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Colorectal Cancer Trends among Young Adults in Erbil Governorate: Stage at Diagnosis, and Disease Characteristics

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Abstract

Early-onset colorectal cancer (EOCRC) has become a health concern worldwide, characterized by the diagnosis of CRC in individuals under the age of 50. This study aims to determine the trends and characteristics of CRC among young adults (below 50 years of age) in Erbil Governorate, Iraq. It was a retrospective cross-sectional study conducted at Rizgary Oncology Center, Erbil, Iraq, between January 2017 and December 2023. Data were obtained from the medical records of the included patients. Descriptive statistics were used to present the patient demographics, clinical characteristics, and tumor features. Of 580 cases, 171 (33.0%) were classified as belonging to the 'young' age group. The majority of the cases were presented in stage III disease (57.8%) and only 5.6% were diagnosed at stage 1, younger ages were presenting with more advanced stage than old patients (p=.002). The most common site of metastasis was liver (60.9%) followed by lungs (15.2%) and bones (10.9%). The most aggressive histologies occurring in younger age group as compared to older group. The percentage of colorectal cancer among young individuals in the Erbil governorate seems to be high, in line with the global increase in early-onset CRC. Young males exhibit a higher percentage of right-sided colon cancer than females, while rectal cancer is more common in females than in males.

Keywords*: Colorectal Cancer, Early Onset Colorectal Cancer, Erbil.*

Introduction

Colorectal cancer (CRC) has traditionally been considered a disease that primarily affects older adults. However, recent studies are revealing an steady increase in incidence of CRC among younger population defined by younger than 50 years. This trend has been observed across various countries and regions, indicating a shift in the epidemiological profile of the disease [1–3]. Same increase was debated in our country among cancer care personnels yet no studies were conducted addressing this matter. Previous studies in the region have either overlooked this subject or found no significant increase in incidence among young population [4]. Answering this question will guide the future care and rise more questions regarding the etiological factor and ultimately may suggest adjustment of screening and other preventive measures.

Emerging evidence suggests that younger patients may present with more advanced disease at diagnosis compared to their older counterparts. Studies have shown that young adults with CRC often experience delays in diagnosis, which can result in more advanced stages of disease and poorer outcomes [5]. Additionally, there are indications that the disease may exhibit distinct biological and histological features in younger patients, which could impact treatment strategies and prognostic factors [2].

Understanding the stage at diagnosis, and other disease characteristics is crucial for

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developing targeted screening programs and effective intervention strategies. This study aims to add fill in some knowledge gaps of this geographical region and tries to compare it with other regional and international data. By examining the trends and characteristics of CRC in this demographic, the study aims to contribute valuable insights that can inform local health policies and improve patient outcomes.

Materials and Methods

Study Design and Setting

This was a retrospective cross-sectional study conducted in Erbil Governorate, Iraq. The study focused on young adults aged 18 to 49 diagnosed with CRC between January 2017 and December 2023. Data were collected from the Rizgary Oncology Center in Erbil. It included all patients under 50 years with the diagnosis of CRC during the study period. Inclusion criteria were histopathologically confirmed cases of colorectal cancer. Exclusion criteria included patients with incomplete medical records and histologically unproven CRC, and cases residing outside Erbil governorate.

Data Collection

Data were obtained from the medical records of the included patients. Information extracted were:

1. Demographic Data: Age, gender, and residence.
2. Clinical Characteristics: Symptoms at presentation, family history of colorectal cancer, and comorbid conditions.
3. Tumor Characteristics: Tumor location (colon, rectum), histopathological type, tumor grade, and stage at diagnosis (using the American Joint Committee on Cancer (AJCC) staging system).

Data Analysis

The Statistical package for social sciences (SPSS) version 27.0 was used for data analysis, Descriptive statistics were used to present the patient demographics, clinical characteristics, and tumor features.

The stage at diagnosis was classified according to the AJCC staging system. The distribution of patients across different stages (I-IV) was analyzed. Tumor characteristics such as histological subtype, grade, and location were reported as frequencies and percentages.

