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Correlating Between Demographic Distribution and Hematological Parameters in Samples of Iraqi Patients with Colorectal Cancer

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Abstract

The current study found no statistically significant difference in gender or age values between the colorectal cancer (n = 41), colitis (n = 19), or control groups (n = 20), despite the fact that the incidence rate of Colorectal Cancer (CRC) increased significantly with age. In addition, the data showed that alcohol raises the risk by 60.98% in the colorectal adenocarcinoma group who drank alcohol, and the male: female ratio indicated that the majority of patients with early-onset CRC were male patients compared to females. Statistically significant ($P \leq 0.05$) differences were found between CRC patients, colitis patients, and control participants who smoked. Furthermore, no significant variations in occupational exposures linked to an elevated risk of CRC were seen between study groups. One of the most fundamental peripheral blood biochemical tests, Hemoglobin (Hb) (g/dL), Red blood cell count (RBC) ($\times 10^6$ cells/µL), and White blood cell count (WBC) ($\times 10^3$ cells/µL), were used to effectively indicate abnormalities of infection and anemia and improve the accuracy of CRC detection. There were significant differences ($P \leq 0.05$) between males and females in W.B.C. count, RBC, and Hb in all types of research groups when compared with the conventional pathological test of tumor lesions. Student's t-test, Fisher's exact test, one-way ANOVA with Hochberg GT2 and Games-Howell tests, and chi-square tests were among the statistical tests used. The diagnostic prediction for CRC early screening was constructed using a panel of commonly used hematological markers, which may serve as useful adjuncts in CRC screening.

Keywords: Colorectal Cancer, Demographic Distribution,WBC, RBC, Hb.

1. Introduction

Adenomatous polyps in the mucosal epithelium that are initially benign give rise to colorectal cancer (CRC), an adenocarcinoma. These polyps typically develop in the rectum, sigmoid colon, or distal descending colon epithelium and are more prevalent in people who consume low amounts of fiber, which reduces the amount of fecal material and, in turn, lengthens the time the mucosa is in touch with the toxins in feces (1). From 2000 to 2019, the

majority of CRC cases were of the adenocarcinoma histological type, which had a sharp rise over that time. The most prevalent kind was adenocarcinoma. None of the identified tumor forms, including epithelial, mucinous, and carcinoid tumors, topped 5% (2). Weight loss and changes in bowel habits are normally only causes for concern if they are linked to rectal bleeding, which is a high-risk symptom in adults over the age of 50 (3). Rectal bleeding or anemia is another high-risk sign.

One of the main public health problems is cancer. According to estimates, there will be 1.9 million newly diagnosed cases of cancer and 609,820 deaths from CRC cancer in the United States in 2023 (4). Between 2000 and 2019, the proportion of all CRC cases to all other cancers in Iraq increased from 3.69% to 6.5%. The annual percentage change (APC) of the CRC mortality proportion increased from 1.25 to 1.77 per 100.000 populations in 2010 and 2019, respectively (2). Initial detection is crucial since colorectal cancer has a low chance of survival when it is advanced. Nine out of 10 patients who are discovered and treated early on, when the cancer has not spread, are still living five years later. This decreases to one in ten living if the cancer is discovered at a late stage and has spread. More than half of colorectal cancers are detected at a late stage, despite the fact that early detection can save lives. A typical blood test used in primary care is the complete blood count (FBC), and pertinent patterns in subsequent FBCs are linked to the early identification of colorectal cancer (5). Numerous peripheral blood indicators found in individuals with colorectal cancer (CRC) who had routine blood testing (BRT) are associated with prognosis. By evaluating the inflammatory and immunological status of CRCs, one can estimate the risk of patients surviving. so as to serve as a reference point for the clinical malignant estimate of CRCs (6).

The current study aimed to clarify the prevalence of Colorectal Cancer and its relationship to demographic distribution factors like age, gender, cigarette and alcohol consumption, and occupational exposure in Iraqi patients, and to establish a predictive model using routine blood parameters to identify CRC with as few variables as possible.

