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STUDY OF BLOOD PARAMETERS IN CANCER PATIENTS IN DHI - QAR GOVERNORATE

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Abstract:
The relationship between cancer and the changes in hematological parameters was rarely referred to and deserves further investigation. Hematological parameters evaluation is a reliable method for diagnosing diseases through laboratory tests. Based on blood parameters, it is possible to predict the severity of the disease and monitor the treatment progress for individuals with cancer. This study aimed to assess blood parameters as valuable markers in cancer patients and their impact on physiological processes in the body.

Keywords: Hematological parameters, cancer, physiological .

INTRODUCTION:

Cancer is a diverse group of malignant tumors that resulted in around 600,000 deaths in the US in 2020, making it the second leading cause of death after heart disease. A significant amount of information has been gathered about the epidemiology and causes of most types of cancer. The most commonly diagnosed types of cancer in adults in many countries are lung cancer, colorectal cancer, breast cancer, melanoma, and prostate cancer. Generally, infection rates increase with age. The primary causes of cancer are smoking, obesity, lack of physical activity, diets low in fruits and vegetables, infectious agents, and sunlight exposure. Early detection of cancer can reduce the risk of death for individuals with breast, colon, cervical, lung, rectal, and prostate cancer (Schwartz ,. 2024) . Breast cancer is a complex disease influenced by both genetic and environmental factors. Breast cancer stem cells (BCSCs) play a crucial role in the aggressiveness of various tumors and present a significant challenge in cancer treatment.he main challenge in cancer treatment (Barzaman *et al* ,. 2020).

Also, breast cancer is one of the most common types of malignant tumors in the world. Breast cancer disproportionately affects women, and the risk of developing it increases with age . More than 80% of breast cancer cases are diagnosed in women over 50 years old. In 2020, breast cancer was the leading cause of cancer-related deaths, with 685,000 fatalities worldwide (World Health Organization, 2021) . The incidence of breast cancer varies widely across the world due to differences in education levels, economic status, environmental conditions, food habits, lifestyle factors, and other cultural practices. Globalization and economic growth may worsen the incidence of breast cancer in developing countries (64% to 95) and developed countries (32% to 56%) by 2040 (Sung *et al*,. 2021) . It's important to have an extensive information program about breast cancer in order to raise awareness about the risk factors and incidence of the disease. Additionally, screening programs and diagnostic tests are crucial for early detection, which can help reduce the burden of breast cancer and prevent deaths(Mathur *et al*,. 2020).

Bone marrow is a complex organ located within the cavities of bones. Its primary function is to produce all the blood cells needed for a healthy blood system. As with any major organ, a number of diseases can arise from faults in bone marrow function, including non-malignant disorders such as anemia and malignant disorders such as leukemia (Moore *et al*,. 2021). Blood cancers are a type of cancer that affects the body's blood and bone marrow. There are three common types of blood cancers: multiple myeloma, leukemia, and lymphoma. Chemotherapy is the main treatment for blood cancers, and involves injecting anti-cancer drugs into the bloodstream. However, there is a high rate of relapses due to the low efficacy of drugs, leading to a decreased survival rate of patients. This highlights the urgent need for a drug delivery method to improve the safety and effectiveness of blood cancer treatments (Jiang *et al*,. 2022) .

Multiple myeloma is characterized by the accumulation of malignant clonal plasma cells in the bone marrow. The exact cause of myeloma is unknown. Radiation is a factor in some cases, although there is no association with radiation therapy. Exposure to industrial/agricultural toxins or viruses has also been considered, but there is no

conclusive evidence to prove this. Chromosomal abnormalities, most often involving the immunoglobulin heavy chain switch region (on the long arm of chromosome 14), although these abnormalities do not appear to be sufficient in themselves to cause multiple myeloma. Tumor cells within the bone marrow support a non-malignant population of stromal cells that produce cytokines (eg, interleukin-6) that promote myeloma cell growth and prevent apoptosis (Firth . 2019).

