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Prevalence of Colorectal Cancer, Anemia, Thrombocytopenia, and the Variations of Hematological Parameters among patients at the Sabratha National Cancer Institute in Western Libya

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Abstract: ***Background:*** *Colorectal cancer is a gradual progression from benign polyps/cysts and development late stage and metastasis and develops largely as a result of inflammatory mechanisms with high rates of incidence, mortality, and morbidity.* ***Objectives:*** *The current study aims to investigate the incidence of Colorectal Cancer, Anemia, Thrombocytopenia, and the Variations of Hematological Parameters among patients at the Sabratha National Cancer Institute in Western Libya.* ***Materials and Methods:*** *The present study was conducted on 100 colorectal cancer patients, attending the National Cancer Institute of Sabratha for colon examination to detect cancerous or other medical conditions from the 1st January 2023 to the 1st January 2024, were enrolled in this prospective study. Also, 100 healthy individuals without any chronic disease were recruited for the control group. Their ages ranged from 19 to 80 years old. Blood samples were collected by vein puncture, 3 ml of venous blood withdrawn from each participant in the study by using disposable syringes under an aseptic technique; they were then transferred to a sterile EDTA tube, for complete blood count. Complete blood count was determined using an automated hematology analyzer Sysmex (KX 21) machine in the Centre laboratory of the National Cancer Institute of Sabratha. The data were analyzed using Statistical Package for Social Sciences (SPSS 26) software.* ***Results:*** *The results showed 53% of colorectal patients were male with mean age 59±15.2 years old. The higher distribution of colorectal cancer patients according to the age groups was 26% in age group (51-60) years, the region was 24%, and 23% in Tripoli, Zawia. Hemoglobin concentrations, Hct, MCV, lymphocytes %, and blood platelets count were significantly decreased in the colorectal cancer patients when compared with the healthy individuals. On the other hand, MCH, WBCs count, neutrophils % , mixed %, Neutro/Lymph, and Plt/Lymph ratios were significantly increased in the colorectal cancer patients when compared with the healthy individuals. Also, results showed that 85% of colorectal cancer patients was anemic with degrees 35% mild, 41% moderate, and 9% severe anemia, and with types 27% microcytic hypochromic, and 58% normocytic hypochromic anemia. Also, 12% of patients have a thrombocytopenia with 7% mild and 5% moderate degrees in thrombocytopenic patients.* ***Conclusion:*** *It can be concluded that the higher distribution of colorectal cancer was in male elderly patients in Tripoli and Zawia than in other regions. Most of the hematological parameters among the patients showed significant alterations. 85% of colorectal cancer patients were anemic, the most with moderate and normocytic hypochromic anemia, and 12% of patients were thrombocytopenic, and the degrees of thrombocytopenic were 07% mild and 05% moderate. The simplest and most significant examination tool for making a diagnosis of illness is a full blood count. Furthermore, it is recommended that patients diagnosed with colorectal cancer have their hematological indicators routinely checked. It's important to consider the findings' clinical implications.*

Keywords: Prevalence of Colorectal cancer, Hematological parameters, Anemia, Thrombocytopenia, Sabratha National Cancer Institute, Western Libya.

1. Introduction:

Globally, rectal cancer is a pathology with high rates of incidence, mortality, and morbidity. Similar to other neoplasms, scientists worldwide are trying to establish statistically significant correlations between simple and affordable hematological markers and the advancement of this disease, which affects over 1.8 million people (Andronic *et al.* 2019). Colorectal cancer was the third most commonly diagnosed cancer (Liu *et al.*, 2014), and cause of deaths from cancer worldwide (Jemal *et al.*, 2011, Inanc *et al.*, 2014). Thankfully, the 5-year survival rate for localized disease is over 90% (Ferlay *et al.*, 2015, Sokmen *et al.*, 2019). According to Sung *et al.* (2021) and Fagaras *et al.* (2022), colorectal cancer is anticipated that the disease's incidence would rise in the near future. It develops largely as a result of inflammatory mechanisms (D'Inca *et al.* 2004, Karacan *et al.* 2020).

CRC arises from a series of histopathological and molecular changes caused by complex interaction between genetic susceptibility and environmental factors. Gastrointestinal blood loss is the most common sign and may include a positive fecal occult blood test resulting in iron deficiency anemia or hematochezia. In case of advanced tumors, patients may suffer from symptoms like anorexia, weight loss and abdominal pain (Bhagat *et al.*, 2011, Sadek *et al.*, 2016). Colon cancer is a gradual progression from benign polyps/cysts and development late stage and metastasis. It is primary metastasis to the liver and other distinct organs such as

gastrointestinal tract and pancreas (Sadek *et al.,* 2016, Kuppusamy *et al.,* 2017). Reactive oxygen species (ROS) have been related to one of the etiological agents in carcinogenesis as they are known to be mitogenic and capable of tumor promotion. ROS can cause severe damage to DNA, protein, and lipids (Sadek *et al.,* 2016).

A diet lacking in fruits and vegetables, physical inactivity, obesity, and smoking are risk factors for colorectal cancer (Giovannucci *et al.,* 2002, Giovannucci and Wu, 2006, Missaoui *et al.,* 2010). Males were found to have a higher incidence rate of colorectal cancer than females, which may be related to their later adoption of risk behaviors like smoking, heavy alcohol consumption, and obesity (Popkin, 2004, Knai *et al.,* 2007, Baillie *et al.,* 2008, Center *et al.,* 2009)

In order to stage colorectal tumors before surgery, it is now preferred to use straightforward, affordable, non-invasive testing (Andronic *et al.,*2019, Karacan *et al.,* 2020). Hematological parameters are more applicable since they are straight forward, affordable, and easily available techniques. Hematological parameters are therefore growing in popularity these days (Karacan *et al.* 2020).

Cancer is one of the most common causes of secondary anemia due to a disease known as anemia of chronic inflammation, which is also present in people with autoimmune or viral infections. Cancer patients with chronic inflammation-related anemia, commonly referred to as cancer-related anemia, have an underlying immune-mediated mechanism that interferes with erythropoiesis and iron metabolism by acting through cytokines (Caro *et al.,* 2001, Arcasoy, 2018). Overall anemia in patients presenting with cancer is associated with reduced survival [Caro *et al.,* 2001, Khanbhai *et al.,* 2014) and reduced quality of life (Ludwig *et al.,* 2004, Khanbhai *et al.,* 2014). Red blood cell transfusions could be required to treat anemia, which, regardless of its etiology or pathophysiology, frequently aggravates fatigue associated with cancer, dyspnea during physical activity, and a decline in quality of life(Caro *et al.,* 2001, Arcasoy, 2018).

2. Objectives

The current study aims to investigate the incidence of Colorectal Cancer, Anemia, Thrombocytopenia, and the Variations of Hematological Parameters among patients at the Sabratha National Cancer Institute in Western Libya.