2. Materials and Methods

The blood samples for this study were collected over a period of a year, from December 2021 to December 2022. There were a total of 80 people, both male and female, ranging in age from 24 to 77, who participated in the study. The Gastroenterology Hospital of the Medical City complex provided 80 patients for analysis (41 colorectal cancers, 19 severe colitis, and 20 controls). Hemoglobin, red blood cell, and white blood cell counts were the standard blood tests.

2.1 Blood sampling

From both the control and patient groups, 5 ml of fasting venous blood was drawn using a plastic disposable syringe, the regular analysis of blood samples was performed using a CELL-DYN Ruby (USA) blood cell analyzer. Hemoglobin, red blood cells, and white blood cell counts were among the test results. The clinical data was collected from the patient themselves using the questionnaire.

2.2 Statistical Analyses

We used the Statistical Package for Social Science (SPSS version 22, Chicago, Illinois, USA) for data description, analysis, and presentation to explore the relationship between white blood cells, red blood cells, hemoglobin, and local recurrence of CRC. For qualitative variables, statistical analyses can be categorized as frequency and percentage, and for quantitative variables, as mean and standard deviation (SD). Independent Sample T-test, Fisher Exact Test, Chi-Square, One-Way Analysis of Variance (ANOVA): statistical tests for

the distinction between k independent groups with Hochberg GT2 and Games-Howell tests. Level of p-value as follows: Not significant P>0.05, significant P≤0.05, p=0.05.

3. Results

3.1. Age Distribution

Twenty-three (56.10%) of the tumor patients were between the ages of 42 and 59, and sixteen (39.02%) were between the ages of 60 and 77. There were 14 (73.68%) positive controls among those aged 24-41, 5 (26.32%) among those aged 42-59, and 2 (4.88%) among those aged 24-41 within the most recent tumor patient cohort. Twenty healthy volunteers were used; their ages matched those of the patient group, making those between the ages of 24 and 41 (40% of the total) the most numerous age group. Viewed in **Figure 1**, 6 individuals, or 30%, belonged to the age groups of 42-59 and 60-77.

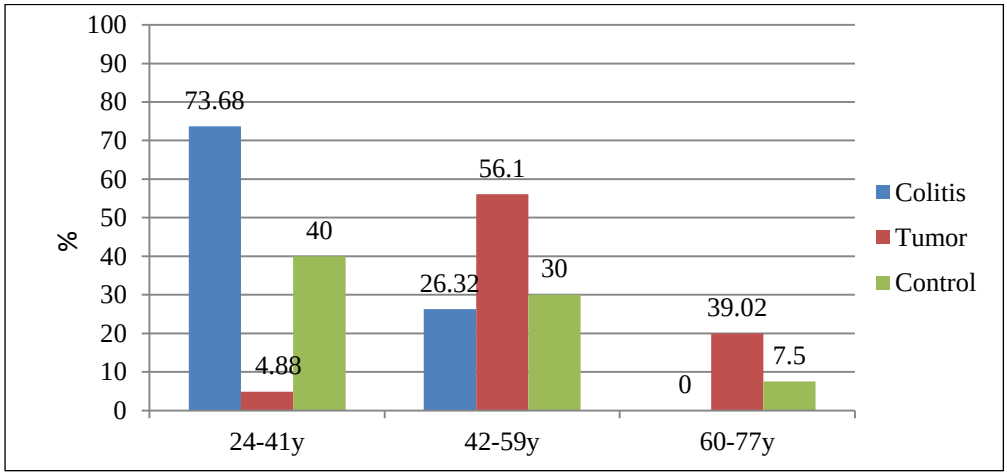

Figure. 1 Distribution of age among groups.

