iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** VIII **Month of publication:** August 2026

DOI: https://doi.org/10.22214/ijraset.2026.84673

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VIII Aug 2026- Available at www.ijraset.com

Evaluation of Complete Blood Count (CBC) among patients with Breast, Ovarian and Colon Cancer Patients Before and After Chemotherapy Administration at Shendi Oncology Center, Sudan-2026

Wala Eldin Osman Elradi[1], Aisha A. S. Abdallatif[2], Alaa B. M. Abdrhman[3], Alaa G B Ibrahim[4], Ibtisam K. A. Anwar[5], Omer F A. Mohammed[6], Maab Shames AL-deen G. A[7], Maye M. Merghani[8], May A. M. Ashmaig[9], Safa Wdidi[10]

[1, 10]*Department of Hematology and Blood Transfusion. University of Alzaiem Alazhary –Faculty of Medical Laboratory Sciences*

[2, 3, 4, 5, 6, 7]*Department of Hematology & Immunohematology. Faculty of Medical Laboratory Sciences. Sudan International & Hayat University*

[8]*Department of Hematology and Blood Transfusion, Medical Laboratory science program, Nahda College*

[9]*Department of Hematology and Blood Transfusion. College of medical laboratory Science, Karray University.*

Department of medical microbiology and immunology. Faculty of medical laboratories science. University of Alzaiem Alazhari

Department of community Medicine- faculty of medicine, university of Dongola e –Sudan

Abstract: Background: Chemotherapy administrated to cancer patients as it toxic and aiming to confine cancer spread for normal organs has effects, it observed that changes in hematological parameters during anti-cancer drugs differ before starting treatment. To this study aimed to evaluate changes may occur among 3 different cancers' patients attended to Shendi Oncology center- River Nile State. Method: The study was approved by Sudan International University-hospital administration as well as patients as they already consent for participating in research concerning cancer at any level. Breast, ovarian and colon cancers patients were involved in this study. Patients whole blood samples were collected in 2 phases, first before starting chemotherapy and second after period of time assessed according to number of drugs' cycles. Complete blood count parameters measured via hematology analyzer Mindray. Data collected analyzed by statistical package of social science (SPSS) version22.

Result: Comparison of data before and after chemotherapy with each other showed significant differences in Hb, PCV, MCV, RDW-CV each of them has p value <0.05 and the rest of parameters compared each has p value >0.05. Age was significantly positively correlated with Hb and PCV and negatively correlated with RDW-CV before chemotherapy. After chemotherapy, age showed significant negative correlations with MCHC and RDW-CV and a significant positive correlation with lymphocyte percentage. Other CBC parameters showed no statistically significant correlations with age.

Conclusion: there were changed observed in parameters after chemotherapy administration

Key words: chemotherapy. Complete blood count.

I. INTRODUCTION

Cancer is the second leading cause of death worldwide and represents a major public health challenge. Its development results from the accumulation of genetic and epigenetic alterations that disrupt normal cell growth, division, differentiation, and death. Cancer cells acquire characteristics such as uncontrolled proliferation, resistance to growth-inhibitory signals, angiogenesis, tissue invasion, and metastasis. Although individual causes are difficult to establish, cancer development is generally influenced by the interaction of multiple genetic, environmental, and lifestyle risk factors. Epidemiological studies are important for understanding cancer diagnosis, treatment, and palliative care, while cancer registration supports effective health-program planning and evaluation. Evidence has long linked certain cancers to specific exposures, such as tobacco use and occupational exposure, and current estimates indicate that more than 40% of cancer cases and over half of cancer deaths may be attributable to potentially preventable risk factors [1—4].

A. Cancer in Sudan

Despite the global rise in cancer incidence, it remains a neglected public health problem in Africa, particularly in Sudan, due to political instability, limited healthcare resources, and competing priorities such as infectious diseases. The true cancer burden in Sudan is uncertain, although reported cases increased substantially from 303 in 1967 to 6,303 in 2010. Common cancers include colorectal, breast, non-Hodgkin lymphoma, leukemia, and esophageal cancers. Increasing urbanization, lifestyle changes such as smoking, tobacco chewing, unhealthy diets, and physical inactivity, together with an aging population, are expected to further increase the cancer burden in Sudan.[5].

B. Chemotherapy

Chemotherapy originated from observations of mustard gas–induced damage to bone marrow and lymphatic tissues, later confirmed through studies using nitrogen mustard, which demonstrated lymphoma regression. Chemotherapy works mainly by inhibiting the proliferation and division of rapidly growing cancer cells, although different drugs act through different mechanisms, including disrupting protein function, autophagy, proteasome activity, and cellular metabolism. However, chemotherapy can also damage normal tissues, causing both short- and long-term toxicity affecting organs such as the kidneys, heart, lungs, brain, gastrointestinal tract, nervous system, and reproductive organs. It may also increase the risk of secondary cancers, potentially through DNA damage and long-term genomic changes in normal tissues [6-7]. Chemotherapy suppresses the activity of rapidly dividing cells in the bone marrow, which can significantly affect hematological parameters. Due to decreased erythropoiesis and the emergence of anemia, this suppression may lower hemoglobin, red blood cell count, and packed cell volume (PCV/Hct). While lymphocyte counts and percentages may differ depending on the chemotherapy regimen and length of treatment, chemotherapy may also lower white blood cell counts, especially neutrophils, increasing susceptibility to infections. Thrombocytopenia, which raises the risk of bleeding, can be brought on by decreased platelet production. Additionally, the kind and course of anemia and bone marrow recovery might affect red blood cell indices including MCV, MCH, MCHC, and RDW-CV. Extensive bone marrow suppression during rigorous chemotherapy may impact several blood cell lineages and cause pancytopenia [8].

C. Method

This study was conducted as a descriptive Cohort study, it involved 3 different types of cancer, they were under chemotherapy regimens, they attended to Shendi Oncology center for drugs' administration and follow-up investigations. Blood collected for complete blood count before cycles of anti-cancer drugs and then after to compare changes may occur due to drug administration. Data collected through questionnaires included age, duration of the disease, type of the disease, number of cycles. Data obtained was undergoing statistical analysis with SPSS version 22.

II. RESULT

This descriptive study was conducted to evaluate the complete blood count among 61 cancer patients before and after starting chemotherapy regimens. The participants were diagnosed with breast 20/32%, ovarian 20/32% and colon 21 /34%, their age ranged from 17 to 80 years and the duration of the diagnosis also ranged from 0 to 9 years as in table 4-1. The distribution of participants according to cancer type, with colon cancer accounting for 34.4% of cases and both breast and ovarian cancers each accounting for 32.8%. CBC assessed before and after starting chemotherapy showed that there were variations in levels. Hb decreased slightly after chemotherapy, as well as PCV, but not MCV. RDW CV was increased after chemotherapy. WBC was decreased after chemotherapy, as well as platelets, as in Table 2.