Chi-square tests were used to assess associations between categorical variables (e.g., gender and stage at diagnosis), and t-tests were used to compare continuous variables (e.g., age) between groups. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Hawler Medical university ethics approval department. Patient confidentiality was maintained by anonymizing data before analysis:

Results

During the data collection phase, we identified 580 cases of colorectal cancer from a total of 836 cases registered and treated at Rizgary Oncology Center in Erbil between January 2017 and September 2024. Cases not meeting residency requirements for Erbil governorate were excluded from the study, resulting in a refined sample size of 580.

Of these, 171 cases (33.0%) were classified as belonging to the 'young' age group, being under 50 years of age.

The geographical distribution of cases was comparable between the younger and older age groups ($P = 0.51$). Both age groups exhibited a higher number of cases in the city center.

Fifty two percent of the young cases were male (n= 89) and 48% were female (n= 82) compared to 56% males and 44 % females from old age group. The mean Body mass index was similar between males and females (24.62 & 24.67 respectively. The sex distribution among the young age group suggests more females from the city center (53.5 %) and more males in city periphery (59.7%) compared to equal sex

distribution in the older age group. However, this difference doesn't reach statistical significance (p = .087 & .56 for young and old age group respectively).

The median age at diagnosis was 56 years for males and 57 for females, The mean age at diagnosis for young group was 38.12 years. About 90% of the case in the young group were in the third and fourth decades of life, and were equally divided between the both decades (Figure 1). The median age for the young group was 38 years for males and 35 years for females. The minimum age at diagnosis was 14 years, 4 out of the 171 patients were below age of 20 years.

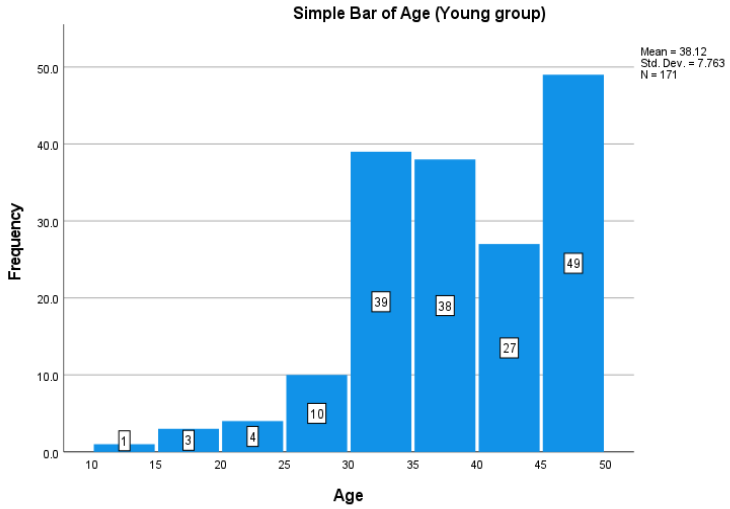

Figure 1. Age Distribution for the Young Group

The majority of patients (57.8%) were diagnosed at stage 3, followed by stage 4, with 25.5% of cases. Earlier stages were observed less, with only 11.2% of patients diagnosed at stage 2 and 5.6% diagnosed at stage 1. Additionally, 5.8% of the cases had missing information on tumor stage. With a Pearson Chi-Square value of 14.586 (df = 3, p = 0.002), younger ages were presenting with more advanced stage than old patients, although the linear-by-linear association wasn't significant (p = .187). The distribution of both age groups with the stage categories are summarized in Table 1.

Table 1. Cross Tab Between Stage at Diagnosis and Age Groups (50 Cut Point)

		Age groups (50 Cut point)			
		<50		**50+**	
		Count	**%**	**Count**	**%**
Stage at diagnosis	Stage 1	9	5.6%	28	8.7%
	Stage 2	18	11.2%	67	20.7%
	Stage 3	93	57.8%	131	40.6%
	Stage 4	41	25.5%	97	30.0%

The younger age had predominantly intermediate grade disease (68.8%), followed by High grade (26.8%) and low grade (2.5%), and 3 patients (1.9%) had undifferentiated tumors. There are more high-grade tumors in the young age group (26.8% vs 17.6%) but not reaching statistical significance (P =0.93). neither there were statistically significant differences between both sexes regarding tumor grade.