3.Materials and Methods

3.1. Study design and population

The present study was conducted on 100 colorectal cancer patients, attending the National Cancer Institute of Sabratha for colorectal cancer detection or other medical conditions from the 1st January 2023 to the 1st January 2024, were enrolled in this prospective study. This study was approved by the Research and Ethical Committee of Sabratha National Cancer Institute. Also, 100 healthy individuals without any chronic disease were recruited for the control group. Their ages ranged from 31 to 90 years old. A personal information about age, gender, region, and file number were collected using a standardized questionnaire.

Blood samples were collected by vein puncture, 3 ml of venous blood withdrawn from each participant in the study by using disposable syringes under aseptic technique; they then transferred to a sterile EDTA tube, for complete blood count.

3.2. Determination of Hematological Parameters

Red blood cells count, haemoglobin concentration, hematocrit value, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, white blood cells count, differential count of leucocytes, and blood platelets count were determined by using an automated haematology analyzer Sysmex (KX 21) machine in Centre laboratory of Sabratha National Cancer Institute.

3.3. Determination of anemia among colorectal cancer patients

According to the World Health Organization (WHO, 2001) criteria for anemia in men is Hb<13 gm/dL and women is Hb<12 gm/dL. The degrees of anemia were mild, moderate, and severe in male>14 years, when haemoglobin concentrations were (11–12.9), (8–10.9), and <8g/dL and in female>14 years, when haemoglobin concentrations were (11–11.9), (8–10.9), and <8 g/dL, respectively (Qureshi *et al.,* 2015).

Thrombocytopenia was determined when the platelet count was less than 150 $x10^3$ platelet/µl, and the degrees of platelet deficiency were classified into thrombocytopenia mild (100-150 $x10^3$ platelet/µl, moderate thrombocytopenia (50-100) $x10^3$ platelet/µl, and severe thrombocytopenia (<50) $x10^3$ cell/µl (Schlappi *et al.,* 2018).

3.4. Statistical analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS 26) software. The statistical significance of differences between groups was evaluated with the independent t-test, and percentages were estimated by Chi-square. The results were considered statistically significant when $p<0.05$.

4. Results

4.1. Distribution of colorectal cancer patients according to gender

A total of 100 patients were diagnosed with colorectal cancer in the patients attending the National Cancer Institute of Sabratha for colorectal cancer detection or other medical conditions from the 1st January 2023 to the 1st January 2024. 53% of colorectal patients were male, while 47% were females.

4.2. Distribution of colorectal cancer patients according to age groups

The mean age of the colorectal cancer patients included in the current study was 59±15.2 years old (31–90 years).

Data in table (1) and figure (1) show the distribution colorectal cancer patients according to age groups. The higher distribution of colorectal cancer patients was 26 patients in age group (51-60) years (more than 58% in age (51-80 years) while, the lower distribution of colorectal cancer patients was 10 patients in age group (>80) years.

Table. 1: Distribution of colorectal cancer patients according to the age groups

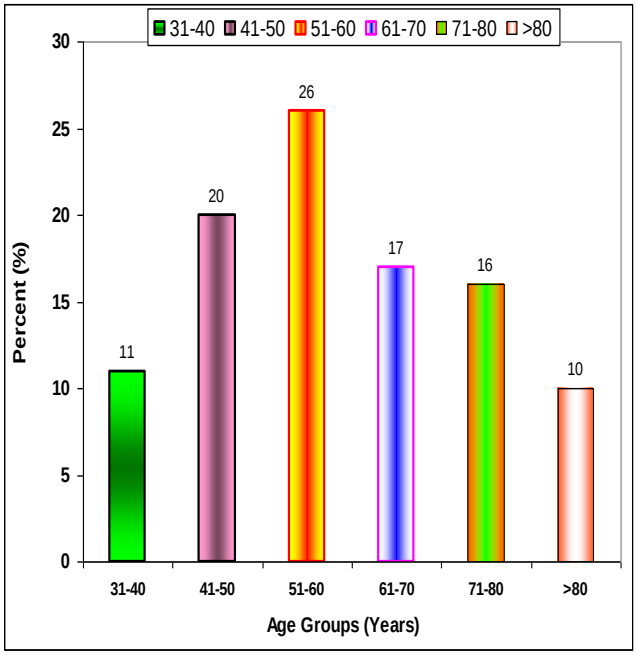
Age group (Years)	Number of patients	Percent (%)
31-40	11	11%
41-50	20	20%
51-60	26	26%
61-70	17	17%
71-80	16	16%
>80	10	10%

4.3. Distribution of colorectal cancer patients according to the region

The distribution of colorectal cancer patients according to the region were 24%, 23%, 19%, 11%, 10%, 9%, and 4% in Tripoli, Zawia, Aljabl Algarbi, Sabratha, West Sabratha, Surman, and South Libya, respectively (Table.2 & Figure.2).

Table. 2: Distribution of cervix cancer patients according to the region

Region	Number of patients	Percent (%)
Tripoli	24	24%
Zawia	23	23%
Aljabl Algarbi	19	19%
Sabratha	11	11%
West Sabratha	10	10%
Surman	09	09%
South Libya	04	04%



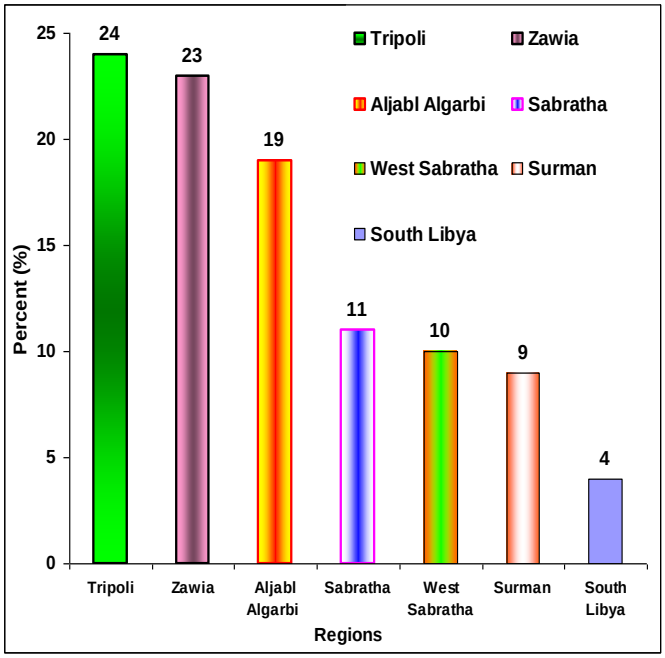


Figure. 1: Distribution of colorectal cancer patients according to age groups

Figure. 2: Distribution of colorectal cancer patients according to the region

4.4. Red blood cells count and its indices in healthy individuals and colorectal cancer patients

The data in Table (3) and Figure (3) show a none significant (*P>0.05*) decrease in RBCs counts (4.45 ± 0.40) x10^6 cell/µl in the colorectal cancer patients as compared with the healthy individuals (4.65 ± 0.06) x10^6 cell/µl.

A significant (*P<0.05*) decrease in hemoglobin concentrations was found (11.08 ± 0.32) g/dl, in the colorectal cancer patients when compared with the healthy individuals (13.67 ± 0.15) g/dl (Table 3 & Figure 4). Hematocrit values were significantly (*P<0.05*) decreased (33.54 ± 0.53) in the colorectal cancer patients when compared to the healthy women (40.52 ± 0.45) (Table 3 & Figure 5).