Table 1: Descriptive Statistics of Age and Duration by Cancer Type

Variable	N/%	Age		Duration of Disease	
		Mean ± SD	Min–Max	Mean ± SD	Min–Max
All patients	61	49.68 ± 11.35	17–80	2.93 ± 2.86	0.0–14.0
Breast cancer	20 (32%)	52.65 ± 11.56	38–80	3.76 ± 3.92	0.0–14.0
Ovarian cancer	20 (32%)	52.15 ± 10.08	35–70	1.53 ± 0.75	1.0–3.3
Colon cancer	21 (34%)	44.25 ± 10.88	17–63	3.55 ± 2.58	1.0–9.0

Table 2: Descriptive Statistics of Hematological Parameters Before and After Chemotherapy in Cancer Patients

Variable	Before		After	
	Min–Max	Mean ± SD	Min–Max	Mean ± SD
Hb (g/dL)	7.5–14.8	11.8 ± 1.9	5.7–15.3	11.3 ± 2.2
PCV (%)	24–45	36.4 ± 5.3	24–46	34.4 ± 7.5
MCV (fL)	57–96	83.0 ± 7.1	73–100	85.3 ± 6.3
MCH (pg)	17.5–34.0	26.3 ± 2.7	17.2–35.0	27.1 ± 2.8
MCHC (g/dL)	29–37	31.7 ± 1.4	4.5–36.0	31.6 ± 3.7
RDW-CV (%)	5.5–24.4	16.4 ± 3.8	13.0–22.7	17.5 ± 2.3
WBC (×10⁹/L)	2.7–18.7	7.3 ± 3.8	0.7–21.9	6.5 ± 3.7
Neutrophils (%)	3–86	58.6 ± 17.0	7–86	54.6 ± 17.7
Lymphocytes (%)	8–65	30.2 ± 14.3	7–59	32.2 ± 14.4
Mixed cell (%)	4–35	11.2 ± 4.7	4–21	11.2 ± 3.8
Platelets (×10⁹/L)	92–712	350.3 ± 144.3	35–842	309.0 ± 167.0

Among breast cancer patients, slight variations were observed in hematological parameters before and after chemotherapy. Most parameters demonstrated minor changes following treatment, as presented in Table 3.

Among ovarian cancer patients, slight variations were observed in hematological parameters before and after chemotherapy. Red blood cell indices showed slight increases, whereas WBC count, neutrophil percentage, and platelet count showed slight decreases following treatment, as presented in Table 4.

Among colon cancer patients, slight variations were observed in hematological parameters before and after chemotherapy. A slight decrease was observed in Hb, PCV, RBC count, WBC count, neutrophil percentage, and platelet count, whereas MCV, MCH, MCHC, and lymphocyte percentage showed slight increases following treatment, as presented in Table 5.

Table 3: Descriptive Statistics of Hematological Parameters Before and After Chemotherapy in C Patients

Variable	Before		After	
	Mean ± SD	Min–Max	Mean ± SD	Min–Max
Hb (g/dL)	11.7 ± 1.8	7.5–13.8	11.1 ± 1.2	8.1–13.0
PCV (%)	36.0 ± 5.3	25–43	34.2 ± 3.7	24–39
MCV (fL)	83.4 ± 8.4	57.0–95.0	86.3 ± 6.1	75.0–99.0
MCH (pg)	26.3 ± 3.2	17.5–33.0	26.9 ± 3.1	17.2–33.0
MCHC (g/dL)	31.7 ± 1.6	30.0–37.0	30.4 ± 6.1	4.5–33.0
RDW-CV (%)	15.6 ± 3.8	5.5–22.0	16.9 ± 1.6	13.0–21.0
WBC (×10⁹/L)	8.1 ± 4.7	3.7–18.7	8.5 ± 4.7	3.3–21.9
Neutrophils (%)	61.2 ± 20.5	3–83	64.5 ± 13.9	32–86
Lymphocytes (%)	27.1 ± 14.7	8–63	24.5 ± 13.5	7–59
Mixed cell (%)	11.1 ± 6.7	5–35	10.7 ± 4.0	6–21
Platelets (×10⁹/L)	362.3 ± 111.5	178–581	389.6 ± 216.5	59–842
MPV (fL)	7.9 ± 0.8	6.7–9.1	7.7 ± 0.8	6.4–9.4
PDW (%)	15.0 ± 2.3	6.0–16.3	15.5 ± 0.5	14.8–16.6

Table 4: Descriptive Statistics of Hematological Parameters Before and After Chemotherapy in Ovarian Cancer Patients

Variable	Before		After	
	Mean ± SD	Min–Max	Mean ± SD	Min–Max
Hb (g/dL)	8.9–13.6	11.8 ± 1.3	7.1–13.6	11.8 ± 1.5
PCV (%)	28–44	36.6 ± 4.1	25–43	36.6 ± 4.1
RBCs ($\times 10^{12}$/L)	3.1–5.6	4.40 ± 0.56	2.5–5.1	4.29 ± 0.59
MCV (fL)	71–96	82.8 ± 6.4	74–93	85.8 ± 5.8
MCH (pg)	22–30	25.9 ± 2.2	22–31	27.3 ± 2.4
MCHC (g/dL)	30–34	31.5 ± 1.1	29–34	32.1 ± 1.3
RDW-CV (%)	14–18.4	15.4 ± 3.8	14–21	17.3 ± 2.5
WBC ($\times 10^{9}$/L)	2.7–15.9	7.2 ± 3.2	2.7–7.7	5.2 ± 1.4
Neutrophils (%)	24–82	57.5 ± 16.4	36–77	51.2 ± 12.5
Lymphocytes (%)	8–65	32.1 ± 16.4	16–53	37.6 ± 11.8
Mixed cell (%)	4–16	10.9 ± 3.0	7–20	11.1 ± 3.3
Platelets ($\times 10^{9}$/L)	163–712	400.5 ± 158.1	146–514	303.8 ± 109.4

Table 5: Descriptive Statistics of Hematological Parameters Before and After Chemotherapy in Colon Cancer Patients

Variable	Before		After	
	Mean ± SD	Min–Max	Mean ± SD	Min–Max
Hb (g/dL)	7.7–14.8	11.8 ± 2.4	5.7–15.3	11.1 ± 3.2
PCV (%)	24–45	36.4 ± 6.4	17–46	32.7 ± 11.6
RBCs ($\times 10^{12}$/L)	3.0–5.8	4.43 ± 0.87	2.1–5.9	4.19 ± 1.03
MCV (fL)	70–95	82.6 ± 7.0	73–100	83.8 ± 7.1
MCH (pg)	23–34	26.5 ± 2.8	21–35	27.0 ± 2.9
MCHC (g/dL)	29–36	31.8 ± 1.6	29–36	32.2 ± 1.6
RDW-CV (%)	13.2–24.4	18.3 ± 3.2	13.9–22.7	18.3 ± 2.7
WBC ($\times 10^{9}$/L)	2.8–14.1	6.5 ± 3.4	0.7–18.3	6.0 ± 3.7
Neutrophils (%)	33–86	57.5 ± 14.8	7–85	49.0 ± 21.5
Lymphocytes (%)	10–50	30.9 ± 11.8	8–59	34.0 ± 15.2
Mixed cell (%)	5–19	11.8 ± 4.4	4–21	11.8 ± 4.3
Platelets ($\times 10^{9}$/L)	92–541	289.6 ± 145.7	35–459	237.1 ± 125.9

Comparison of data before and after chemotherapy with each other showed significant differences in Hb, PCV, MCV, RDW-CV each of them has p value <0.05 and the rest of parameters compared each has p value >0.05 as in table 6.

