomatous polyposis, and those with inflammatory bowel disease [4].

In Syria, the National Cancer Registry indicated that CRC was the second most common cancer in both males and females in 2009, ranked after lung cancer in males and breast cancer in females [5]. Statistics after the decade-long Syrian war are limited, but there is evidence that cancer cases, including CRC, are on the rise, and screening rates remain negligible in the absence of an official national CRC screening policy [6–8]. This underscores the urgent need to raise public awareness about CRC, its risk factors, and the importance of early detection through screening. Increased awareness could lead to more proactive health behaviors, such as seeking screening and adopting healthier lifestyles, ultimately reducing CRC incidence and mortality.

While many studies have assessed CRC knowledge and screening behaviors in neighboring countries, our

automatically excluded. Participants were encouraged to share the survey link within their networks, employing a snowball sampling approach to maximize reach. The questionnaire consisted of six socio-demographical questions (sex, age, social status, working status, educational level, and economic level), as well as questions assessing knowledge of symptoms and management of colorectal cancer, knowledge about colonoscopy, and participants' opinions on the study. It also included questions on intestinal stoma, diet, and the effect of low-dose acetylsalicylic acid on colorectal cancer.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) v28.0. Categorical variables were presented as frequencies and percentages. To determine differences between knowledge questions and socio-demographical variables, a Chi-square test of independence was performed. We assessed multicollinearity among the independent variables (age, economic status, gender, and education level), treated as categorical, using Variance Inflation Factor (VIF) values. All VIFs ranged from 1 to 1.5, indicating no multicollinearity concerns. Additionally, multinomial regression was conducted to determine the adjusted odds ratio (OR) for age as a predictor of CRC knowledge, further confirming the relationship previously identified through Chi-square analysis.

Ethical considerations

The study protocol was approved by the Research Ethics Committee of Damascus University, Faculty of Medicine (MD-020624-247). The research adhered to the ethical principles of the Declaration of Helsinki, ensuring respect for participants' autonomy, confidentiality, and

well-being. Informed consent was obtained electronically via the survey's introduction page, which outlined the study's purpose, voluntary nature, and confidentiality measures. Participants confirmed their consent by selecting an agreement checkbox before accessing the survey questions. Data collection was anonymized; participants were not required to provide identifying information, and responses were linked to unique codes instead of personal identifiers. The data were securely stored on a password-protected server accessible only to the research team, and no individual-level data were disclosed in the results.

Results

The study included 772 participants. Online distribution through social media platforms prevents determining the exact response rate due to the lack of tracking for the number of individuals reached or invited.

The majority of respondents were female (64.4%) and aged between 30 and 35 years (42.6%) (Fig. 1). Most respondents were married (56.3%) and employed (62.3%), reflecting a population engaged in work and family life.

The socioeconomic status varied, with 46.9% reporting a median economic status and 48.6% holding a bachelor's degree as the highest level of education (Table 1).

Regarding colorectal cancer (CRC) knowledge, 27.8% of participants considered themselves informed. However, only 29.9% correctly identified a link between adenocarcinoma polyps and CRC, and 35.9% believed that CRC could be an inherited disease. A significant portion of respondents lacked clarity on key aspects of CRC; for

recognizing the role of diet in increasing CRC risk. Furthermore, only 17.7% were aware of the potential protective role of aspirin in reducing CRC risk (Table 2).

Colonoscopy was known to 54.8% of the respondents. However, only 15.4% of participants had undergone a colonoscopy, with most of these procedures being performed without anesthesia (Table 3). Despite low utilization, 86.4% of participants would undergo the procedure if recommended by a healthcare provider. Additionally, 62.5% believed that colonoscopy helps detect and treat CRC, yet 55.3% perceived the procedure as painful, 38.6% found it embarrassing, and 16.4% considered it an unsafe examination. Moreover, 34.1% were unaware of the need for preparation prior to the procedure (Table 3).

Statistical analysis (Table 4) revealed significant associations between CRC knowledge and demographic factors. Statistically significant gender differences were observed, with males generally demonstrating higher awareness levels. The data showed that 34% of males accurately recognized the link between polyps and CRC, compared to 27% of females. Additionally, 42% of females were uncertain about whether CRC is curable,

beliefs about illness (“there is no escape from God’s will”), further restrict proactive health measures like screening.

These shared cultural and systemic barriers could help explain the results of our study, given the great cultural and societal similarities between the two countries [11].