There was no statistically significant difference between the city center and

periphery population in terms of stage at diagnosis (P=.44, df =3, n= 161), both showed highest stage III numbers followed by stage IV, stage II and stage I.

No relationship cold be found between the tumor grade and stage at diagnosis among both the young (P = .27, n = 148) and the older age groups (n=308). Table 2 shows the cross tab between tumor grade and stage at diagnosis.

Table 2. Stage at Diagnosis-Tumor Grade Cross Tabulation (Young Age Group)

		Grade							
		Low grad		**Intermediate grade**		**High grade**		**Undifferentiated**	
		Count	**Row N %**	**Count**	**Row N %**	**Count**	**Row N %**	**Count**	**Row N %**
Stage at Diagnosis	Stage 1	0	0.0%	6	66.7%	3	33.3%	0	0.0%
	Stage 2	0	0.0%	12	75.0%	4	25.0%	0	0.0%
	Stage 3	2	2.3%	57	66.3%	27	31.4%	0	0.0%
	Stage 4	1	2.7%	25	67.6%	8	21.6%	3	8.1%
	Unknown	0	0.0%	0	0.0%	0	0.0%	0	0.0%

The majority of the cases had Rectal tumor location (41.5%, n=71), followed by left side colon (27.5%, n= 47 and Right side (10.5%, n = 18), 20.5% of cases weren't staged properly due to missing one or more TNM parameters. This wasn't different when compared with the older group (P= .2).

There was statistically significant difference between males and females in regards of tumor location (p = .015, df = 2 and n= 136), with more females (n=40) had rectal cancer vs males (n=31) and more males had right sided tumor (n=15) vs females (n=3).

The tumor location showed no significant association with stage at diagnosis and tumor grade (P value = .17 and .84, df = 5 and 4 respectively, n = 136). Table 3 shows cross tabulation between sex, stage at diagnosis and grad with tumor location.

Table 3. Cross Tab of Sex, Stage and Grad vs Tumor Location (Young Age Group)

		Tumor location							
		Left side		**Right side**		**Rectum**		**Not specified**	
		Count	**Row N %**	**Count**	**Row N %**	**Count**	**Row N %**	**Count**	**Row N %**
Sex	Male	22	24.7%	15	16.9%	31	34.8%	21	23.6%
	Female	25	30.5%	3	3.7%	40	48.8%	14	17.1%
Stage at diagnosis	Stage 1	2	22.2%	2	22.2%	4	44.4%	1	11.1%
	Stage 2	8	44.4%	3	16.7%	2	11.1%	5	27.8%
	Stage 3	27	29.0%	10	10.8%	44	47.3%	12	12.9%
	Stage 4	9	22.0%	2	4.9%	15	36.6%	15	36.6%
	Unknown	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grade	Low grad	1	25.0%	0	0.0%	1	25.0%	2	50.0%
	Intermediate grade	32	29.6%	10	9.3%	50	46.3%	16	14.8%
	High grade	10	23.8%	6	14.3%	16	38.1%	10	23.8%
	Undifferentiated	0	0.0%	0	0.0%	0	0.0%	3	100.0%

The most common site of metastasis was liver (60.9%) followed by lungs (15.2%) and bones (10.9%), as shown in figure 2.

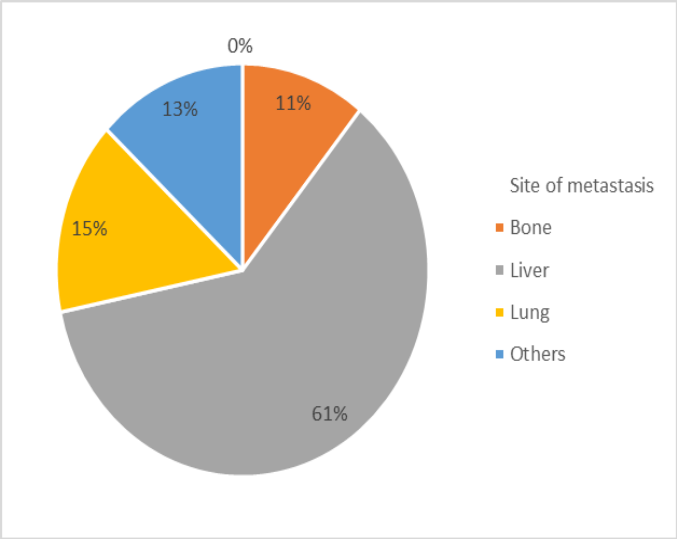

Figure 2. Percentage Distribution of Site of Metastasis (Young Age Group)