Table 6: Comparison of Hematological Parameters Before and After Chemotherapy in All Cancer Patients

Variable	Before	After	p-value
Hb (g/dL)	11.9 ± 2.3	11.5 ± 2.5	0.064
PCV (%)	36.6 ± 5.4	35.2 ± 7.1	0.023*
MCV (fL)	83.8 ± 6.7	85.5 ± 5.9	<0.001*
MCH (pg)	26.9 ± 2.8	27.5 ± 2.8	0.010*
MCHC (g/dL)	32.0 ± 1.5	32.0 ± 3.3	0.878
RDW-CV (%)	15.6 ± 3.8	16.4 ± 3.1	0.020*
WBC (×10⁹/L)	7.0 ± 3.5	6.5 ± 3.4	0.115
Neutrophils (%)	57.2 ± 16.5	54.3 ± 16.8	0.160
Lymphocytes (%)	30.6 ± 13.5	32.2 ± 13.4	0.342
Mixed cell (%)	10.9 ± 4.5	10.9 ± 3.9	0.964
Platelets (×10⁹/L)	329.0 ± 142.0	299.3 ± 156.8	0.102
MPV (fL)	7.9 ± 0.8	7.7 ± 0.8	0.226
PDW (%)	15.0 ± 2.3	15.6 ± 0.5	0.347

Considering control data, comparing data of cancer patients before and after chemotherapy with control data showed significant differences in MCH, MCHC and RDW cv each has p value <0.05, for platelet count compared before with control also showed significant difference as p value <0.05 and the rest each of comparison has no change occurred as in table 7:
Considering age, correlation of age with CBC parameters showed positive correlations with Hb, PCV with significant differences (p value <0.05) and negative correlation with RDWcv with significant difference as well, for CBC after chemotherapy negative correlations with MCHC and RDWCV with significant differences, positive correlations with lymphocyte % with significant difference, the rest of parameters showed no significant differences with different correlations as in table 8.

Table 7: Comparison of Hematological Parameters Before and After Chemotherapy in All Cancer Patients with a Control Group

Variable	Before	After	Control	p-value (Before vs Control)	p-value (After vs Control)
Hb (g/dL)	11.8 ± 2.4	11.3 ± 2.2	12.0 ± 3.3	0.106	0.265
PCV (%)	36.4 ± 6.4	34.4 ± 7.5	37.0 ± 5.7	0.638	0.130
MCV (fL)	83.0 ± 7.1	85.3 ± 6.3	85.8 ± 4.9	0.045*	0.707
MCH (pg)	26.3 ± 2.7	27.1 ± 2.8	28.4 ± 2.4	0.001*	0.042*
MCHC (g/dL)	31.7 ± 1.4	31.6 ± 3.7	33.0 ± 1.3	<0.001*	0.012*
RDW-CV (%)	16.4 ± 3.8	17.5 ± 2.3	13.9 ± 3.1	0.004*	<0.001*
WBC (×10⁹/L)	7.3 ± 3.8	6.5 ± 3.7	6.5 ± 2.6	0.378	0.987
Neutrophils (%)	58.6 ± 17.0	54.6 ± 17.7	54.9 ± 15.6	0.361	0.942
Lymphocytes (%)	30.2 ± 14.3	32.2 ± 14.4	31.1 ± 11.5	0.780	0.715
Mixed cell (%)	11.2 ± 4.7	11.2 ± 3.8	9.9 ± 3.8	0.230	0.158
Platelets (×10⁹/L)	350.3 ± 144.3	309.0 ± 167.0	275.6 ±123.1	0.029*	0.378

Table 8: Correlation Between Age of Disease and Hematological Parameters Before and After Chemotherapy in All Cancer Patients

Variable	before r		After	
	r value (Age)	p-value	r value (Age)	p-value
Hb (g/dL)	0.352	0.006*	-0.032	0.809
PCV (%)	0.276	0.033*	0.125	0.341
MCV (fL)	0.088	0.508	0.060	0.650
MCH (pg)	0.141	0.288	-0.071	0.591
MCHC (g/dL)	0.088	0.506	-0.324	0.012*
RDW-CV (%)	-0.466	<0.001*	-0.325	0.014*
WBC (×10⁹/L)	0.041	0.759	0.015	0.910
Neutrophils (%)	0.090	0.497	-0.107	0.418
Lymphocytes (%)	-0.113	0.393	0.305	0.019*
Mixed cell (%)	-0.112	0.406	0.080	0.549
Platelets (×10⁹/L)	-0.032	0.809	0.056	0.670
MPV (fL)	0.021	0.935	0.040	0.867
PDW (%)	0.203	0.418	-0.125	0.600

An association was observed between disease duration and some hematological parameters before and after chemotherapy, with a change in the pattern of these relationships between the two phases. Overall, this suggests a variable effect of disease duration on hematological indices depending on the treatment stage, as shown in Table 9. The comparison of hematological parameters before and after chemotherapy in breast cancer patients showed no statistically significant differences in most variables. A significant change was observed only in MCV (p=0.042), while the remaining hematological indices demonstrated no significant differences between the two time points. Overall, chemotherapy was associated with a limited effect on the measured hematological parameters, as shown in Table 10. The comparison of hematological parameters in breast cancer patients before and after chemotherapy, as well as with the control group, showed no statistically significant differences in most variables between the groups. Significant differences in Hb, MCH, MCHC, RDW-CV, and platelets in at least one comparison with the control group, indicating partial hematological changes associated with the disease and/or chemotherapy. Overall, these findings suggest that breast cancer and its treatment have a variable effect on selected hematological indices compared with healthy controls, as shown in the table 11.

The results showed an association between age and some hematological parameters before and after chemotherapy in breast cancer patients, with a few statistically significant correlations while most variables were not significant. Overall, these findings suggest that the effect of age on hematological indices varies according to the chemotherapy stage, as shown in table 12.

Correlations were observed between disease duration and selected hematological parameters before and after chemotherapy in breast cancer patients, with statistically significant associations mainly observed prior to treatment and weaker or fewer relationships after chemotherapy. Overall, this suggests that disease duration exerts a more pronounced influence on hematological indices before chemotherapy, which diminishes following treatment, as presented in table 13.

The results demonstrated correlations between the number of chemotherapy cycles and hematological parameters before and after treatment in breast cancer patients, with generally weak or non-significant associations across most variables. A statistically significant negative correlation was observed only between the number of cycles and neutrophil percentage after chemotherapy. Overall, these findings suggest that the number of chemotherapy cycles has a limited influence on hematological indices, with minimal significant effects, as shown in the table 14. The comparison of hematological parameters before and after chemotherapy in ovarian cancer patients showed no significant differences in Hb, PCV, RBCs, MCHC, neutrophils, lymphocytes, and monocytes. However, significant changes were observed in MCV, MCH, RDW-CV, WBCs, and platelets, indicating chemotherapy-related alterations in both red cell indices and white blood cell parameters. Overall, these findings suggest that chemotherapy has a notable impact on selected hematological indices in ovarian cancer patients, as shown in Table 15.