3.2. Association between gender and groups

There were 20 (48.78%) female and 21(51.22%) male CRC cases; additionally, 10 (52.63%) were female and 9 (47.37%) were male in the positive control group, compared to 9 (45.00%) male and 11 (55.00%) female in the control group. The gender distribution of the patient, positive control, and control groups does not demonstrate any appreciable variations in the current investigation. P-value= 0.893 as shown in **Figure 2.**

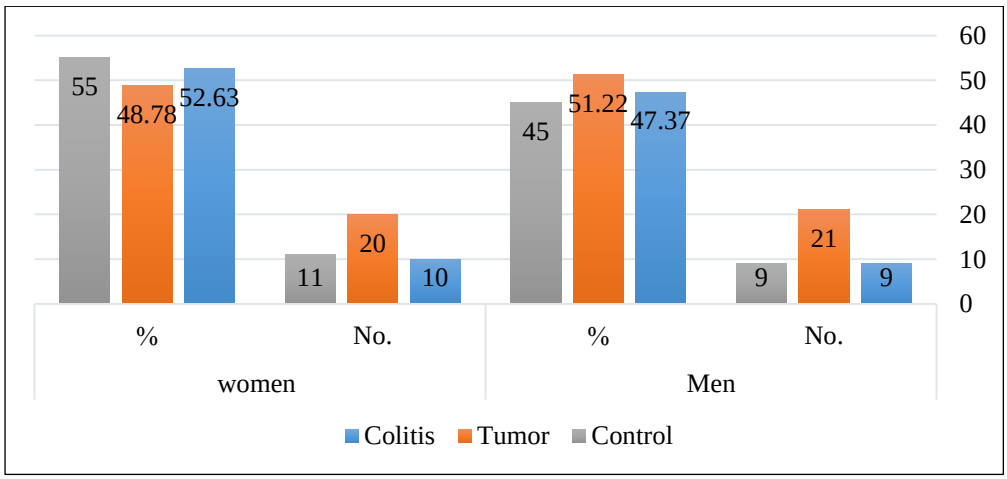

Figure. 2 Association between gender and groups.

This may be due to a number of factors, including the fact that males are more likely to consume a diet high in red and processed meat and to smoke. Men have a greater propensity for visceral fat deposition, which is associated with an increased risk of colorectal cancer. In

the current study, there was no significant difference between the gender and age values in the colorectal cancer group, the colitis group, and the control group.

3.3. Association between Alcohol, Smoke and Occupation

Table 1 displays statistically significant differences (P≤0.05) between CRC patients, colitis patients, and control subjects with regard to alcoholism duration > 10 years. Thus, longer-term drinking increased CRC risk. In this study, CRC, colitis, and control people with alcoholism duration > 10 years differed considerably (P≤0.05).

Table 1. Association between demographic data and study group

Vars.			Type			Chi square	P value	Total
			Colitis	Tumor	Control			
Alcohol	Yes	N	6	25	3	11.513	0.000*	34
		%	31.58	60.98	15.00			42.5
	NO	N	13	16	17			46
		%	68.42	39.02	85.00			57.5
Smoke	Yes	N	9	34	8	13.613	0.000*	51
		%	47.37	82.93	40.00			63.75
	NO	N	10	7	12			29
		%	52.63	17.07	60.00			36.25
Occupation	Un-employed	N	6	11	6	9.249	0.052	23
		%	31.58	26.83	30.00			28.75
	Employee	N	13	17	10			40
		%	68.42	41.46	50.00			50.00
	retired	N	0	13	4			17
		%	.00	31.71	20.00			21.25

* Highly significant difference (P≤0.05)

Thirty-four smoking patient tumors and nine smoking colitis, seven nonsmoking patient tumors, and 10 nonsmoking colitis were recorded among the study group, compared with eight smoking and three and twelve nonsmoking among controls, as shown in **Table 1**. This indicates significant differences (P≤0.05) between smoking and non-smoking participants, which means significant differences (P≤0.05) between CRC patients, colitis, and controls regarding smoking