The majority of the cases were adenocarcinoma (88%), followed by mucinous carcinoma (9%) and Signet ring cell carcinoma (3%), Although not reaching statistical significance; the both more aggressive histologies occurring in younger age group as compared to older group (P = .19, df = 2, n =506). But it is not significantly associated with age at diagnosis among younger group patients (P = .15, df = 6, n = 171).

Discussion

Early-onset colorectal cancer (EOCRC) has become a health concern worldwide, characterized by the diagnosis of colorectal cancer in individuals under the age of 50. The incidence of EOCRC has been rising at an alarming rate over the past few decades, with a significant increase in recent years [6, 7]. Several risk factors have been implicated in the development of EOCRC, including environmental exposures, microbiome alterations, and genetic predisposition [7–9].

Erbil is one of the major governorates of Iraq with a growing population of currently around 2 million distributed somewhat equally between the city center and the peripheral suburbs. colorectal cancer is one of the top cancer diagnosis in Erbil governorate as it is in Iraq in general, it is in the fourth place headed only by breast, prostate and lung cancer [10], the Rizgary Oncology center is the major and one of the two medical oncology centers in the governorates and more than 70 % of non-hematologic malignancies of the governorate are treated there.

In our study, we identified 506 eligible cases of colorectal cancer after excluding non-residents of Erbil and cases with incomplete data, from an initial pool of 580 cases. Notably, 33.0% of the cases in our sample were under 50 years of age, classifying them as the ‘young’ age group. This proportion aligns with emerging trends in global CRC epidemiology, where there is a rising incidence of CRC among younger populations despite the decrease in overall CRC cases in developed and the neighboring countries [11–14]. Despite the reduction of overall incidence of CRC by nearly 2% each year since early 2000s attributed to adoption of effective screening programs that led to the identification of polyps before being transformed [15, 16], there is nearly the same increase in incidence rate in young individuals [16, 17]. Two decades ago, the population of the governorate predominantly belonged to a lower

socioeconomic class with limited access to food resources. The traditional diet was largely Mediterranean, characterized by low consumption of red meat, particularly in grilled and fried forms. However, over the past decade, there has been a significant shift in dietary habits, especially among younger individuals. The population is increasingly adopting a Westernized diet, marked by higher intake of processed and grilled red meat, while moving away from traditional, primarily plant-based dishes. This trend in diet shift together with the availability of personal transport facilities that causes more decline physical inactivity level may both be causes for this high numbers in young onset CRC [18–20].

It seems that the cases are equally distributed geographically, as the city center of Erbil contains larger number of populations which is around 1,010,100 and periphery the periphery contains around 870,000 [21]. By periphery we do not only mean the outskirts of the main city but all the small cities, district sub region and villages that are structured under the Erbil governorate dome. Although many smaller cities are well urbanized, the central city—often referred to as the city center—is commonly associated with higher rates of cancer and other pollution-related diseases. This is attributed to its elevated pollution levels, population density, and industrial activity. Having the equal distribution of patients between the city center and periphery can be explained by the fact that most of the periphery population are living in the center of districts and sub regions that are urbanized to a large degree only handful of them truly live in rural environment.

It is argued that the rural patients may come with more advanced stage at diagnosis ought to the limited health facilities in general including screening and effective primary care and to the health awareness of remote rural population [22, 23], however we couldn't find such association as there was no statistically significant difference in stage at diagnosis between both city center and periphery. Sample size and the urbanization of the rural areas may be the cause of this finding.