Table 9: Correlation Between Duration of Disease and Hematological Parameters Before and After hemotherapy in All Cancer Patients

Variable	Before		After	
	R value (Duration)	p-value	R value (Duration)	p-value
Hb (g/dL)	-0.065	0.626	0.099	0.456
PCV (%)	-0.091	0.493	0.108	0.414
MCV (fL)	-0.312	0.017*	-0.114	0.392
MCH (pg)	-0.218	0.101	-0.025	0.849
MCHC (g/dL)	-0.002	0.989	0.030	0.820
RDW-CV (%)	0.259	0.048*	0.135	0.320
WBC (×10⁹/L)	0.135	0.313	0.330	0.011*
Neutrophils (%)	0.107	0.426	-0.279	0.034*
Lymphocytes (%)	-0.041	0.762	0.015	0.909
Mixed cell (%)	-0.005	0.970	-0.046	0.732
Platelets (×10⁹/L)	0.044	0.744	0.028	0.831
MPV (fL)	-0.047	0.857	0.064	0.793
PDW (%)	0.109	0.676	0.063	0.798

Table 10: Comparison of Hematological Parameters Before and After Chemotherapy in B C Patients

Variable	Before	After	p-value
Hb (g/dL)	11.7 ± 1.8	11.1 ± 1.2	0.222
PCV (%)	36.0 ± 5.3	34.2 ± 3.7	0.191
MCV (fL)	83.4 ± 8.4	86.7 ± 5.9	0.042*
MCH (pg)	26.3 ± 3.2	26.9 ± 3.2	0.485
MCHC (g/dL)	31.7 ± 1.6	30.3 ± 6.3	0.345
RDW-CV (%)	15.6 ± 3.8	16.9 ± 1.6	0.101
WBC (×10⁹/L)	8.2 ± 4.8	8.4 ± 4.8	0.876
Neutrophils (%)	60.0 ± 20.4	63.3 ± 13.4	0.554
Lymphocytes (%)	27.7 ± 14.9	25.4 ± 13.2	0.652
Mixed cell (%)	11.4 ± 6.8	11.0 ± 4.1	0.865
Platelets (×10⁹/L)	362.3 ± 111.5	393.2 ± 221.8	0.544
MPV (fL)	7.9 ± 0.8	7.7 ± 0.8	0.226
PDW (%)	15.0 ± 2.3	15.6 ± 0.5	0.347

Table 11: Comparison of Hematological Parameters Before and After Chemotherapy in Breast Cancer Patients with a Control Group

Variable	Before	After	Control	p-value (Before vs Control)	p-value (After vs Control)
Hb (g/dL)	11.7 ± 1.8	11.1 ± 1.2	12.6 ± 2.2	0.106	0.026*
PCV (%)	36.0 ± 5.3	34.2 ± 3.7	37.4 ± 6.2	0.443	0.095
MCV (fL)	83.4 ± 8.4	86.3 ± 6.1	85.8 ± 5.4	0.286	0.873
MCH (pg)	26.3 ± 3.2	26.9 ± 3.1	28.4 ± 2.6	0.048*	0.073
MCHC (g/dL)	31.7 ± 1.6	30.4 ± 6.1	33.0 ± 1.3	0.009*	0.066
RDW-CV (%)	15.6 ± 3.8	16.9 ± 1.6	14.2 ± 3.4	0.332	0.007*
WBC (×10⁹/L)	8.1 ± 4.7	8.5 ± 4.7	6.6 ± 2.1	0.254	0.160
Neutrophils (%)	61.2 ± 20.5	64.5 ± 13.9	54.6 ± 15.5	0.279	0.065
Lymphocytes (%)	27.1 ± 14.7	24.5 ± 13.5	30.7 ± 11.1	0.415	0.096
Mixed cell (%)	11.2 ± 6.9	10.6 ± 4.1	9.8 ± 2.5	0.491	0.749
Platelets (×10⁹/L)	362.3 ± 111.5	389.6 ± 216.5	274.4 ± 113.4	0.025*	0.045*

Table 12: Correlation Between Age and Hematological Parameters Before and After Chemotherapy in Breast Cancer Patients

Variable	Before		After	
	r value (Age)	p-value	r value (Age)	p-value
Hb (g/dL)	0.501	0.025*	-0.033	0.890
PCV (%)	0.353	0.126	0.001	0.996
MCV (fL)	0.109	0.657	-0.054	0.820
MCH (pg)	0.164	0.502	-0.422	0.064
MCHC (g/dL)	0.098	0.690	-0.555	0.011*
RDW-CV (%)	-0.603	0.005 *	-0.031	0.898
WBC (×10⁹/L)	0.129	0.598	0.359	0.131
Neutrophils (%)	0.070	0.776	-0.418	0.075
Lymphocytes (%)	-0.145	0.553	0.445	0.056
Mixed cell (%)	-0.213	0.411	-0.131	0.594
Platelets (×10⁹/L)	-0.265	0.273	-0.088	0.711
MPV (fL)	0.021	0.935	0.040	0.867
PDW (%)	0.203	0.418	-0.125	0.600

Table 13: Correlation Between Duration of Disease and Hematological Parameters Before and After Chemotherapy in Breast Cancer Patients

Variable	Before		Aft er	
	r value (Duration)	p-value	r value (Duration)	p-value
Hb (g/dL)	-0.392	0.097	-0.025	0.918
PCV (%)	-0.361	0.129	0.042	0.863
MCV (fL)	-0.606	0.008 *	-0.237	0.329
MCH (pg)	-0.489	0.039*	-0.120	0.624
MCHC (g/dL)	-0.139	0.582	0.065	0.790
RDW-CV (%)	0.241	0.320	0.397	0.093
WBC (×10⁹/L)	0.273	0.273	0.332	0.178
Neutrophils (%)	0.272	0.274	-0.303	0.221
Lymphocytes (%)	-0.115	0.649	0.298	0.229
Mixed cell (%)	-0.088	0.746	-0.045	0.859
Platelets (×10⁹/L)	0.399	0.101	0.074	0.763
MPV (fL)	-0.047	0.857	0.064	0.793
PDW (%)	0.109	0.676	0.063	0.798

Table 14: Correlation Between Number of Cycle of Disease and Hematological Parameters Before and After Chemotherapy in Breast Cancer Patients

Variable	Before		After	
	r value (No. of Cycles)	p-value	r value (No. of Cycles)	p-value
Hb (g/dL)	0.063	0.791	0.323	0.164
PCV (%)	0.124	0.603	0.363	0.116
MCV (fL)	-0.046	0.853	-0.109	0.648
MCH (pg)	-0.148	0.545	-0.056	0.815
MCHC (g/dL)	-0.180	0.460	0.013	0.955
RDW-CV (%)	-0.055	0.816	0.207	0.381
WBC (×10⁹/L)	0.282	0.242	0.002	0.995
Neutrophils (%)	0.041	0.867	-0.475	0.040*
Lymphocytes (%)	-0.118	0.630	0.410	0.081
Mixed cell (%)	-0.183	0.482	0.150	0.540
Platelets (×10⁹/L)	0.035	0.885	0.261	0.267
MPV (fL)	0.259	0.299	0.334	0.150
PDW (%)	-0.033	0.896	0.088	0.712

Table 15: Comparison of Hematological Parameters Before and After in Ovarian Cancer Patients