3.4. The correlation between White Blood Cell (W.B.C) count among gender and groups

It follows from the data presented in **Table 2** that the mean of W.B.C. count is higher in females than males, and with colitis, it was higher at 14.212($\times10^3$ cells/µL)±2.214 and 14.785($\times10^3$ cells/µL)±2.235, respectively, in males and females compared with CRC patients, which showed 9.455 ($\times10^3$ cells/µL)±1.428 in males and 10.15($\times10^3$ cells/µL) ± 0 ± 2.036 in females, and the mean was low in the control group, showing 5.600 ($\times10^3$ cells/µL) ±0.802 in males and 5.764 ($\times10^3$ cells/µL)±0.715 in females.

Table 2. Descriptive and statistical test of WBC among groups and gender.

Gender		Colitis	Tumor	Control	F	P value
Male	Mean ($\times10^3$ cells/µL)	14.212	9.455	5.600	70.976	**0.000***
	±SD	2.214	1.428	0.802		
	Minimum	10.700	7.500	4.300		
	Maximum	17.600	12.500	6.800		
Female	Mean ($\times10^3$ cells/µL)	14.785	10.150	5.764	62.886	**0.000***
	±SD	2.235	2.036	0.715		
	Minimum	11.950	6.100	4.400		
	Maximum	19.500	12.700	6.900		
T test		0.560	1.270	0.483		
P value		0.583	0.212	0.635		

* Highly significant difference (P≤0.05)

There were significant differences (P≤0.05) between males and females in W.B.C. count and all types of study groups.

In the analysis of methods that produce results from pairwise comparison data, we examine the difference between these results it seems significant differences (P≤0.05) between colitis and CRC tumor; colitis and control and tumor and control, respectively in male and female as shown in **Table 3.**

Table 3. Multiple pairwise comparisons of WBC between groups

Gender		type	type	Mean Difference	P value
Male	Games-Howell	Colitis	Tumor	4.757($\times10^3$ cells/μL)	**0.000***
			Control	8.612($\times10^3$ cells/μL)	**0.000***
		Tumor	Control	3.855($\times10^3$ cells/μL)	**0.000***
Female	Games-Howell	Colitis	Tumor	4.635($\times10^3$ cells/μL)	**0.000***
			Control	9.021($\times10^3$ cells/μL)	**0.000***
		Tumor	Control	4.386($\times10^3$cells/μL)	**0.000***
		Tumor	Control	4.386($\times10^3$ cells/μL)	**0.000***

* Highly significant difference (P≤0.05)

3.5 The correlation between Red Blood Cell (R.B.C) count among gender and groups.

The findings demonstrated that the R.B.C. count in patients with CRC was decreased significantly (P ≤ 0.05) in the patients' group as compared with other groups. 3.419 ($\times10^6$ cells/μL) ± 0.419 in males and 2.909 ($\times10^6$ cells/μL) ± 0.516 in females compared with other groups; in the colitis group, the mean showed 3.704($\times10^6$ cells/μL) ± 0.286 in males and 3.012($\times10^6$ cells/μL) ± 0.665 in females; and in the control group, the mean showed 5.133 ($\times10^6$ cells/μL) ± 0.180 in males and 4.304 ±($\times10^6$ cells/μL) 0.405 in females. Further, there were significant differences between males and females in R.B.C. count and in all study groups, as shown in **Table 4**.