Leukemia is a type of cancer that originates from hematopoietic stem cells (HSCs). A small portion of leukemic stem cells (LSCs) are accountable for the start, drug resistance, and recurrence of leukemia (Ma *et al* ,. 2021). Lymphomas can be broadly categorized as non-Hodgkin (90%) and Hodgkin (10%) types. The majority of lymphomas (90%) originate from B cells, although they can also stem from T cells or natural killer cells (Mugnaini & Ghosh ,. 2016).

Colon cancer (CC) is a global health challenge. Diet, microbiome, obesity, and family history may all play a role in the development of CC. Recent studies have demonstrated a strong association between colon microbiota and CC. The microbiota either protects or harms colonic cells, depending on the type of metabolites and their mode of action. Any imbalance in colon microbiota causes colon cancer cells to proliferate and promotes metastasis (Malla .2020) .

MATERIALS AND METHODS:

Collection of data

The current study included collecting information from the patients included in the current study, as blood samples were collected from the main laboratory of the analysis center at the Cancer Center at Al-Haboubi Hospital during the period from the beginning of November 2021 to the end of December 2021, and a questionnaire was prepared for each case to collect its information such as (patient number, age, gender).

Determination of some Blood Parameters Level

The level of some blood parameters was measured in the studied groups, including measuring the level of hemoglobin level (Hb), the number of red blood cells (RBC), the total number of white blood cells (WBC), and the differential count of white blood cells (DLC), using a haemocytic analyzer that automatically analyzes each sample and gives readings automatically. The Blood coulter device from the American company Genux U.S.A. was used in this study.

Statistical analysis: -

The results of the study were statistically analyzed using the statistical program (SPSS) version 22 at the probability level (P≤0.05).

RESULTS AND DISCUSSION

The effect of cancer on blood parameters according to age group in patients with cancer (breast, colon and blood)

The results of the current study showed that there was no significant difference in breast cancer and leukemia patients in the number of red blood cells (RBC) in the age groups when compared with the control group at the probability level (p≤0.05). RBC counts decreased in colon cancer patients in the age group (30-39) and ((50-59) when compared with the control group and the rest of the age groups at the probability level ((p≤0.05, as shown in Table (1).

The results also indicated a significant increase in the packed red blood cell volume (PCV) in breast cancer patients in the age group (30-39) when compared with the control group and the rest of the age groups at the probability level (p≤0.05). The results also showed a significant decrease in colon cancer patients in the age group (30-39) when compared with the control group and the rest of the age groups at the probability level (p≤0.05), while there was no significant difference in leukemia patients when comparing between the age groups at the mentioned probability level.

The results showed a significant increase in the concentration of hemoglobin Hb in breast cancer patients in the age group (30-39) when compared with the control group and the rest of the age groups at the probability level (p≤0.05). The results also showed a significant decrease in colon cancer patients in the age group (30-39) when compared with the control group and the rest of the age groups at the probability level (p≤0.05), while there was no significant difference in leukemia patients when comparing between the age groups at the mentioned probability level.

TYPE OF CANCER	AGE CATEGORIES	(RBC) $*10^6$/ MM	PCV %	HB (G/DL)
	control group	4.76 ± 0.67a	37.37± 1.29a	12.2± 3.89a
breast cancer	(30-39)	4.75± 0.06a	67.26± 12.23b	29.3± 8.00b
	(50-59)	3.95	34.067	11.27

		±0.2996 a	±2.153a	±0.67 a
	(60-69)	4.013 ±0.497a	33.067 ±2.761 a	11.3± 0.79a
Colon Cancer	(39-3	3.12 ±0.00b	21.2 ±0.00b	7.2 ±0.00b
	(49-4	4.497 ±0.497 a	36.93± 3.132 a	11.97 ±1.417 a
	(59-50)	3.76± 0.480 a b	31.63± 5.765 a b	10.87 ±2.167 a b
blood cancer	(20-29)	4.437 ±0.409 a	37.4±2.754 a	11.23±1.0745 a
	(40-49)	4.33 ±1.127 a	33.63±7.42 a	9.667±1.994 a
	(50-59)	3.49±0.8 87 a	29.1±6.53 a	9.8±1.87 a
	(60-69)	3.72 a ±0.729	32.167±6.64 5 a	10.367±1.9056 a

Table (1) The effect of cancer on blood parameters according to age group in patients with cancer (breast, colon and blood)

(Saleem *et al*,. 2017) indicated that the values of Hb, PCV increase when using anti-breast cancer drugs such as FAC (5-fluorouracil, Adriamycin and cyclophosphamide) and AC (Adriamycin and cyclophosphamide) depending on the stage of infection. In general, an increase was observed in these parameters. The researchers also showed that the value of Hb increases.