Variable	Before	After	p-value
Hb (g/dL)	11.8 ± 1.3	11.8 ± 1.5	0.951
PCV (%)	36.6 ± 4.1	36.6 ± 4.1	1.000
RBCs ($\times 10^{12}$/L)	4.40 ± 0.56	4.29 ± 0.59	0.437
MCV (fL)	82.8 ± 6.4	85.8 ± 5.8	0.003 *
MCH (pg)	25.9 ± 2.2	27.3 ± 2.4	0.002 *
MCHC (g/dL)	31.5 ± 1.1	32.1 ± 1.3	0.108
RDW-CV (%)	15.3 ± 3.9	17.3 ± 2.5	0.034*
WBC ($\times 10^{9}$/L)	7.2 ± 3.2	5.2 ± 1.4	0.008 *
Neutrophils (%)	57.5 ± 16.4	51.2 ± 12.5	0.162
Lymphocytes (%)	32.1 ± 16.4	37.6 ± 11.8	0.194
Mixed cell (%)	10.9 ± 3.0	11.1 ± 3.3	0.790
Platelets ($\times 10^{9}$/L)	400.5 ± 158.1	303.8 ± 109.4	0.041*

The comparison of hematological parameters in ovarian cancer patients before and after chemotherapy, as well as with the control group, showed no statistically significant differences in most variables across the groups. Significant differences were observed mainly in MCH, RDWCV, and platelets in comparison with the control group, indicating partial hematological alterations associated with the disease and/or chemotherapy. Overall, these findings suggest that ovarian cancer and its treatment have a selective impact on certain hematological indices compared with healthy controls, as shown in Table 16.

The results showed correlations between age and hematological parameters before and after chemotherapy in ovarian cancer patients, with a few statistically significant associations observed, particularly before treatment and in selected parameters after chemotherapy. Overall, these findings indicate that the relationship between age and hematological indices varies depending on the treatment stage, as shown in Table 17.

Associations were observed between disease duration and hematological parameters before and after chemotherapy in ovarian cancer patients, with statistically significant relationships mainly identified before treatment and in selected parameters after chemotherapy. Overall, these findings suggest that disease duration exerts a variable influence on hematological indices depending on the treatment stage, as shown in Table 18.

The comparison of hematological parameters before and after chemotherapy in colon cancer patients showed statistically significant reductions in PCV and RBCs, while the remaining hematological indices did not demonstrate significant differences between the two time points. Overall, these findings suggest that chemotherapy has a limited but notable impact on selected red blood cell parameters in colon cancer patients, as shown in the table 19.

Table 16: Comparison of Hematological Parameters Before and After Chemotherapy in Ovarian Cancer Patients with a Control Group

Variable	Before	After	Control	p-value (Before vs Control)	p-value (After vs Control)
Hb (g/dL)	11.8 ± 1.3	11.8 ± 1.5	12.6 ± 2.2	0.132	0.190
PCV (%)	36.6 ± 4.1	36.6 ± 4.1	37.4 ± 6.2	0.606	0.615
RBCs ($\times 10^{12}$/L)	4.40 ± 0.56	4.29 ± 0.59	4.39 ± 0.80	0.965	0.589
MCV (fL)	82.8 ± 6.4	85.8 ± 5.8	86.0 ± 5.2	0.127	0.934
MCH (pg)	25.9 ± 2.2	27.3 ± 2.4	28.4 ± 2.5	0.002 **	0.189
MCHC (g/dL)	31.5 ± 1.1	32.1 ± 1.3	33.0 ± 1.3	0.001 **	0.053
RDW-CV (%)	15.4 ± 3.8	17.3 ± 2.5	14.2 ± 3.4	0.278	0.007 **
WBC ($\times 10^{9}$/L)	7.2 ± 3.2	5.2 ± 1.4	6.6 ± 2.1	0.455	0.052
Neutrophils (%)	57.5 ± 16.4	51.2 ± 12.5	54.1 ± 15.3	0.387	0.609
Lymphocytes (%)	32.1 ± 16.4	37.6 ± 11.8	31.1 ± 11.0	0.823	0.100
Mixed cell (%)	10.8 ± 3.1	11.1 ± 3.4	10.1 ± 2.9	0.504	0.290
Platelets ($\times 10^{9}$/L)	400.5 ± 158.1	303.8 ± 109.4	273.6 ± 110.5	0.013*	0.392

Table 17: Correlation Between Age and Hematological Parameters Before and After Chemotherapy in Ovarian Cancer Patients

Variable	Before		After	
	r value (Age)	p-value	r value (Age)	p-value
Hb (g/dL)	0.463	0.040*	0.159	0.504
PCV (%)	0.255	0.279	0.153	0.519
RBCs ($\times 10^{12}$/L)	0.134	0.572	0.061	0.799
MCV (fL)	0.195	0.410	0.083	0.728
MCH (pg)	0.270	0.250	0.132	0.580
MCHC (g/dL)	0.181	0.446	-0.156	0.512
RDW-CV (%)	-0.309	0.185	-0.290	0.229
WBC ($\times 10^{9}$/L)	-0.092	0.700	-0.357	0.122
Neutrophils (%)	0.207	0.382	-0.486	0.030*
Lymphocytes (%)	-0.238	0.313	0.379	0.099
Mixed cell (%)	0.189	0.424	0.532	0.016*
Platelets ($\times 10^{9}$/L)	-0.067	0.779	0.009	0.969

Table 18: Correlation Between Duration of Disease and Hematological Parameters Before and After Chemotherapy in Ovarian Cancer Patients

Variable	Before		After	
	r value (Duration)	p-value	r value (Duration)	p-value
Hb (g/dL)	0.180	0.447	0.462	0.040*
PCV (%)	0.314	0.177	0.469	0.037*
RBCs ($\times 10^{12}$/L)	0.241	0.306	0.404	0.078
MCV (fL)	0.125	0.599	0.063	0.792
MCH (pg)	0.112	0.639	0.021	0.929
MCHC (g/dL)	-0.084	0.725	-0.149	0.530
RDW-CV (%)	0.277	0.237	-0.041	0.868
WBC ($\times 10^{9}$/L)	-0.609	0.004 *	-0.198	0.404
Neutrophils (%)	-0.334	0.151	-0.094	0.694
Lymphocytes (%)	0.272	0.247	0.003	0.989
Mixed cell (%)	0.235	0.318	0.327	0.159
Platelets ($\times 10^{9}$/L)	-0.338	0.145	-0.098	0.680

Table 19: Comparison of Hematological Parameters Before and After in Colon Cancer Patients

Variable	Before	After	p-value
Hb (g/dL)	11.8 ± 2.4	11.0 ± 3.2	0.148
PCV (%)	36.4 ± 6.4	32.2 ± 11.7	0.042*
RBCs ($\times 10^{12}$/L)	4.43 ± 0.87	4.16 ± 1.05	0.040*
MCV (fL)	82.6 ± 7.0	83.7 ± 7.2	0.181
MCH (pg)	26.5 ± 2.8	27.1 ± 3.0	0.110
MCHC (g/dL)	31.8 ± 1.6	32.4 ± 1.6	0.061
RDW-CV (%)	18.3 ± 3.0	18.3 ± 2.7	0.932
WBC ($\times 10^{9}$/L)	6.5 ± 3.4	6.1 ± 3.7	0.605
Neutrophils (%)	57.5 ± 14.8	49.2 ± 22.0	0.130
Lymphocytes (%)	30.9 ± 11.8	33.7 ± 15.5	0.327
Mixed cell (%)	11.8 ± 4.4	11.5 ± 4.2	0.767
Platelets ($\times 10^{9}$/L)	289.6 ± 145.7	239.4 ± 128.7	0.159

The comparison of hematological parameters in colon cancer patients before and after chemotherapy, as well as with the control group, showed no statistically significant differences in most variables across the groups. Significant differences were observed in MCH, MCHC, and RDW-CV in at least one comparison with the control group, indicating hematological alterations associated with the disease and/or chemotherapy. Overall, these findings suggest a selective impact of colon cancer and its treatment on certain red cell indices compared with healthy controls, as shown in Table 20.