Table 4. Descriptive and statistical test of RBC among gender and groups**.**

	Gender	**Type**				
		Colitis	**Tumor**	**Control**	**F**	**P value**
Male	Mean ($\times10^6$ cells/μL)	3.704	3.419	5.133	63.528	0.000*
	±SD	0.286	0.471	0.180		
	Minimum	3.241	2.542	4.900		
	Maximum	4.021	4.276	5.400		
Female	Mean ($\times10^6$ cells/μL)	3.012	2.909	4.304	26.636	0.000*
	±SD	0.665	0.516	0.405		
	Minimum	2.012	2.100	3.990		
	Maximum	3.971	3.732	5.300		
	T test	2.885	3.311	5.685		
	P value	0.010*	0.002*	0.000*		

*Highly significant difference (P≤0.05)

Concerning the mean difference for each pair of variables, it appeared that there was a significant (P≤0.05) difference. Further, a significant (P≤0.05) difference between tumor colitis and control in females and males. No significant difference between tumor and colitis in females and males demonstrated by **Table 5**.

Table 5. Multiple pairwise comparisons of RBC between groups using Games_ Howell**.**

Gender	type	type	Mean Difference	p value
Male	Colitis	Tumor	0.285($\times10^6$ cells/µL)	0.126
		Control	-1.429($\times10^6$ cells/µL)	0.000*
	Tumor	Control	-1.714($\times10^6$ cells/µL)	0.000*
Female	Colitis	Tumor	0.103($\times10^6$ cells/µL)	0.904
		Control	-1.292($\times10^6$ cells/µL)	0.000*
	Tumor	Control	-1.394($\times10^6$ cells/µL)	0.000*

*Highly significant difference (P≤0.05)

3.6 The correlation between Hemoglobin (Hb) count among gender and groups

The results that are obtained from **Table 6** show that hemoglobin mean was at a higher level in the healthy group (control) in males and females compared with patient groups; there were significant differences (P≤0.05) between males and females in the test of Hb count and all types of study groups.

Table .6 Descriptive and statistical test of HB among groups and gender.

Gender		Colitis	Tumor	Control	F	P value
Male	Mean	10.051 g/dL	9.663 g/dL	14.559 g/dL	69.817	0.000*
	±SD	0.808	1.234	0.816		
	Minimum	9.300	7.700	13.200		
	Maximum	12.100	12.400	15.800		
Female	Mean	8.833 g/dL	7.832 g/dL	12.391 g/dL	79.885	0.000*
	±SD	1.146	0.979	0.758		
	Minimum	7.100	5.500	11.300		
	Maximum	10.900	9.500	13.600		
T test		2.647	5.245	6.148		
P value		0.017*	0.000*	0.000*		

* Highly significant difference (P≤0.05)

The results based on pairwise comparisons in the next sections, Table 7, show the presence of significant differences between colitis, CRC tumor, and control in males; compared with females, there are significant differences (P ≤ 0.05) between I-J types, as shown in **Table 7.**

Table 7. Multiple pairwise comparisons of HB between groups.

Gender		type	type	Mean Difference (I-J)	P value
Male	Hochberg	Colitis	Tumor	0.388 g/dL	0.742
			Control	-4.508 g/dL	0.000*
		Tumor	Control	-4.896 g/dL	0.000*
Female	Hochberg	Colitis	Tumor	1.001 g/dL	0.033*
			Control	-3.558 g/dL	0.000*
		Tumor	Control	-4.559 g/dL	0.000*

*Highly significant difference (P≤0.05)

Higher values in female patients were identified for WBC, compared with male WBC, and lower values for RBC and HGB of CRC patients.

4. Discussion

There was a unique global trend involving an increase in the number of CRC cases among individuals under the age of 50 according to (7), despite (8) opinion that being older than 50 was a significant risk factor for colorectal cancer, he has observed an increase in the prevalence of CRC among young adults aged 30–40 in the Asian community and elsewhere over the past three decades. In study (9), investigation on CRC patient characteristics found that the median age of the 153 patients was 56 (range: 27-85), which is consistent with the