It is well known that there is slight male predominance in CRC even for the early onset CRC [7, 24]. The sex distribution in the young age group in our study reveals an almost equal representation of males and females, with 52% males and 48% females, closely mirroring the distribution across all age groups (56% males, 44% females). Interestingly, when examining geographic patterns, more females from the city center (53.5%) and more males from the city periphery (59.7%) were noted among the young population. However, the lack of statistical significance ($p = .087$ for the young group and $p = .56$ for the older group) indicates that while there may be trends in sex distribution by location, they are not strong enough to suggest a definitive pattern.

As it is well known that rates of CRS increases with age with the median age of 68 and 72 for men and women respectively in developed countries [16, 25]; the median age at diagnosis in our study was 56 years for men and 57 years for women, in young individuals the medians of age at diagnosis was 39 and 36 for males and females respectively and they were not statistically different in age at presentation, This observation warrants further investigation and may suggest the need for an in-depth examination of potential risk factors beyond the conventional explanations.

The mean body mass index (BMI) is remarkably similar between sexes (24.62 for males and 24.67 for females) with no statistical significant differences between them, because obesity is one of the well-known risk factors for CRC and EOCRC, it is being said that each 5 unit increase in BMI will increase the risk of CRC by about 15% [26–28], we have to mention that the BMI was calculated during the admission of the patients and the CRC itself causes weight loss due to anemia or as a result of surgery[29]. Ther is limited data about Iraq or KRG's population BMI though there is a

steady increase in childhood obesity since 2000 in Iraq as well as in the region [30].

The stage at diagnosis was one of the most important goal of our study because even if it is difficult to address and intervein with a modifiable risk factor; finding the young individuals in an early stage is something not beyond reach. We have found that most of the patients of young age group they were presented in stage III disease (54.4%) and only 5.3% were diagnosed at stage I. There was a statistically significant difference (p= .002) between both groups indicating that the younger age group they come with more advanced stages. In the absence of screening program in the country, its impact on stage at diagnosis between young and old age group being absent (i.e. screening which includes older ages can detect the tumor earlier and causes this difference in stage at presentation [7, 13]), it is again worthy of further characterization and more rigorous search for possible causes. One possible cause of this late presentation is may be due to the fact that it is common to overlook cancer diagnosis in young individuals. We have to mention that one reason of having low numbers of stage I cases is probably due to the fact that many surgeons especially in the private facilities do not refer the stage I cases to oncology facilities after they are surgically managed.

Other biological factors such as tumor grade and tumor location which are both known to affect stage at presentation, the former is a marker of aggressiveness of disease nature and the latter impacts the clinical symptom in a way that rectal tumors are presented with bleeding in early stages of the disease, the left side of colon may cause constipation early in the disease course while the right side presents in later stages due relatively to lack of these symptoms [31–33]. We found no association between either of tumor grade or the tumor location with stage at diagnosis in our study.

It is expected to have more rectal cancers in male while more right-side colon cancer in females [34] however we have found the reverse, more females were found with rectal and more males with right sided tumor, in the older age group the males are presented with rectal tumor more than females, but again more males had right side tumor than females. Such finding will raise more suspicion about familial and genetic factor such as MSI and Lynch syndrome [35].

Although the mucinous adenocarcinoma was present in 9% of cases and signet ring cell in 3% of cases but most of these cases were belonging to the younger group and this confirms the fact that the more aggressive histologies are more common in early onset colorectal cancer [2, 7, 13].

The most difficult challenge of this study was the availability of a solid patient health record, the lack of electronic records, the patient load on the center and lack of sufficient numbers of medical staffs have made the available data to be confined to very basic ones. We had to go through each file and take out the most data from the medical reports, prescription sheets, MDT forms, histopathology reports and many other kinds of available papers, although the data that we collected wasn't going with our ambitions when we first thought of the study topic but however we concluded some findings hopefully will be the base of further studies in the governorate and the country given the large knowledge gap in oncology studies in general in the country.

Conclusion

The incidence of colorectal cancer among young individuals in the Erbil governorate seems to be high, in line with the global increase in early-onset CRC. The younger group presents at more advanced stages and with more aggressive histology. Young males exhibit a higher incidence of right-sided colon cancer compared to females, while rectal cancer is more common in females than in males. Both of these findings are the opposite of what is typically expected.

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All the authors have contributed equally in each step of the study, from the study design, data collection, analysis and writing.

Conflict of Interests

Nothing to declare.