Associations between age and hematological parameters before and after chemotherapy in colon cancer patients showed generally weak and non-significant correlations across most variables. A borderline negative relationship was observed for RDW-CV and WBC after chemotherapy, although it did not reach statistical significance. Overall, these findings suggest that age has a limited influence on hematological indices in colon cancer patients regardless of treatment stage, as shown in Table 21.

Associations between disease duration and hematological parameters before and after chemotherapy in colon cancer patients revealed generally weak correlations across most variables. A statistically significant negative correlation was observed between disease duration and neutrophil percentage after chemotherapy, while the remaining parameters showed no significant associations. Overall, these findings indicate that disease duration has a limited and selective influence on hematological indices in colon cancer patients, particularly after treatment, as shown in Table 22.

Table 20: Comparison of Hematological Parameters Before and After Chemotherapy in Colon Cancer Patients with a Control Group

Variable	Before	After	Control	p-value (Before vs Control)	p-value (After vs Control)
Hb (g/dL)	11.8 ± 2.4	11.1 ± 3.2	12.6 ± 2.2	0.277	0.104
PCV (%)	36.4 ± 6.4	32.7 ± 11.6	37.4 ± 6.2	0.635	0.127
RBCs ($\times 10^{12}$/L)	4.43 ± 0.87	4.19 ± 1.03	4.39 ± 0.80	0.898	0.543
MCV (fL)	82.6 ± 7.0	83.8 ± 7.1	86.0 ± 5.2	0.085	0.264
MCH (pg)	26.5 ± 2.8	27.0 ± 2.9	28.4 ± 2.5	0.029*	0.118
MCHC (g/dL)	31.8 ± 1.6	32.2 ± 1.6	33.0 ± 1.3	0.034*	0.143
RDW-CV (%)	18.3 ± 3.2	18.3 ± 2.7	14.2 ± 3.4	0.001*	<0.001 *
WBC ($\times 10^{9}$/L)	6.5 ± 3.4	6.0 ± 3.7	6.6 ± 2.1	0.923	0.513
Neutrophils (%)	57.5 ± 14.8	49.0 ± 21.5	54.1 ± 15.3	0.386	0.237
Lymphocytes (%)	30.9 ± 11.8	34.0 ± 15.2	31.1 ± 11.0	0.938	0.347
Mixed cell (%)	11.7 ± 4.5	11.8 ± 4.4	10.1 ± 2.9	0.125	0.160
Platelets ($\times 10^{9}$/L)	289.6 ± 145.7	237.1 ± 125.9	273.6 ±110.5	0.693	0.267

Table 21: Correlation Between Age and Hematological Parameters Before and After Chemotherapy in Colon Cancer Patients

Variable	Before		After	
	r value (Age)	p-value	r value (Age)	p-value
Hb (g/dL)	0.279	0.233	0.114	0.632
PCV (%)	0.286	0.222	0.076	0.751
RBCs ($\times 10^{12}$/L)	0.238	0.312	0.179	0.449
MCV (fL)	-0.047	0.844	-0.017	0.943
MCH (pg)	0.118	0.622	0.154	0.518
MCHC (g/dL)	0.108	0.650	0.304	0.193
RDW-CV (%)	-0.233	0.322	-0.437	0.070
WBC ($\times 10^{9}$/L)	-0.130	0.584	-0.382	0.096
Neutrophils (%)	-0.040	0.866	0.049	0.837
Lymphocytes (%)	0.100	0.673	0.334	0.150
Mixed cell (%)	-0.138	0.562	0.044	0.854
Platelets ($\times 10^{9}$/L)	-0.159	0.503	-0.067	0.779

Table 22: Correlation Between Duration of Disease and Hematological Parameters Before and After Chemotherapy in Colon Cancer Patients

Variable	Before		After	
	r value (Duration)	p-value	r value (Duration)	p-value
Hb (g/dL)	0.245	0.297	0.300	0.199
PCV (%)	0.164	0.489	0.330	0.155
RBCs ($\times 10^{12}$/L)	0.313	0.179	0.327	0.159
MCV (fL)	-0.135	0.569	-0.057	0.812
MCH (pg)	-0.083	0.728	0.138	0.562
MCHC (g/dL)	0.078	0.742	0.223	0.344
RDW-CV (%)	0.301	0.198	0.044	0.861
WBC ($\times 10^9$/L)	0.100	0.674	0.230	0.330
Neutrophils (%)	-0.093	0.695	-0.602	0.005 *
Lymphocytes (%)	0.094	0.693	-0.011	0.964
Mixed cell (%)	0.020	0.935	-0.166	0.483
Platelets ($\times 10^9$/L)	0.094	0.693	-0.108	0.649

III. DISCUSSION

Overall, in all cancer patients, significant reductions were observed in packed cell volume (PCV), while mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and red cell distribution width-coefficient of variation (RDW-CV) showed significant increases after chemotherapy. Hemoglobin (Hb) and white blood cell (WBC) counts, along with platelet counts, showed slight decreases, though not always statistically significant when considering all cancer types together. These findings are consistent with previous research indicating that chemotherapy commonly induces myelosuppression, leading to a decrease in various blood cell lineages.[9-10]

Specifically, the decrease in Hb and PCV observed in our study aligns with the common occurrence of chemotherapy-induced anemia. Aynalem et al. reported an increase in anemia prevalence from 21.7% before treatment to 26.4% after treatment in breast cancer patients, emphasizing the significant impact of cancer treatment on red blood cell parameters[9].

Similarly, Ahmed et al. found significant reductions in RBC levels (mean pre-chemotherapy: 3.8 ± 1.1 g/d; mean post-chemotherapy: 2.1 ± 1.1 g/dL; $p<0.001$) in breast cancer patients, further supporting our observations of decreased Hb and PCV[11].