present study. The majority of CRC patients, according to the current study, are between the ages of 42 and 59. This result agrees with those of (10), who discovered that the incidence rate of CRC increased noticeably with aging and peaked at about 30% in people 55 and older. The latest research supports (11) finding that those under the age of 50 may be at increased risk in the coming years as a result of lifestyle changes, as this age range comprises the second-largest group of patients. According to (12), the lack of routine screening and diagnosis is likely to blame for the decline in reported data in the United States regarding the incidence of CRC in younger patients. This is true even though some CRC patients are asymptomatic, especially in the early stages of the disease. Using information from medical records between 2012 and 2020, (13) conducted a study with 325 colorectal adenoma and 531 CRC patients. found that people were, on average, (56.39±12.15) years old; this matched the findings of the current study. About 80% of CRC cases occur in men and women between the ages of 55 and 85, where the illness is most prevalent (14).

As for the ratio of males to females in the present study was consistent with that found by (5, 15-17), indicating that the preponderance of early-onset CRC patients was male. According to (2), the male predominance in CRC in our work is a global trend; for instance, British and Turkish statistics have demonstrated a similar pattern (18). This gender difference may be attributable to sex-specific differences in biochemical responses to dietary components (19). There was no significant difference $p \leq 0.05$ between males (19 cases) and females (17 cases) in high-grade malignancies. However, males between the ages of 50 and 60 are more likely than females to develop colon cancer. The preponderance of colorectal cancer patients was male, according to the results of the current study (20), which are consistent with those of earlier studies. Regarding the alcohol consumption (21) estimated that increases the risk of colorectal cancer by 60%. Similar rates of colorectal adenocarcinoma were found in a cohort of alcoholics (60.98%). Several environmental and behavioral factors have been linked to the risk of colorectal cancer. Alcohol consumption is one of the most important risk factors for the development of colorectal cancer (CRC), and some epidemiologic studies imply that even moderate drinking increases the risk (22). It was revealed that the case study and control groups differed significantly and that alcoholism duration may be associated with CRC risk in the > 1 year, > 2 years, > 5 years, and > 11 years (23).

Therefore, (24) found that anatomic site may affect CRC risk factor existence and strength, and smoking increased CRC risk at all sites, especially proximal and rectal. while prior smoking enhanced rectal cancer risk. As for smoking (25) found that CRC incidence has gradually increased in developing nations that are adopting the "western" way of life, including tobacco smoking, which may be one of the main causes of CRC in their populations. It was found that smoking is a risk factor that increased linearly with smoking habits, intensity, and duration (26). Smokers who quit for 25 years or more have a lower CRC risk than current smokers. However, (16) found that CRC patients who smoked (from 19.0% in 2000–2011 to 24.8% in 2015–2018) were more likely to be elderly, have a history of chronic alcohol use, or have a family history of cancer. The recent study agrees. In addition, the manufacturing of rubber and plastics, machinery, and leather, as well as the printing industry, were among the industrial sectors with potential chemical exposure that (27) found to have significantly increased risks for colon cancer. This contradicts the findings of my present study; the result found no statistically significant difference in all study groups regarding occupation because it wasn't a nationwide study that looked at a variety of occupational sectors to add to the existing knowledge about the workplace exposures linked to an elevated risk of CRC.

Regarding the routine blood parameters were Hb (g/dL), RBC ($\times 10^6$ cells/μL), and WBC ($\times 10^3$ cells/μL). As one of the most important peripheral blood biochemical tests, it offers the significant benefits of quick and easy sample acquisition, cheap collection costs, minimal trauma, and preoperative detection to efficiently signal anomalies of infection and anemia and increase the level of accuracy of CRC detection. Compared to the standard pathological examination of malignant lesions (28, 29). Studies on comprehensive markers of CRC patients' peripheral blood have gained increasing attention in recent years, and pertinent research materials have either been made more detailed or applied to clinical antitumor therapy (30, 31).