The results in the same table show a significant (*P<0.01*) decrease in MCV (80.99 ± 1.42 μ^3) in the colorectal cancer patients when compared to the healthy individuals (87.97 ± 0.71 μ^3) (Table 3 & Figure 6). On the other hand, MCH (30.90 ± 1.28 pg) in the colorectal cancer patients increase as compared to the healthy individuals (29.26 ± 0.28 pg) (Table 3 & Figure 7). MCHC (34.04 ± 0.70 g/dl) in the colorectal cancer patients showed a none significant change as compared to the healthy individuals (33.45 ± 0.17 g/dl), respectively (Table 3 & Figure 8).

Table. 3: Red blood cells count and its indices in healthy individuals and colorectal cancer patients

Groups Parameters	Healthy Individuals Mean ± SE	Colorectal Cancer Patients Mean ± SE	F	P Value
RCs Count (x10^6)	4.65 ± 0.06	4.45 ± 0.40	2.091	0.150
Hb (g/dl)	13.67 ± 0.15	11.08 ± 0.32	5.328	0.022
Hct (%)	40.52 ± 0.45	33.54 ± 0.53	6.687	0.011
MCV (fl)	87.97 ± 0.71	80.99 ± 1.42	10.526	0.001
MCH (Pg)	29.26 ± 0.28	30.90 ± 1.28	8.086	0.005
MCHC (g/dl)	33.45 ± 0.17	34.04 ± 0.70	2.990	0.086

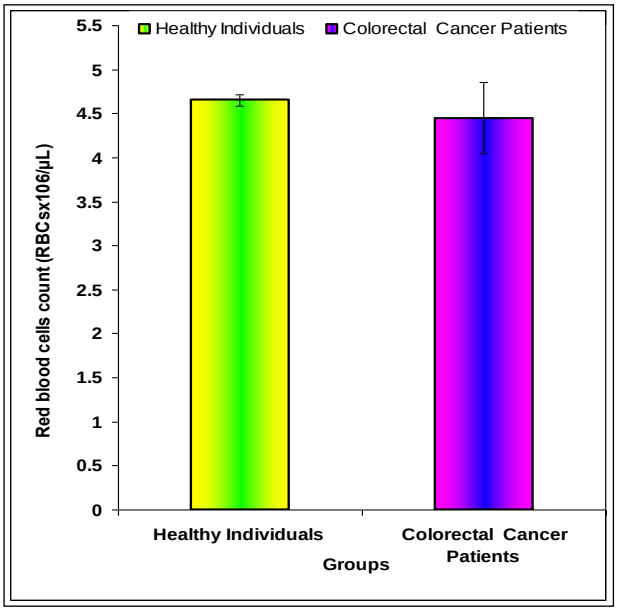


Figure. 3: Red blood cells count in healthy individuals and colorectal cancer patients

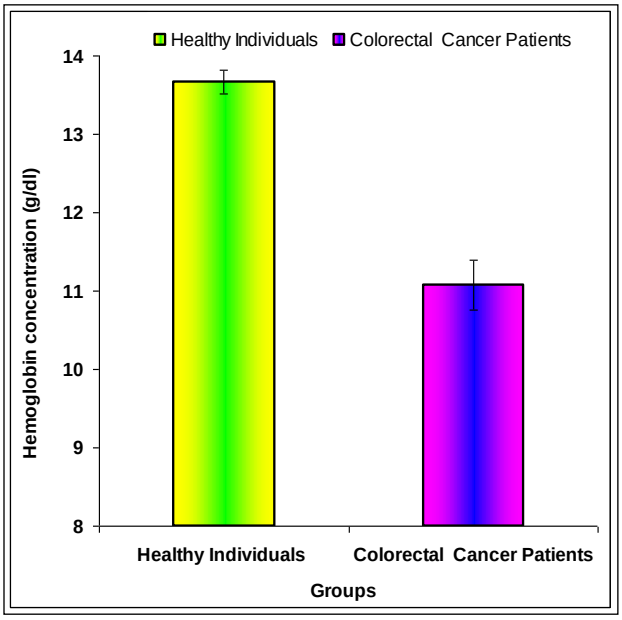


Figure. 4: Hemoglobin concentration in healthy individuals and colorectal cancer patients

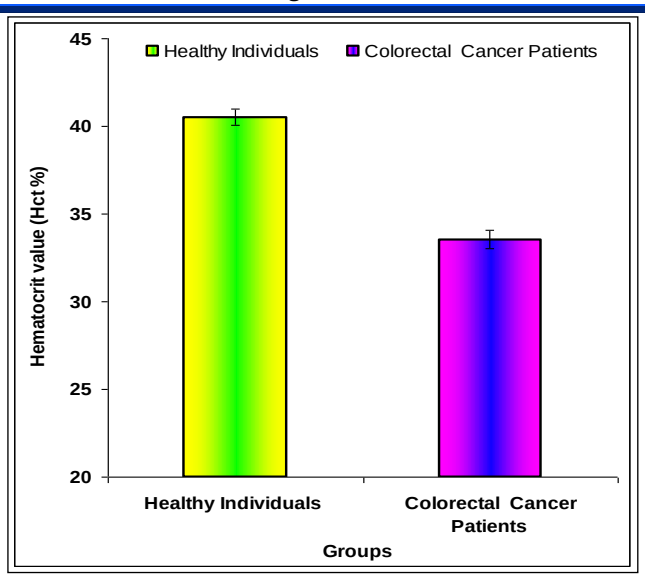


Figure. 5: Hematocrit value in healthy individuals and colorectal cancer patients

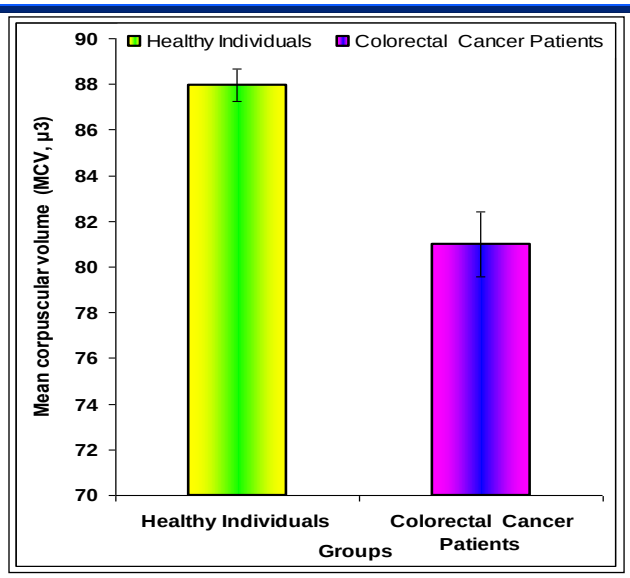


Figure. 6: Mean corpuscular volume in healthy individuals and colorectal cancer patients