The decrease in these red cell indices may be due to treatment-induced oxidative stress, leading to the failure of erythropoiesis and the destruction of mature cells. The blockage of iron incorporation into hemoglobin, caused by a disturbance in the biogenesis structure of hemoglobin molecules and oxidation of iron, can result in problems with hemoglobin synthesis (Oronsky *et al*,. 2017) , Which is consistent with the study (Tadesse & Leminie ,. 2023).

The effect of cancer on the total and differential white blood cell count according to age group in patients with cancer (breast, colon and blood)

The results of the current study showed that there was no significant difference in breast cancer patients in the number of white blood cells (WBC) in the age groups when compared with the control group at the probability level ($p \leq 0.05$), while the number of WBC increased in colon cancer and leukemia patients in the age group (30-39) and (50-59) respectively when compared with the control group and the rest of the age groups at the probability level ($p \leq 0.05$), as shown in Table (2).

The findings revealed a noteworthy reduction in basophil count among breast cancer patients aged 50-59 and 60-69 compared to the control group at a probability level of $p \leq 0.05$. Likewise, there was a significant decrease in the basophil count among colon cancer patients aged 30-39 and 40-49 compared to the control group and other age groups at the same probability level. In addition, there was a substantial decrease in basophil count across all age groups in leukemia patients compared to the control group and between different age groups at the mentioned probability level. Additionally, there was a significant decrease in basophil counts across all age groups among leukemia patients compared to the control group, as well as between different age groups, at the specified probability level in Table (2).

TYPE OF CANCER		WBC*10^3/ MM ^{3}	BASOPHILS 1/MM3	EOSINOPHILS, 1/MM	NEUTROPHILS , 1/MM3	LYMPHOCYTES, 1/MM3	MONOCYTES, 1/MM3
control group		5.913± 0.77 a	49 ± 29 a	148 ± 108 a	3991 ± 1406 a	183 ±617a	450± 182 a
breast cancer	(30-39)	3.9± 0.3a	0.500 ±0.10 ab	0.500 ±0.100b	1.9 ±0.0 b	1.5 ±0.2 b	0.5 ±0.1 b
	(50-59)	6.82± 3.1a	3.295 ±3.97b	3.98 ±2.27b	5.88 ±2.009b	2.54 ±0.563 b	0.56 ±0.206b
	(60-69)	7.95±1.56a	1.57 ±0.03 c	1.85 ±1.68 b	2.29 ±1.207 b	2.12 ±0.5710b	2.01 ±1.598b
Colon Cancer	(30-39)	13.8 ±0.00b	0.01 ±0.0 b	0.0 ±0.00b	10.05 ±0.00b	1.42 ±0.00b	2.34 ±0.00b

	(40-49)	6.58 ±2.65 ab	0.35 ±0.325 b	0.40 ±0.30 b	4.13 ±2.229 c	1.45 ±0.4158 b	0.89 ±0.2178 c
	(59-50)	9.14 ±2.33a	0.033 ±0.012b	0.087 ±0.045b	6.14 ±1.972cb	1.7667 ±0.516 b	1.123 ±0.6087c
blood cancer	(20-29)	7.66 ±1.84 a	0.54 ±0.348 c	0.62 ±0.23b	5.08 ±1.19b	1.79 ±0.542 c	0.7 ±0.252 b
	(40-49)	6.70 ±0.874 a	0.53 ±0.088 c	0.53 ±0.09 b	4.1 ±0.603 b	2.1 ±0.61 c	0.5 ±0.0882 b
	(50-59)	10.50 ±1.86 b	3.49 ±0.23b	0.04±1.63b	2.82 ±1.55 b	7.32 ±0.52 b	0.09 ±1.495 b
	(60-69)	6.90 ±2.136 a	0.0 ±0.267d	2.57 ±2.57b	4.35 ±2.046 b	2.06 ±0.086c	3.04 ±2.35 b

Table (2) shows the effect of cancer on the total and differential count of white blood cells according to age group in patients with cancer (breast, colon and blood).