Obstacles in the Syrian healthcare system, including inadequate primary care services and fragmented referral systems, could also hinder early detection and timely treatment of CRC. Additionally, the absence of a comprehensive health insurance system creates significant financial barriers, leaving individuals to bear the full cost of CRC screening and treatment. This financial strain discourages many from seeking preventive care or addressing symptoms early, leading to delayed diagnoses

and poorer health outcomes, particularly among lower-income populations.

Only 54.8% of respondents knew what a colonoscopy was, and even fewer had undergone the procedure (15.4%). Moreover, a significant number of respondents were not aware of the usefulness of fecal occult blood tests (38.9% were neutral or uninformed). This indicates an urgent need for improved health education and better access to screening services.

In addition, we found significant associations between knowledge levels and sociodemographic factors such as gender, education, and economic status. Understandably, higher education levels correlated with better knowledge about the treatment of CRC surgically. Financial status also played a role, with those in better economic sta051 aning servicesir

Table 4 Correlation between knowledge and other variables

Knowledge questions	Chi-square test <i>p</i> -value			
	Knowl- edge* Gender	Knowl- edge* Education	Knowl- edge* Eco- nomic Status	Knowl- edge* Age
Do you consider yourself an informed person , with awareness of colorectal cancer?	0.13	0.19	0.01	0.816
According to your knowledge, is there a proven link between the presence of adenocarcinoma polyps in the large intestine and the possibility of colorectal cancer development?	0.001	0.5	0.01	0.91
Do you think that colorectal cancer can be an inherited disease ?	0.3	0.2	0.01	0.033
Does colorectal cancer in your immediate family put you at an increased risk for developing colorectal cancer?	0.004	0.28	0.26	0.032
Do you think colorectal cancer is a malignant neoplastic disease?	0.004	0.02	0.065	0.008
Do you agree with the statement that colorectal cancer is a disease with no possibility of being completely cured ?	0.001	0.09	0.19	0.548
Can colorectal cancer be treated surgically ?	0.04	0.04	0.04	0.121
Can colorectal cancer be completely cured ?	0.002	0.009	0.01	0.012
Do you agree with the statement that colorectal cancer can be completely cured in any case ?	0.001	0.01	0.01	0.008
Is fecal occult blood test helpful in detecting colorectal cancer?	0.001	0.01	0.01	0.394
Do you think in ammatory bowel diseases can be linked to the development of colorectal cancer?	0.03	0.65	0.17	0.19
In case of having colorectal cancer, would you agree to undergo colostomy to have permanent intestinal stoma if that would be required?	0.02	0.17	0.67	0.226
Do you think that the type of diet can affect the development of colorectal cancer?	0.01	0.08	0.001	0.247
Do you think that taking regular small doses of aspirin may protect against colorectal cancer?	0.001	0.01	0.13	0.086