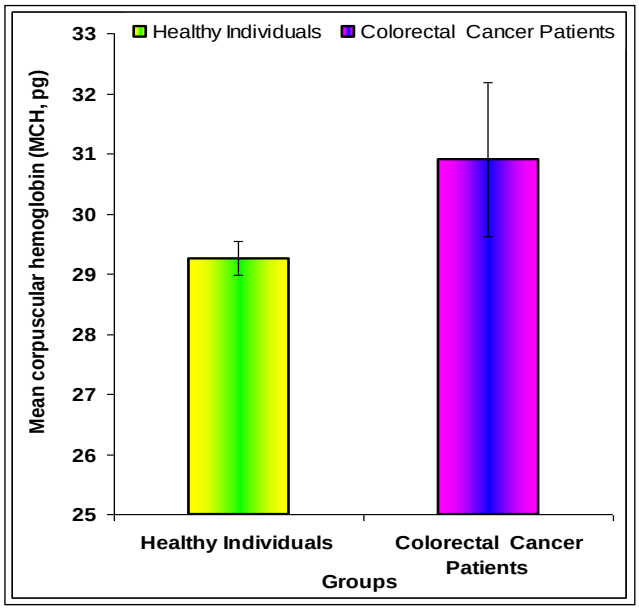


Figure. 7: Mean corpuscular hemoglobin in healthy individuals and colorectal cancer patients

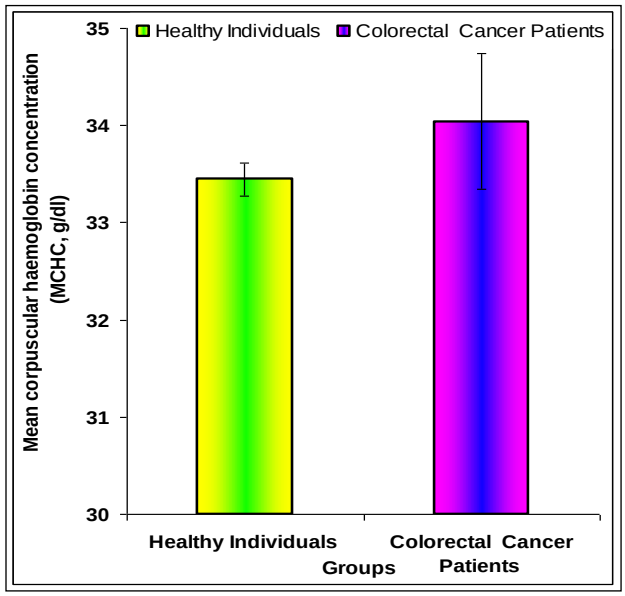


Figure. 8: Mean corpuscular haemoglobin concentration in healthy individuals and colorectal cancer patients

4.5. White blood count, differential count, and platelets count in the healthy individuals and colorectal cancer patients

WBCs count exhibited a significant (*P<0.01*) increase (7.12 ± 0.58) in colorectal cancer patients when compared with the healthy individuals (6.35 ± 0.15) (Table 4 & Figure 9).

The data recorded in table (4) and figure (10 &12) indicated a significant (P<0.01) increase in neutrophils % (59.16 ± 2.42) and mixed % (13.50 ± 2.50) in colorectal cancer patients as compared with healthy individuals (51.63 ± 1.46), and (10.70 ± 0.49), respectively. Also, Neutro/Lymph and Plt/Lymph ratios were increased (4.28 ± 1.31, 23.00 ± 8.03) in colorectal cancer patients as compared to the healthy individuals (1.51 ± 0.07, 7.58 ± 0.36) respectively (Table. 4& Figure. 13& 14).
On the other hand, lymphocytes % and blood platelets count were significantly (*P<0.01*) decreased (27.89 ± 1.51), (254.38 ± 11.06)) $x10^3$ cell/µl) in colorectal cancer patients as compared to the healthy individuals (36.00 ± 1.12) and (265.00 ± 7.21) $x10^3$ cell/µl), respectively (Table. 4& Figure. 11& 15).

Table. 4: White blood count, neutrophils %, lymphocytes %, mixed %, and platelets count in healthy individuals and colorectal cancer patients

Groups Parameters	Healthy Individuals Mean ± SE	Colorectal Cancer Patients Mean ± SE	F	P-Value
WBCs Count (x103)	6.35 ± 0.15	7.12 ± 0.58	9.128	0.003
Neutrophils %	51.63 ± 1.46	59.16 ± 2.42	12.398	0.001
Lymphocytes %	36.00 ± 1.12	27.89 ± 1.51	12.371	0.001
Mixed %	10.70 ± 0.49	13.50 ± 2.50	3.171	0.079
Neutro/Lymph	1.51 ± 0.07	4.28 ± 1.31	11.793	0.001
Plt/Lymph	7.58 ± 0.36	23.00 ± 8.03	8.415	0.005
Platetes(Plt)	265.00 ± 7.21	254.38 ± 11.06	28.010	0.000

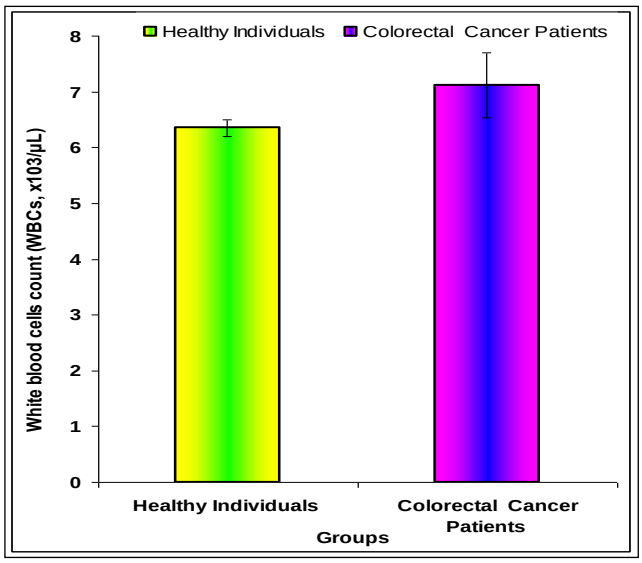


Figure. 9: White blood cells count in healthy individuals and colorectal cancer patients

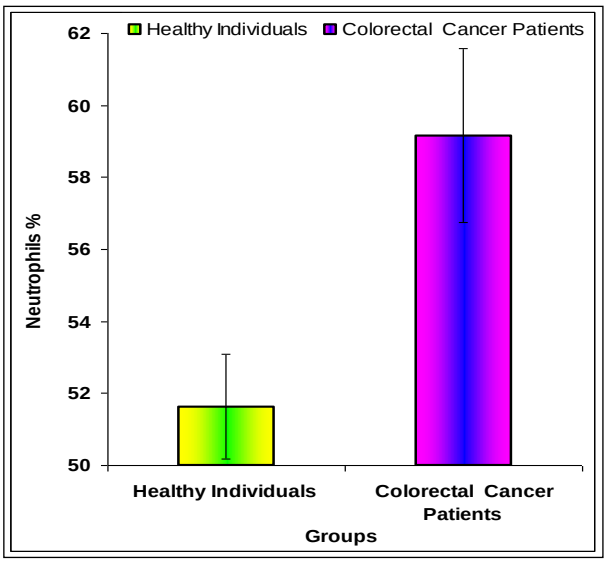


Figure. 10: Neutrophils percent in healthy individuals and colorectal cancer patients