There is a complex interaction between tumor-host immunity and the inflammatory response. Tumor-induced tissue damage can trigger a series of immune responses, both locally and systemically (De Visser *et al*,. 2006). High white blood cell (WBC) counts in cancer patients have also been linked to the migration of cancer cells (Kahramanca *et al*,. 2014). Neutrophils, monocytes, platelets, and lymphocytes are associated with the prognosis of various types of cancer. Neutrophils indicate inflammatory and immune responses and impact tumor development, progression, and metastasis by restraining inflammatory factors such as neutrophil elastase, matrix metalloproteinase-9 (MMP-9), nuclear factor-κB (NF-κB), vascular endothelial growth factor (VEGF), and interleukin-8 (IL-8) (Xiao *et al*,. 2018).

The effect of cancer on red blood cell parameters according to age group in patients with cancer (breast, colon and blood)

The results of the current study indicate that there is no significant difference in MCV rate among breast cancer patients in different age groups when compared with the control group at the p≤0.05 level. However, the MCV rate decreased in colon cancer patients in the 30-39 age group and increased in leukemia patients in the 50-59 age group compared to the control group and other age groups at the p≤0.05 level, as shown in Table 3.

Additionally, the study found that there was no significant difference in the mean corpuscular hemoglobin (MCH) rate among breast cancer and colon cancer patients across different age groups when compared with the control group at the significance level of p≤0.05. Nevertheless, the MCH rate increased in leukemia patients aged 60-69 compared to the control group and the rest of the age groups at the significance level of p≤0.05.

The current study's results indicate no significant difference in the mean corpuscular hemoglobin concentration (MCHc) levels in patients with blood cancer and colon cancer across different age groups when compared to the control group at a significance level of p≤0.05. However, the MCHc level decreased in breast cancer patients in the age group of 30-39 when compared to the control group and other age groups at a significance level of p≤0.05.

The study's results also clarified the absence of a significant difference in the red cell distribution width (RDW) in colon cancer patients across different age groups when compared to the control group at a significance level of p≤0.05. Nevertheless, it decreased in blood cancer patients in the 60-69 age group and in breast cancer patients in the 30-39 age group when compared to the control group and other age groups at a significance level of p≤0.05.

TYPE OF CANCER	AGE CATEGORIES	MCV /MM^3	MCH-(PG)	MCHC –(G/DL)	RDW %
	control group	82.29 ±0.00a	26.34 ±0.00 a	32.25 ±0.00 ab	14.44 ±0.00 a
breast cancer	(30-39)	81.967 ±2.97 a	24.43 ±1.433 a	29.7 ±0.00 b	12.2 ±0.10 b
	(50-59)	83.167 ±3.579 a	28.43 ±1.812 a	34.2 ±76.67 a	15.367 ±10.942 a
	(60-69)	82.667 ±4.689 a	26.67 ±1.01708 a	32.167 ±0.78 a	15.67 ±4.342 a
Colon Cancer	(39-3	67.9 ±0.00b	23.1 ±0.00 a	34. ± 0.00 a	15.4 ±0.00 a
	(49-4	82.67 ±3.658	26.67 ±1.7372 a	32.17 ±1.255 a	15.67 ±1.1624 a

		a			
	(59-50)	83.17 ±7.882 a	28.43 ±2.6692 a	34.2 ±0.872 a	15.37 ±0.8951 a
blood cancer	(20-29)	84.83 ± 1.683 b	25.4 ±1.081 ab	30.07 ±1.51 a	16.7±0.58 a
	(40-49)	79.67± 8.849 ab	23.3±3.09 ab	25.7±4.286 a	16.27±2.30 a
	(50-59)	66.4±7.1 2 a	22.3±2.15 a	33.5±6.96 a	17.8±3.03a
	(60-69)	79.57± 6.75 1ab	27.97 ±0.93b	135.6±104.19 a	4.29 ±4.154b