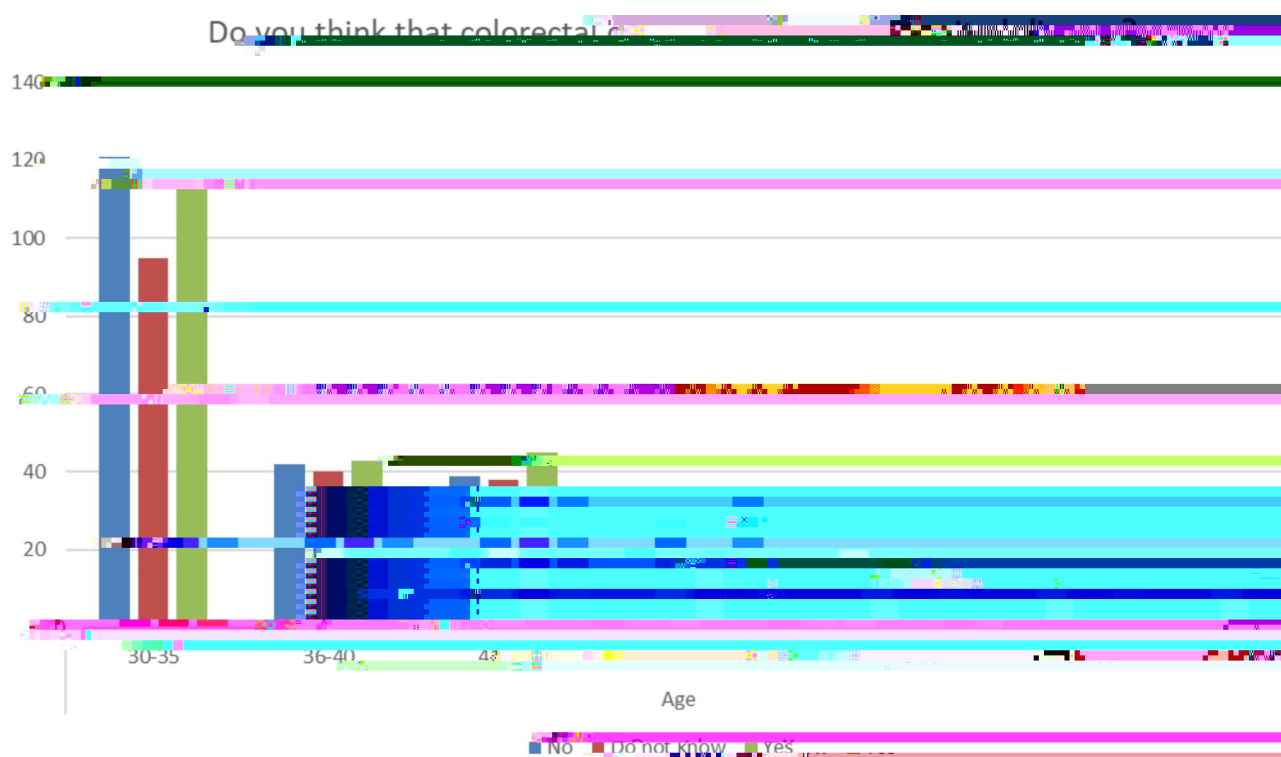


Fig. 2 Awareness of the hereditary nature of colorectal cancer (CRC) across age groups. The figure illustrates the distribution of responses (“Yes,” “No,” and “Do not know”) to whether CRC can be inherited, stratified by age groups. Statistical analysis indicates significant differences among age groups (*p*

sector should be prioritized, focusing on restoring medical centers and providing essential diagnostic equipment. A national CRC screening campaign should be established, with a specific month dedicated to intensive outreach and awareness. To enhance accessibility, screening services should be complimentary, especially for economically disadvantaged populations.

The correlation between higher education and CRC knowledge underscores the importance of targeted educational interventions. Campaigns should be tailored to various socioeconomic and educational groups, simplifying messages for low-literate populations through visuals, infographics, and community meetings. For college students, CRC education should be integrated into university programs. Roadshows and mobile units can also promote CRC screening, particularly in rural areas.

Existing nonprofit organizations focused on healthcare education for underserved populations should include CRC awareness in their outreach. These organizations, with their established networks, can significantly expand awareness among vulnerable groups. Additionally, the Ministry of Health should collaborate with social media influencers to reach younger, tech-savvy audiences, using platforms to promote CRC prevention and screening.

Global CRC awareness initiatives, such as those in the US, the UK, and Canada, provide valuable lessons for Syria. Adapting these strategies to the post-war context may require international partnerships for financial and technical support. Local adaptation should focus on cultural relevance, leveraging existing networks, and community involvement for sustainable impact.

Limitations

This study is significant as it is the first of its kind in Syria, providing valuable insights into the current state of CRC awareness and knowledge. However, there are several limitations to acknowledge. First, the reliance on online questionnaires and the use of the snowballing method for participant selection limit the sample to those with internet access, digital literacy, and social networks, excluding many individuals, particularly in rural areas or from lower socioeconomic backgrounds. This limits the generalizability of the results and introduces sampling and self-selection bias, as participants might already have a higher interest or awareness regarding health issues. Second, conducting research via social media presents challenges such as the potential inaccuracy of user-generated content, lack of editorial oversight, and difficulties in verifying participants' authenticity. Third, the use of a self-administered survey carries risks of response bias, as participants may overestimate or underestimate their knowledge. Additionally, cultural and social desirability bias might influence responses, with participants potentially answering based on what they perceive as socially

acceptable rather than accurate. Self-reported data can also lead to recall bias or inconsistencies due to varying interpretations of medical or technical terms in the questionnaire. Fourth, the cross-sectional design prevents the assessment of changes in knowledge or awareness over time and limits causal inferences.

Future research

In conclusion, while this study highlights the urgent need for enhanced public health education and accessible screening programs to improve CRC awareness and knowledge among the Syrian population, these limitations suggest that further research using more diverse sampling methods, such as in-person surveys or mixed-method approaches, would improve representativeness and generalizability. Additionally, future research should consider strategies to mitigate the limitations of online recruitment and self-reported data.

Future research in this field should also consider longitudinal studies to track changes in CRC knowledge and screening behaviors over time, especially following public health interventions. Additionally, qualitative research exploring the cultural, socioeconomic, and systemic barriers to CRC screening could deepen our understanding of these challenges.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 24 August 2024 / Accepted: 3 March 2025

Published online: 11 March 2025

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