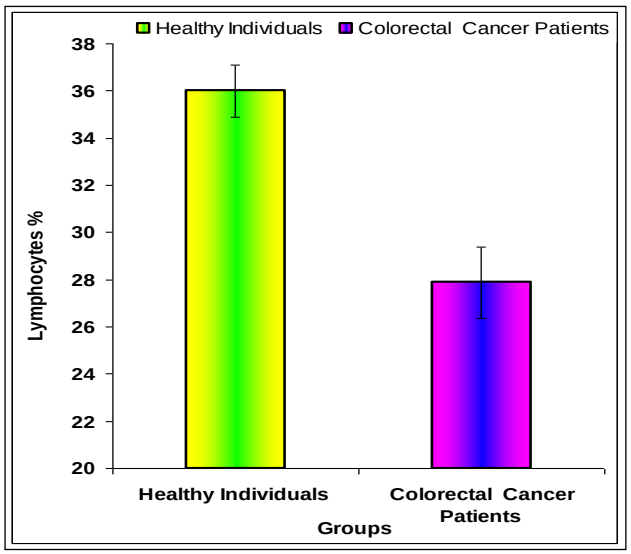


Figure. 11: Lymphocytes percent in healthy individuals and colorectal cancer patients

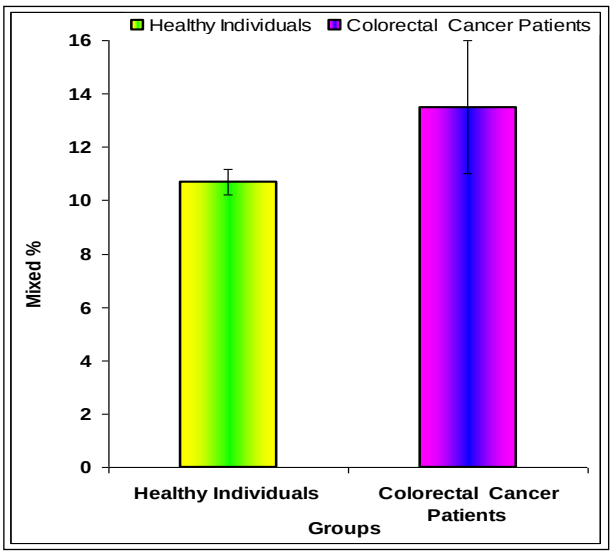


Figure. 12: Mixed percent in healthy individuals and colorectal cancer patients

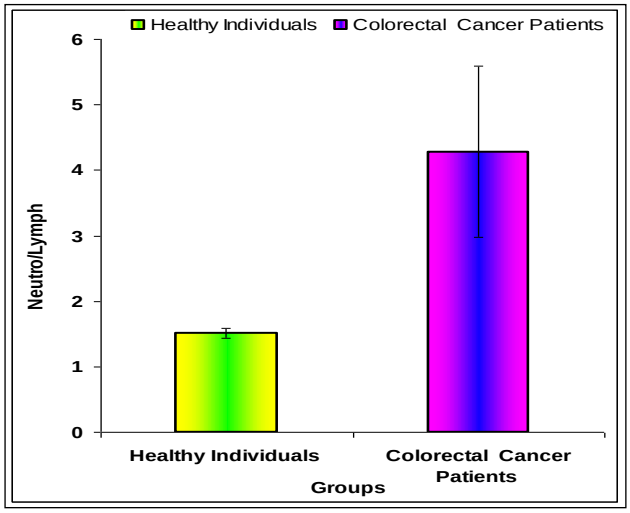


Figure. 13: Neutro/Lymph in healthy individuals and colorectal cancer patients

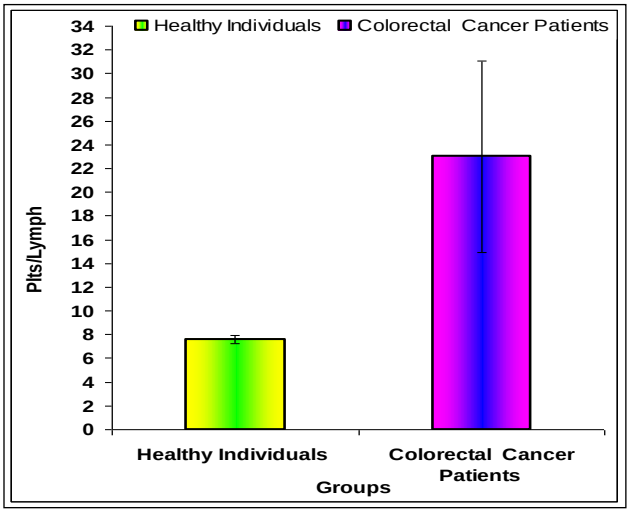


Figure. 14: Plts/Lymph in healthy individuals and colorectal cancer patients

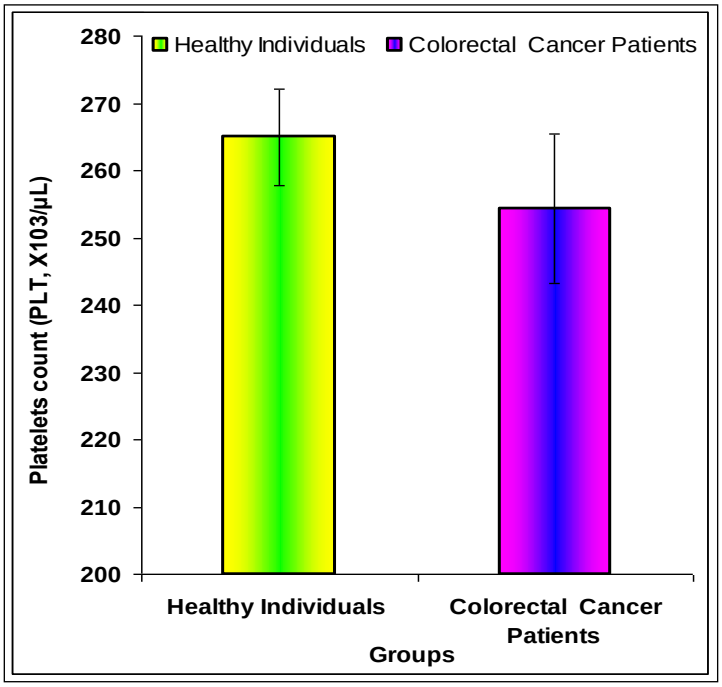


Figure. 15: Platelets count in healthy individuals and colorectal cancer patients

4.6. Distribution of anemia among colorectal cancer patients

Statistical analysis of the results showed that 85% of colorectal cancer patients was anemic (Table. 5& Figure. 16).

Table. 5: Distribution of anemia among colorectal cancer patients

Groups	Frequency	Percent (%)
Anemic Patients	85	85

None Anemic Patients	15	15

Data in table (6) and figure (17) shown that the distribution of anemic colorectal cancer patients according to the degrees of anemia. The degrees of anemia were 35% mild, 41% moderate, and 9% severe anemia in anemic colorectal cancer patients.