References

[1]. Vuik, F. E., Nieuwenburg, S. A., Bardou, M., Lansdorp-Vogelaar, I., Dinis-Ribeiro, M., Bento, M. J., et al., 2019, Increasing incidence of colorectal cancer in young adults in Europe over the last 25 years. *Gut*, 68(10), 1820–1826.

[2]. Saraiva, M. R., Rosa, I., Claro, I., 2023, Early-onset colorectal cancer: A review of current knowledge. *World Journal of Gastroenterology*, 29(8), 1289–1303.

[3]. Sifaki-Pistolla, D., Poimenaki, V., Fotopoulou, I., Saloustros, E., Mavroudis, D., Vamvakas, L., et al., 2022, Significant Rise of Colorectal Cancer Incidence in Younger Adults and Strong Determinants: 30 Years Longitudinal Differences between under and over 50s. *Cancers*, 14(19), 4799.

[4]. Ibrahem, S., Ahmed, H., Zangana, S., 2022, Trends in colorectal cancer in Iraq over two decades: incidence, mortality, topography and morphology. *Annals of Saudi Medicine*, 42(4), 252–261.

[5]. Chen, F. W., Sundaram, V., Chew, T. A., Ladabaum, U., 2017, Advanced Stage Colorectal Cancer in Persons Younger Than 50 Years not Associated With Longer Duration of Symptoms or Time to Diagnosis. *Clinical Gastroenterology and Hepatology*, 15(5), 728–737.

[6]. Meester, R. G. S., Mannalithara, A., Lansdorp-Vogelaar, I., Ladabaum, U., 2019, Trends in Incidence and Stage at Diagnosis of Colorectal Cancer in Adults Aged 40 Through 49 Years, 1975–2015. *JAMA*, 321(19), 1933–1934.

[7]. Siegel, R. L., Jakubowski, C. D., Fedewa, S. A., Davis, A., Azad, N. S., 2020, Colorectal Cancer in the Young: Epidemiology, Prevention, Management. *American Society of Clinical Oncology Educational Book*, (40), e75–e88.

[8]. Kirzin, S., Marisa, L., Guimbaud, R., Reynies, A. D., Legrain, M., Laurent-Puig, P., et al., 2014, Sporadic Early-Onset Colorectal Cancer Is a Specific Sub-Type of Cancer: A Morphological, Molecular and Genetics Study. *PLOS ONE*, 9(8), e103159.

[9]. Vieira, A. R., Abar, L., Chan, D. S. M., Vingeliene, S., Polemiti, E., Stevens, C., et al., 2017, Foods and beverages and colorectal cancer risk: a systematic review and meta-analysis of cohort studies, an update of the evidence of the WCRF-AICR Continuous Update Project. *Annals of Oncology*, 28(8), 1788–1802.

[10]. Cancer Today, 2024. International Agency for Research on Cancer, https://gco.iarc.who.int/today/

[11]. Alsanea, N., Abduljabbar, A. S., Alhomoud, S., Ashari, L. H., Hibbert, D., Bazarbashi, S., 2015, Colorectal cancer in Saudi Arabia: incidence, survival, demographics and implications for national policies. *Annals of Saudi Medicine*, 35(3), 196–202.

[12]. Hessami Arani, S., Kerachian, M. A., 2017, Rising rates of colorectal cancer among younger Iranians: is diet to blame? *Current Oncology*, 24(2), e131–e137.

[13]. Mauri, G., Sartore-Bianchi, A., Russo, A., Marsoni, S., Bardelli, A., Siena, S., 2019, Early-onset colorectal cancer in young individuals. *Molecular Oncology*, 13(2), 109–131.

[14]. Yeo, H., Betel, D., Abelson, J. S., Zheng, X. E., Yantiss, R., Shah, M. A., 2017, Early-onset Colorectal Cancer is Distinct From Traditional Colorectal Cancer. *Clinical Colorectal Cancer*, 16(4), 293–299.

[15]. Holme, Ø., Bretthauer, M., Fretheim, A., Odgaard-Jensen, J., Hoff, G., 2013, Flexible sigmoidoscopy versus faecal occult blood testing for colorectal cancer screening in asymptomatic individuals. *Cochrane Database of Systematic Reviews*, 2013(9), CD009259.