Table (3) The effect of cancer on red blood cell constants according to age group in patients with cancer (breast, colon and blood)

The study revealed that patients with leukemia showed a significant increase in red blood cell volume (MCV) and red blood cell hemoglobin (MCH) . On the other hand, patients with breast cancer and leukemia exhibited a decrease in red blood cell hemoglobin concentration (MCHC) and red blood cell width (RDW) , Which is consistent with the results of the study (Rajizadeh *et al*,. 2017) . The increase in red blood cell volume (MCV) in leukemia patients may be due to anemia. The study also found that the number of red blood cells and the percentage of hemoglobin decreased slightly, but remained within the normal range. This decrease may be attributed to a shortage of iron, which is necessary for the production of red blood cells (Adris *et al*,. 2018). Significant disturbance in measures of red blood cell iron status has also been associated with a systemic inflammatory response in patients with colorectal cancer (McSorley *et al*,. 2019).

The effect of cancer on platelet count according to age group in patients with cancer (breast, colon and blood)

The results of the current study show that there was no significant difference in platelet count (PLT) among leukemia and breast cancer patients when compared with the control group at the probability level ($p \leq 0.05$). However, an increase in platelet count was observed in colon cancer patients in the age group (30-39) when compared with the control group and the other age groups at the probability level ($p \leq 0.05$).

Similarly, the results indicated that there was no significant difference in platelet volume (MPV) among leukemia and breast cancer patients when compared with the control group at the probability level ($p \leq 0.05$). However, an increase in platelet volume was observed in colon cancer patients in the age group (30-39) compared to the control group and the other age groups at the probability level ($p \leq 0.05$).

Furthermore, the study found no significant difference in platelet count (PCT) among leukemia, breast, and colon cancer patients compared to the control group and the other age groups at the probability level ($p \leq 0.05$).

Type of cancer	age categories	Plt $*10^3/mm^3$	pct %	mpv
	control group	306.67 a ±78.8106	3.5 a ±3.2837	11.00a ±1.15470
breast cancer	(30-39)	233. a ±46	0.23 a ±0.04	10.1667 a ±0.367
	(50-59)	307.5 a ±38.44	1.85a ±0.7854	9.267a ±0.2963
	(60-69)	238.67 a ±55.18	1.82 a ±0.84	9.33 a ±0.3667
Colon Cancer	(39-30)	465.0 ±0.0 b	0.5 ±0.0a	15.8 ±0.0b
	(49-40)	240.33 ±12.129 a	1.90 ±1.685a	11.4 ±2.0421a
	(59-50)	361.0 ±61.8493 ab	2.05 ±1.595a	10.467 ±0.491a
blood cancer	(20-29)	256. ±11.06 a	3.77±3.513 a	9.77±0.3712 a
	(40-49)	148. ±69.241 a	0.13±0.0651 a	6.067±3.0339 a
	(50-59)	106. ±70.58 a	9.5±0.00 a	9.5±3.58 a

	(60-69)	210.667±86.826 a	0.81±0.496 a	8.2±1.012 a

Table (4) shows the effect of cancer on the number of platelets according to age group in patients with cancer (breast, colon and blood).

MPV, an indicator of platelet volume, is an effective indicator of platelet activity. For example, previous studies have shown that MPV was higher in gastric cancer patients than in normal individuals, and the MPV/PC ratio (platelet count) was significantly higher in hepatocellular carcinoma patients. In addition, there is a significant association between high MPV and the development of cancer, such as breast cancer (Gu *et al* ,. 2016) and colon cancer (Li *et al*,. 2015) . It has been suggested that some inflammatory cytokines, such as interleukin-6, produced by cancer cells may stimulate both platelet differentiation and proliferation, thus producing abundant giant platelets (Mutlu *et al* ,. 2013).

CONCLUSION

According to the results of our study, blood parameters levels can be used as an indicator of cancer risk and to monitor its progression.

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