Table. 6: Distribution of anemic colorectal cancer patients according to the degrees of anemia

Degrees of anemia	Frequency	Percent (%)
Severe	9	9
Moderate	41	41
Mild	35	35

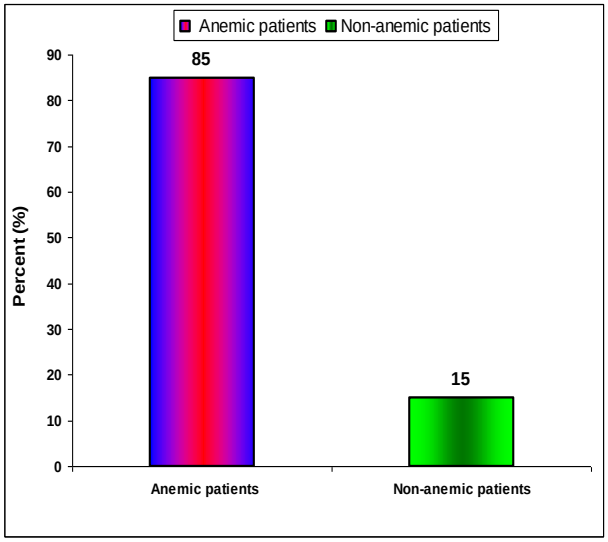


Figure. 16: Distribution of anemia among colorectal cancer patients

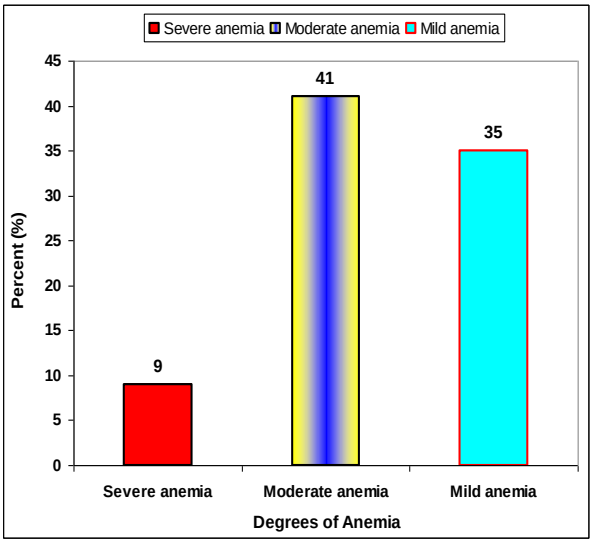


Figure. 17: Distribution of anemic colorectal cancer patientsaccording to the degrees of anemia

4.2. Distribution of anemic colorectal cancer patients according to the type of anemia

The distribution of anemic colorectal cancer patients according to the types of anemia was 27 patients with microcytic hypochromic, and 58 patients with normocytic hypochromic anemia (Table. 7& Figure. 18).

Table .7: Distribution of anemic colorectal cancer patients according to the type of anemia

Types of anemia	Frequency	Percent (%)
Microcytic hypochromic	27	27
Normocytic hypochromic	58	58

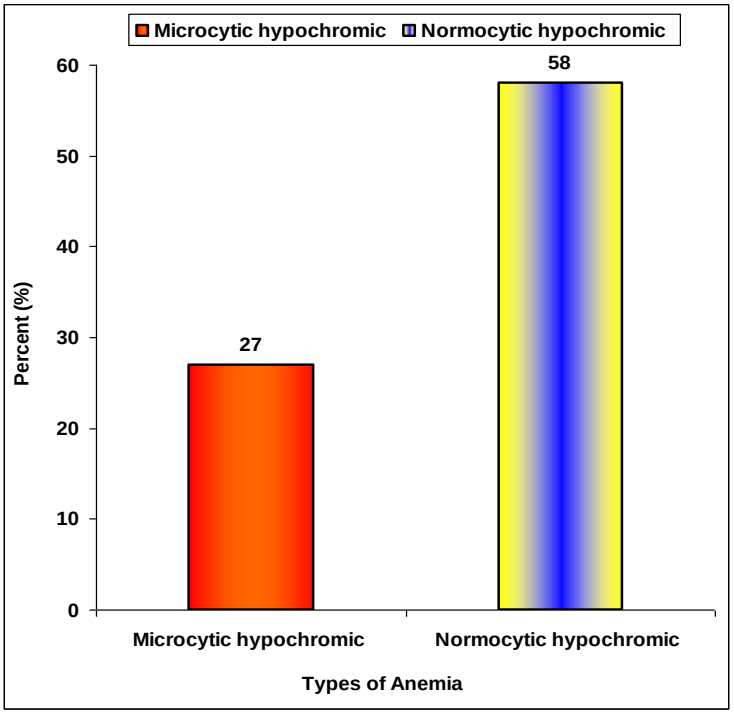


Figure . 18: Distribution of anemic colorectal cancer patients according to the type of anemia

4.2. Distribution of thrombocytopenia among colorectal cancer patients

Statistical analysis of the results showed that 12% of colorectal cancer patients have been thrombocytopenia (Table. 8& Figure. 19).

Table. 8: Distribution of thrombocytopenia among colorectal cancer patients

Groups	Frequency	Percent (%)
Thrombocytopenic Patients	12	12
None Thrombocytopenic Patients	88	88

Data in table (9) and figure (20) shown that the distribution of thrombocytopenic colorectal cancer patients according to the degrees of thrombocytopenia. The degrees of thrombocytopenia were 07% mild and 05% moderate in thrombocytopenic colorectal cancer patients.

Table. 9: Distribution of thrombocytopenic colorectal cancer patients according to the degrees of thrombocytopenia