Numerous prior investigations have shown that individuals with CRC had higher WBC values, which indicate that the immune system's innate neutrophils and adaptive lymphocytes are active and increase through the identification and destruction of tumor cells, peripheral blood WBC play a critical part in the tumor immune response. By producing several pro-angiogenic substances, including as vascular endothelial growth factor, interleukin (IL) 8, and matrix metalloproteinase 9 and NEU are essential for the progression of tumors (9). This could be related to One of the most frequent pathological responses in the body is inflammation, which has a strong link to the development of tumors, when inflammation develops white blood cells may change in kind and number and may be linked to certain cancer types, such as bladder, breast, and prostate cancer (32–33).

According to Mazaki *et al*. (34), higher neutrophils (NEU) and decreased lymphocytes (LYM) in the immune system are linked to CRC and its prognosis, while white blood cells (WBC) and monocytes (MONO) have also been linked to malignancies, the present study agrees with all previous studies. All of which are indications of peripheral blood in routine blood test (BRT) results that are connected to prognosis (28). The results we obtained coincide with these findings. The following hematological parameters were found to be significantly different between patients with colorectal carcinoma (CRC) and colorectal adenoma, as determined by Huang et al. (13) using data from medical records between 2012 and 2020: Hb ($P < 0.001$) and RBC ($P < 0.001$). This was in agreement with the current study; the variables with significant differences were basically the same as the variables with differences between the groups of CRC, colitis, and controls. As for hemoglobin test patients with colorectal cancer (CRC) have a higher risk of having a poor prognosis because of their preoperative anemia, which is often caused by iron deficiency. Tumors of the colorectal crypt can have an immediate effect on gastrointestinal absorption (35,16). Intestinal obstruction and/or persistent colorectal bleeding due to cancer progression, as mentioned by Ristescu et al. (36), are also often directly associated with the severe deterioration of patients' physical status. Hb and RBC in peripheral blood of CRCs were low, worse in colorectal tumors, indicating substantial anemia, agreeing with the previous findings. Li et al. (37) discovered that the complex interrelationships among the variables determined by machine learning methods can only explain lower hemoglobin and red blood cell levels, likely caused by occult gastrointestinal hemorrhage in CRC. Regression coefficients >0.50 explain the relative importance of each feature, and these variables are already associated with CRC. Late-stage colorectal cancer has low survival rates; therefore, early detection is critical. Primary care standardizes the complete blood count (FBC) as a blood test, and links colorectal cancer to relevant changes in repeated FBCs (38). The current investigation confirmed earlier findings.

Finally, one may propose a further examination of this topic using additional variables, such as Basophil percentage (BASO_PER) and Neutrophil count (NEU_C.), High density lipoprotein (HDL), Low density lipoprotein (LDL), Trigly (TG), Lymphocyte count

(LYMPH_C), Lymphocyte percentage (LYMPH_PER), and Platelet volume distribution width (PDW) may be useful as CRC screening indicators. Therefore, routine blood tests, liver function tests, and blood lipid tests are useful for CRC screening. This study will presumably inspire additional research on the meanings of knowledge in this field.

The present study's limitations include its specific timeframe, the collection of data from a single hospital, and the unavailability of easily studied cases. Further studies may focus on larger sample sizes and diverse methodologies.

5. Conclusion

Colorectal cancer is becoming more prevalent and lethal in people of all ages in Iraq, where it is still mostly a disease of the elderly. To account for these serious changes, health policy involving CRC, as well as public awareness, screening, and management techniques, must be reconsidered.

Between the ages of 42 and 59, men are more likely than women to develop CRC.

A panel of easily accessible hematological indicators, in particular WBC, RBC, and Hb, which could provide auxiliary tools for early screening of CRC, were used to create the diagnostic prediction for early screening of CRC.

Acknowledgments

None declared by the authors.

Ethical Clearance

The research was ethically approved by the Ethics Committee of the Department of Biology, College of Science, University of Baghdad, Baghdad, Iraq. Committee number dated CSEC/1121/0076. Written informed consent was obtained from all patients.

Conflicts of Interests

No conflicts of interests were reported.

Fundings

None declared by the authors.

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