The observed increase in MCV and MCH after chemotherapy in our study suggests a shift towards macrocytic red blood cells, which can be an indicator of bone marrow stress or certain types of anemia. This is a notable finding that warrants further investigation into the underlying mechanisms. The significant increase in RDW-CV post-chemotherapy across all cancer types in our study indicates increased heterogeneity in red blood cell size, a common feature in various anemias and myelodysplastic syndromes, often exacerbated by chemotherapy [9]

Regarding white blood cells, our study showed a decrease in overall WBC count after chemotherapy, although this was not statistically significant when considering all cancer types together ($p=0.115$). However, a significant decrease in WBC count was observed specifically in ovarian cancer patients (7.2 ± 3.2 to 5.2 ± 1.4; $p=0.008$*). This is in line with the well-documented myelosuppressive effect of chemotherapy, leading to leukopenia[15,16,18]. Ahmed et al. reported a significant reduction in WBC counts (mean pre-chemotherapy: 13.9 ± 1.9 x 10^3/µL; mean postchemotherapy: 4.1 ± 1.9 x 10^3/µL; $p<0.001$) in breast cancer patients, which is a more pronounced decrease than observed in our overall cohort but consistent with the general trend[18]. Hu-Heimgartner et al. highlighted that gBRCA1 carriers were at a higher risk of developing severe neutropenia (32% vs. 14.5%, $p=0.007$) and requiring G-CSF for secondary prophylaxis, suggesting that genetic factors can influence the severity of chemotherapy-induced hematologic toxicities[12].

Platelet counts also decreased after chemotherapy in our study, with a significant decrease observed in ovarian cancer patients (400.5 ± 158.1 to 303.8 ± 109.4; p=0.041*). Ahmed et al. also found a significant decrease in platelet counts (mean pre-chemotherapy: 661.8 ± 128.5 x 10^3/μL; mean post-chemotherapy: 182.4 ± 125.5 x 10^3/μL; p<0.01) in breast cancer patients. These findings underscore the risk of chemotherapy-induced thrombocytopenia, which can lead to bleeding complications[11].

In breast cancer patients, our study found a significant increase in MCV (p=0.042) after chemotherapy, while other parameters showed non-significant changes. When compared to a control group, significant differences were noted in Hb (after vs. control, p=0.026*), MCH (before vs. control, p=0.048*), MCHC (before vs. control, p=0.009*), RDW-CV (after vs. control, p=0.007*), and platelets (before vs. control, p=0.025*; after vs. control, p=0.045*). These results suggest that while chemotherapy may not induce drastic changes in all hematological parameters in breast cancer patients, there are still notable alterations compared to healthy individuals, particularly in red blood cell indices and platelet counts. Aynalem et al. specifically focused on breast cancer patients and reported significant reductions in red blood cell, white blood cell, and lymphocyte counts, as well as hematocrit and hemoglobin values after treatment, which is a more widespread impact than observed in our breast cancer subgroup. This difference might be attributed to variations in chemotherapy regimens, patient populations, or study methodologies[12].

Ovarian Cancer Patients: Our study revealed significant changes in MCV (p=0.003*), MCH (p=0.002*), RDW-CV (p=0.034*), WBCs (p=0.008*), and platelets (p=0.041*) in ovarian cancer patients after chemotherapy. These findings indicate a more pronounced hematological toxicity in ovarian cancer patients compared to breast cancer patients in our cohort. Hu-Heimgartner et al. also investigated hematologic toxicities in ovarian cancer patients, particularly those with BRCA1/BRCA2 germline pathogenic variants. Their study suggested an increased acute hematologic toxicity upon exposure to chemotherapy among gBRCA1 carriers, but not gBRCA2 carriers, highlighting the role of genetic predisposition in chemotherapy-induced myelosuppression. This suggests that the severity of hematological changes in ovarian cancer patients might be influenced by genetic factors, which was not assessed in our study[12].

In colon cancer patients, our study observed a slight decrease in Hb, PCV, RBC count, WBC count, neutrophil percentage, and platelet count, while MCV, MCH, MCHC, and lymphocyte percentage showed slight increases after chemotherapy. While no specific reference among the provided ones directly addresses colon cancer, the general trend of myelosuppression (decreased Hb, PCV, RBC, WBC, platelets) is consistent with the known side effects of chemotherapy across various cancer types. The increases in MCV, MCH, MCHC, and lymphocyte percentage could indicate specific adaptive responses or different toxicity profiles of the chemotherapy regimens used for colon cancer[10].

Jameus et al. provided a comprehensive review comparing hematological changes following low dose radiation therapy (LD-RT) to standard-of-care treatments, including chemotherapy and high dose radiation therapy (HD-RT). Their review concluded that while HD-RT and chemotherapy can result in widespread changes in blood counts, with the most severe effects related to leukopenia, LD-RT generally leads to similar, yet more mild hematological changes. This suggests that the hematological toxicities observed in our study, particularly the decreases in WBC and platelets, are more aligned with the effects of chemotherapy as a standard-of-care treatment, which typically involves higher doses and systemic exposure compared to LD-RT. The study by Jameus et al. emphasizes that hematological toxicities should not be a limiting factor for LD-RT, implying that chemotherapy often presents a more significant challenge in managing these adverse effects[10].

Our study also explored the correlation between age, disease duration, and the number of chemotherapy cycles with hematological parameters. We found positive correlations between age and Hb and PCV before chemotherapy, and a negative correlation with RDW-CV. After chemotherapy, age showed negative correlations with MCHC and RDW-CV, and a positive correlation with lymphocyte percentage. These findings suggest that age can influence baseline hematological parameters and their response to chemotherapy. Similarly, disease duration showed a negative correlation with MCV and a positive correlation with RDW-CV before chemotherapy, and a positive correlation with WBC and a negative correlation with neutrophils after chemotherapy. The number of chemotherapy cycles showed a significant negative correlation with neutrophil percentage after chemotherapy in breast cancer patients. These correlations highlight the complex interplay between patient-specific factors, disease progression, and treatment intensity in shaping hematological outcomes [10].

IV. CONCLUSION

This study evaluated complete blood count (CBC) parameters in 61 cancer patients (20 breast, 20 ovarian, and 21 colon cancer) before and after chemotherapy. The participants had a mean age of 49.7 ± 11.4 years, with disease duration ranging from 0 to 14 years. Colon cancer accounted for 34.4% of cases, while breast and ovarian cancers each represented 32.8%.

The chemotherapy resulted in decreased hemoglobin (Hb), packed cell volume (PCV), white blood cell (WBC) count, neutrophil count, and platelet count, whereas mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and red cell distribution width (RDW-CV) increased. Statistically significant changes after chemotherapy were observed in PCV ($p=0.023$), MCV ($p<0.001$), MCH ($p=0.010$), and RDW-CV ($p=0.020$), while changes in Hb, WBC, neutrophils, lymphocytes, and platelets were not significant.

Comparison with healthy controls showed significant differences in MCV, MCH, MCHC, RDWCV, and platelet count, indicating that cancer and chemotherapy mainly affected red blood cell indices.

Among breast cancer patients, chemotherapy produced minimal hematological changes, with MCV being the only parameter that changed significantly. Comparisons with controls demonstrated significant differences in Hb, MCH, MCHC, RDW-CV, and platelet count, while correlations with age, disease duration, and chemotherapy cycles were generally weak, except for significant associations involving MCV, MCH, RDW-CV, MCHC, and post-treatment neutrophil percentage.

In ovarian cancer patients, chemotherapy significantly increased MCV, MCH, and RDW-CV, while significantly decreasing WBC and platelet counts. Significant differences compared with controls were mainly observed for MCH, MCHC, RDW-CV, and platelets. Age and disease duration showed selective correlations with hematological indices, particularly involving Hb, neutrophils, mixed cells, WBC, PCV, and Hb after treatment.