Degrees of thrombocytopenia	Frequency	Percent (%)
Moderate	05	05
Mild	07	07

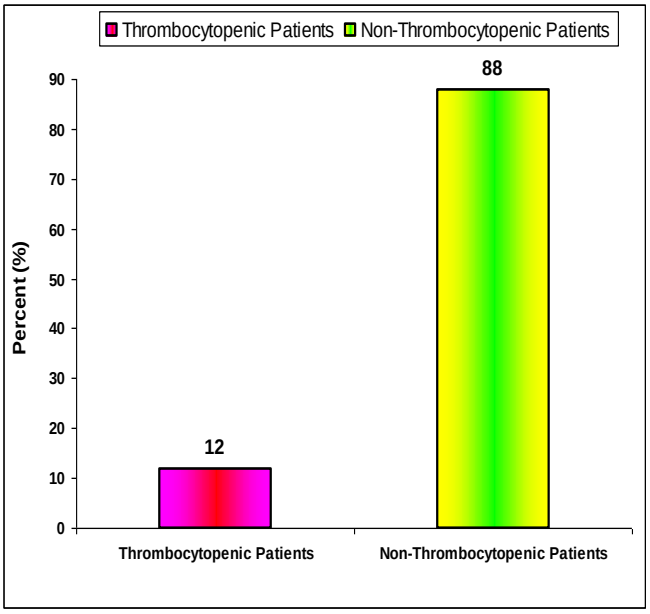


Figure. 19: Distribution of thrombocytopenia among colorectal cancer patients

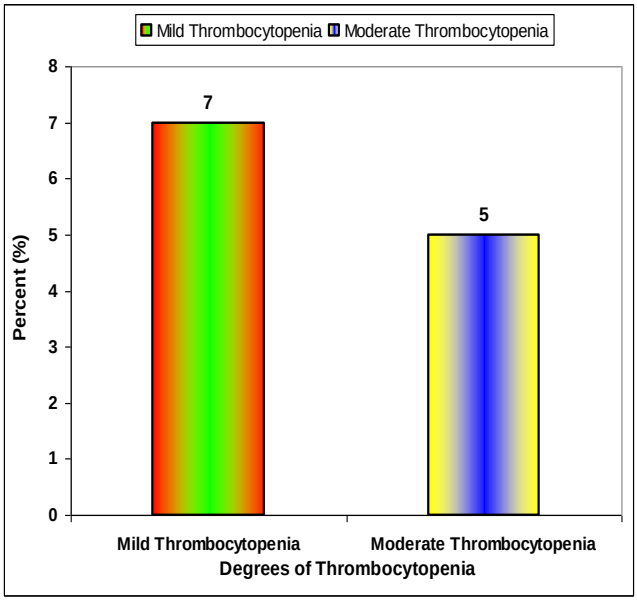


Figure. 20: Distribution of thrombocytopenic colorectal cancer patients according to the degrees of thrombocytopenia

5. Discussion

The current study has investigated the incidence of Colorectal Cancer, Anemia, Thrombocytopenia, and the Variations of Hematological Parameters among patients at the Sabratha National Cancer Institute in Western Libya compared with healthy individuals.

The current study showed that 53% of colorectal patients were male, while 47% were females. The mean age of the colorectal cancer patients included in the current study was 59±15.2 years old. Similarly, Bodalal, and Bendardaf, 2014 reported that 51.7% of the colorectal carcinoma patients in the eastern region of Libya were male, while 48.3% were females. The average age of the patients was (58.7 ± 13.4) years. Also, Mussa *et al.*. 2015 recorded that the mean age of patients with colorectal cancer, admitted to the Misurata Cancer Centre, in the middle region of Libya was 56.06 years, which in men is much higher than in women. So, authors suggested that a possible hidden familial risk for colorectal cancer and justify the need for a mass screening program for colorectal cancer, preferably for individuals aged 40 years and above. In addition, it is well known that the colon cancer more frequently in male than female patients, and its prevalence increases with age in both gender. Over thirty percent of patients with colorectal cancer are over the age of 70 years in the Western world (Abir *et al.*, 2004, Boyle and Ferlay, 2005, Kiran *et al.*, 2007).

In the present study, the higher distribution of colorectal cancer patients was 26% in age group (51-60) years (more than 58% in age (51-80 years) while, the lower distribution of colorectal cancer patients was 10% in age group (>80) years. These results are in agreement with the previous studies (Jass, 1991, Ferlay *et al.*, 2004, American Cancer Society, 2014, Bodalal, and Bendardaf, 2014,Mussa *et al.*. 2015). Mussa *et al.*. 2015 mentioned that the occurrence of colon cancer in Libyan population is age related with nearly 65% of cases arising in-patient who are 50 years or older. 61% of male colon cancers aged more than 50 years. On contrast with female colon cancer, we found that in females aged older than 50 years there is about 54% of female colon cancers. Bodalal, and Bendardaf, 2014 recorded that when the age was categorized into groups, it was found that a peak occurred in the 60-64 year age group (17.1%). 9.4% of colorectal carcinoma patients were diagnosed < 40 years. 23.5% of patients presented before the age of 50 years and that figure jumped to over one-third of patients when cases under 55 years are studied (35.3%). In New Zealand, the incidence of colorectal cancer has continued to rise in older age group of population, but has fallen in age group below 50 years (Jass, 1991). In European countries, colon cancer is a rare diagnosis before the age of 40, with 90 % of cases occurring after age 50 years (Ferlay *et al.*, 2004). The incidence rate is more than 50 times higher in persons aged 60 to 79 years than in those younger than 40 years (American Cancer Society, 2011).

Our results showed that the distribution of colorectal cancer patients according to the region were 24%, 23%, 19%, 11%, 10%, 9%, and 4% in Tripoli, Zawia, Aljabl Algarbi, Sabratha, West Sabratha, Surman, and South Libya. These may be due to potentially modifiable behaviours such as physical inactivity, unhealthy diet, smoking and obesity that are thought to account for a significant part (30–50%) of the socioeconomic imbalance in the risk of developing CRC (Lewandowska *et al.*, 2022). Diet strongly influences the risk of colorectal cancer. A diet high in fat, especially animal fats, high-temperature meal preparation, and red meat are major risk factors for colorectal cancer (Amersi *et al.*,2005, Cronin *et al.*,2018, Lewandowska *et al.*, 2022).

The current study showed a significant decrease in hemoglobin concentrations, hematocrit values, and MCV in the colorectal cancer patients when compared with the healthy individuals. The present study is run parallel to the study of Bagaria *et al.* 2022 who found that there was a decrease in Hb in gastrointestinal cancer patients as compared to healthy individuals. Kilincalp *et al.*, 2015 observed the results of hematological parameters in 144 patients with colorectal cancer and 143 healthy controls, and found that the patients with colorectal cancer had a significant low hemoglobin compared with the control group. Abushofa *et al.*, 2021 recorded that hemoglobin concentration and Hct value were significantly (*P<0.01*) decreased in cervical cancer patients compared with the healthy individuals. The study of Gascon and Barret-Lee, 2006 showed that MCV was lower among cancer patients compared to controls. Angeli *et al.*,2011 reported that intestinal bleeding causes a decrease in hemoglobin, thus to promoting DNA damage in tumor cells. Anemia is a typical clinical symptom of cancer patients (Dicato *et al.,* 2010, Sadek *et al*.,2016, Albisinni *et al.,* 2019, Hu *et al.*, 2020). It is common in cancer patients with a reported prevalence of 40% in solid tumors (Tchekmedyian, 2002, Ludwig *et al.,* 2004, Khanbhai *et al.,* 2014).

The current study showed that 85% of colorectal cancer patients was anemic, the distribution of the degrees of anemia were 35% mild, 41% moderate, and 9% severe anemia, and the types of anemia was 27 patients with microcytic hypochromic, and 58 patients with normocytic hypochromic anemia in anemic colorectal cancer patients. A similar results obtained by Khanbhai *et al.,* 2014 who found that preoperatively 44% of colorectal cancer patients were anaemic retrospectively and 60% prospectively. Authors concluded that anaemia is common in patients with colorectal cancer. Anemic patients were at high risk of receiving blood transfusion, which in turn increased length of stay and mortality.