[16]. Siegel, R. L., Miller, K. D., Jemal, A., 2018, Cancer statistics, 2018. *CA: A Cancer Journal for Clinicians*, 68(1), 7–30.

[17]. SEERExplorer Application, 2024. SEERExplorer: An interactive website for SEER cancer statistics. *SEER*.

[18]. Castelló, A., Amiano, P., Fernández de Larrea, N., Martín, V., Alonso, M. H., Castaño-Vinyals, G., et al., 2019, Low adherence to the western and high adherence to the mediterranean dietary patterns could prevent colorectal cancer. *European Journal of Nutrition*, 58(4), 1495–1505.

[19]. Collins, K., 2023, AICR Cancer Prevention Recommendations as a Path to Diet Quality. *American Institute for Cancer Research*.

[20]. Slattery, M. L., 2004, Physical activity and colorectal cancer. *Sports Medicine*, 34(4), 239–252.

[21]. Danishtwan, 2024. Kurdistan Region Statistics Office. https://krso.gov.krd/ku/statistics/%D8%AF%D8%A7%D9%86%D9%8A%D8%B4%D8%AA%D9%88%D8%A7%D9%86]

[22]. Andrilla, C. H. A., Moore, T. E., Man Wong, K., Evans, D. V., 2020, Investigating the Impact of Geographic Location on Colorectal Cancer Stage at Diagnosis: A National Study of the SEER Cancer Registry. *Journal of Rural Health*, 36(3), 316–325.

[23]. Zahnd, W. E., James, A. S., Jenkins, W. D., Izadi, S. R., Fogleman, A. J., Steward, D. E., et al., 2018, Rural-Urban Differences in Cancer Incidence and Trends in the United States. *Cancer Epidemiology Biomarkers & Prevention*, 27(11), 1265–1274.

[24]. Abotchie, P. N., Vernon, S. W., Du, X. L., 2012, Gender Differences in Colorectal Cancer Incidence in the United States, 1975–2006. *Journal of Women's Health*, 21(4), 393–400.

[25]. *Colorectal Cancer Facts & Figures*, 2024. *American Cancer Society*.

[26]. Rosato, V., Bosetti, C., Levi, F., Polesel, J., Zucchetto, A., Negri, E., et al., 2013, Risk factors for young-onset colorectal cancer. *Cancer Causes & Control*, 24(2), 335–341.

[27]. Kim, J. Y., Jung, Y. S., Park, J. H., Kim, H. J., Cho, Y. K., Sohn, C. I., et al., 2016, Different risk factors for advanced colorectal neoplasm in young adults. *World Journal of Gastroenterology*, 22(13), 3611–3620.

[28]. Pan, S. Y., DesMeules, M., 2009, Energy intake, physical activity, energy balance, and cancer: epidemiologic evidence. *Methods in Molecular Biology*, 472, 191–215.

[29]. Colorectal cancer, 2024. *World Health Organization*.

[30]. Doggui, R., Al-Jawaldeh, H., Al-Jawaldeh, A., 2020, Trend of Iodine Status in the Eastern Mediterranean Region and Impact of the Universal Salt Iodization Programs: a Narrative Review. *Biological Trace Element Research*, 198(2), 390–402.

[31]. medtextfree, 2012, Pathology and Genetics of Tumours of the Digestive System. Free Medical *Textbook*.

[32]. Compton, C. C., 2003, Colorectal Carcinoma: Diagnostic, Prognostic, and Molecular Features. *Modern Pathology*, 16(4), 376–392.

[33]. Siegel, R. L., Wagle, N. S., Cercek, A., Smith, R. A., Jemal, A., 2023, Colorectal cancer statistics, 2023. *CA: A Cancer Journal for Clinicians*, 73(3), 233–254.

[34]. Sex-specific differences in colorectal cancer: A multicenter retrospective cohort study, 2024. *PubMed Central*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10432433/

[35]. Genetics of Colorectal Cancer (PDQ®), 2024. *National Cancer Institute*. https://www.cancer.gov/types/colorectal/hp/colorectal-genetics-pdq