Gastrointestinal patients had an iron deficiency anemia (Goodman. and Irvin,1993, Khanbhai *et al.,* 2014). Bagaria *et al.* 2022 mentioned that gastrointestinal cancer patients had a significantly lower serum iron concentration and a significantly higher total iron binding capacity as compared to healthy individuals. Sadek *et al*.,2016 reported that rats with colorectal cancer showed a significant (*P<0.05*) reduction in serum iron, ferritin compared with control rats. Serum iron and ferritin levels have been reported to be significantly lower in colorectal carcinoma group that could be caused by depleted ferritin stores, a result of continuous bleeding. Serum iron level would also decrease subsequently, resulting in iron deficiency anemia (Li *et al.,* 1999, Sadek *et al*.,2016). Chronic blood loss from the gastrointestinal tract, malignancy induced inflammation and underlying comorbidities are causal factors for anemia of chronic disease (Spivak *et al.,* 2009, Khanbhai *et al.,* 2014). Anemia occurs mainly due to the reduction in RBC or hemoglobin production, and this may occur either due to iron deficiency or due to hemolytic or may be due TNF-α inhibition of hemoglobin production by affecting erythropoiesis induced by erythropoietin (EPO). TNF-α might indirectly inhibit the proliferation of erythroid progenitor cells by triggering nuclear factor-κB (NF-κB), thus suppressing erythropoietin production (Dicato *et al.*, 2010, Sadek *et al*.,2016).

White blood cells count, or the measurement of white blood cells in the blood, is a reliable and widely used marker that reflects inflammation throughout the body. Various evidence suggested that inflammation is correlated with the development and progression of cancer, and individuals in the highest quartile of WBC count had an increased risk of death from cancer. The association provided an essential relationship between inflammation and cancer mortality, local inflammatory processes that have long been known to be associated with tumor progression may be reflected in the systemic inflammatory marker of higher WBC count (Shankar *et al.* 2006, Bagaria *et al.* 2022). Platelets are best known for their role in hemostasis and thrombosis. Platelets have additional roles in wound healing, inflammation and angiogenesis (Sun *et al.,* 1979, Monreal *et al.,* 1998; Inanc *et al.,* 2014).

The present study recorded that a significant increase in WBCs count, neutrophils %, and mixed% and a significant decrease in lymphocytes % and blood platelets count in colorectal cancer patients as compared to the healthy individuals. 12% of colorectal cancer patients have been thrombocytopenia and the degrees of thrombocytopenia were 07% mild and 05% moderate in thrombocytopenic colorectal cancer patients. These results are in concordant with the study of Satomi *et al.,* 1995 found that the WBC and neutrophils increased with cancer stage. Conversely, lymphocytes decreased with stage. Neutrophils increase and lymphocytes decrease with the advancement of cancer **(**Ueda *et al.,* 1992**),** changes that may mirror the status of a living body (Ietomi, 1990). Owada *et al.*,1990 reported that the helper T cells decreased in cancer patients. Neutrophils play an important role in cytoprotection. In a tumor-bearing host, neutrophils specifically damage cancer cells or non-specifically damage cancer cells through an antibody (Satomi *et al.,* 1995). Welch *et al.,* 1978 have reported a study which indicates that an increase of neutrophils may contribute to metastasis of cancer. Some studies report that a decrease of neutrophils may indicate a better prognosis for stage IV and terminal stage patients (Urata, 1988). There might be a possibility that an increase of non-functional neutrophils cannot suppress invasion and lymph node metastasis of cancer (Satomi *et al.,* 1995). It has been reported from experimental studies that neutrophils may promote transformation, growth, progress and metastasis of cancer, and have a suppressive effect on antitumor immunology (Ishikawa, 1987**).** Also, Bagaria *et al.* 2022 reported that there was an increase in WBC count and a decrease in platelets count were found in gastrointestinal cancer patients as compared to healthy individuals

Sadek *et al*.,2016 reported that malignant rats showed a decrease in lymphocyte percentage in rats with colorectal cancer, that indicate an impaired host immune response to the tumor or inflammatory conditions that are associated with recurrence of the tumor. It is well known that lymphocytes are the most important factor in the anti-tumor immune system. Malignant rats with decreased lymphocyte percentage may exhibit a poorer lymphocyte-mediated immune response to malignancy, thereby increasing the risk of tumor recurrence (Yoneyama *et al*.,2011, Sadek *et al*.,2016).

Mierke, 2014, Mouasni and Tourneur, 2018, and Hu *et al.,* 2020 mentioned that the critical role that inflammation plays in the occurrence and progression of malignancies. The neutrophil-lymphocyte ratio (NLR) has been used not only as a marker of inflammation, but also as a prognostic index for various common solid tumors such as gastric cancer, breast carcinoma, colorectal carcinoma, nasopharyngeal cancer and malignant melanoma (Roxburgh *et al.,* 2009, Noh *et al.,* 2013, Mallappa *et al.,* 2013, Inanc *et al.,* 2014). The ratio of platelets to lymphocytes has been linked to systemic inflammation and has been found to have clinical significance in a number of disorders (Qin *et al.,* 2016, Yang *et al.,* 2017, Zhu *et al.,* 2018, Hu *et al.,* 2020). Reduced hemoglobin to platelet ratio is linked to a poor prognosis for renal cell carcinoma (Albisinni *et al.,* 2019, Hu *et al.,* 2020).

The results of the current study indicated that Neutro/Lymph and Plt/Lymph ratios were increased in colorectal cancer patients as compared to the healthy individuals. These results run parallel with the results of the study of Hu *et al.,*2020 recorded that PLR were significantly higher in patients with colon cancer than those with benign colon tumors. Emir *et al.,* 2015 recorded that the patients with colorectal cancer had significantly higher PLR values than those with colorectal polyps and healthy controls. The results showed that the PLR value of colon cancer group was significantly higher than that of benign colon tumor group and healthy control group. In a retrospective study of the hematological ratios and clinicopathological features of 1,383 patients with colorectal cancer, high levels of PLR were associated with larger tumor size, advanced tumor invasion, lymph node metastasis, distant metastasis and tumour, node and metastasis (TNM) stages (Chen *et al.*,2017). Satomi *et al.,* 1995 mentioned that the N/L ratio increased with cancer stage sharply from stage IIIb, and was highest in the terminal stage. The ratios in stage IIIb, stage IV and the terminal stage were statistically different from those in the controls. The ratio of neutrophils to lymphocytes in the peripheral blood in patients with colorectal cancer were significantly higher in the advanced stages of cancer than in normal controls. These finding suggest that the ability to N/L ratio reflect anticancer mechanisms and that they may be useful when considering treatment or prognosis of patients with advanced stages of cancer.

6. Conclusion

It can be concluded that the higher distribution of colorectal cancer was in male elderly patients in Tripoli and Zawia than in other regions. Most of the hematological parameters among the patients showed significant alterations. 85% of colorectal cancer patients were anemic, the most with moderate and normocytic hypochromic anemia, and 12% of patients were thrombocytopenic, and the degrees of thrombocytopenic were 07% mild and 05% moderate. The simplest and most significant examination tool for making a diagnosis of illness is a full blood count. Furthermore, it is recommended that patients diagnosed with colorectal cancer have their hematological indicators routinely checked. It's important to consider the findings' clinical implications.

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