Among colon cancer patients, chemotherapy significantly reduced PCV and RBC count, whereas other CBC parameters showed no significant changes. Compared with controls, significant differences were observed in MCH, MCHC, and RDW-CV, but age had little influence on CBC parameters. Disease duration showed only one significant association, a negative correlation with neutrophil percentage after chemotherapy.

All findings indicate that chemotherapy produces selective hematological alterations, primarily affecting red blood cell indices (PCV, MCV, MCH, RDW-CV) and, to a lesser extent, WBC and platelet counts. The magnitude of these changes varied according to cancer type, with ovarian cancer patients showing the most pronounced hematological effects, while breast and colon cancer patients experienced relatively limited changes.

V. RECOMMENDATION

1) Routine complete blood count (CBC) monitoring should be performed before and after each chemotherapy cycle to detect hematological changes early.

2) Further studies with larger sample sizes and longer follow-up periods are recommended to better evaluate the long-term effects of chemotherapy on hematological parameters.

3) Healthcare institutions should establish standardized protocols for monitoring complete blood count in cancer patients receiving chemotherapy.

REFERENCES

[1] Anna Maria Lewandowska, , Marcin Rudzki, Sławomir Rudzki,Tomasz Lewandowski, Barbara Laskowska. Environmental risk factors for cancer – review paper. Ann Agric Environ Med. 2019;26(1):1-7.

[2] Tatiana N Toporcov, Victor Wünsch Filho. Epidemiological science and cancer control. Clinics: Volume 73, Supplement 1, 2018, e627s.

[3] Rosario Castro-Oropeza, Antonieta Chávez-González, Alejandra Mantilla-Morales, Martha E. Ruiz-Tachiquín, Hector Mayani & Patricia Piña-Sánchez. Is cancer the result of uncontrolled cellular growth? a glance into the tumorigenic process. Cancer Cell International. Volume 26, article number 196 (2026)

[4] Emaduldeen H. A, Dhifaf J. Shamran, Dhuha J. Mahdi, Mohammed Muayad T.A. Risk factors of cancer: a review . Science Archives (2022), volume 3 (4), 284-288.

[5] Amany Elamin, Muntaser E Ibrahim, DafallaAbuidris, Kamal Eldin H Mohamed, Sulma Ibrahim Mohammed. Part I: cancer in Sudan—burden, distribution, and trends breast, gynecological, and prostate cancers. Cancer Med. 2015 Jan 30;4(3):447–456.

[6] UttpalAnand a, AbhijitDey et al. Cancer chemotherapy and beyond: Current status, drug candidates, associated risks and progress in targeted therapeutics. Genes Dis. 2022 Mar 18;10(4):1367–1401.

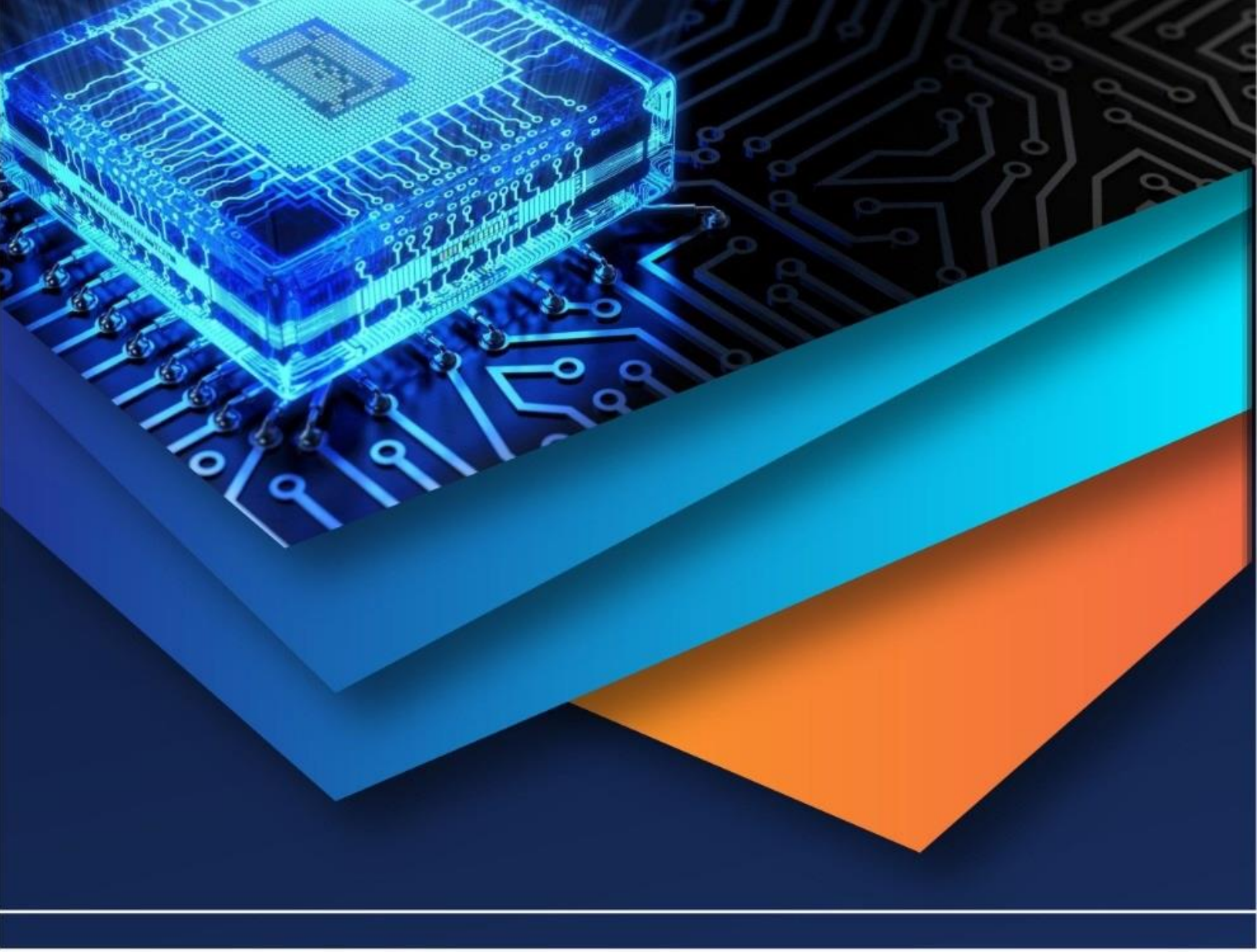
[7] Emily Mitchell, My H. Pham, Anna Clay, RasheshSanghvi, Nicholas Williams, Sandra Pietsch, Joanne I. Hsu, Nina FriesgaardØbro, Hyunchul Jung, Aditi Vedi, Sarah Moody, Jingwei Wang, Daniel Leonganmornlert, Michael Spencer Chapman, Ellie Dunstone, Anna Santarsieri, Alex Cagan, Heather E. Machado, E. Joanna Baxter, George Follows, Daniel J. Hodson, Ultan McDermott, Gary J. Doherty, Inigo Martincorena. The long-term effects of chemotherapy on normal blood cells. Nature Genetics volume 57, pages1684–1694 (2025).

[8] Sandra Kurtin. Myeloid Toxicity of Cancer Treatment. J Adv Pract Oncol. 2012 Jul 1;3(4):209–224.

[9] Aynalem M, Adem N, Wendesson F, Misganaw B, Mintesnot S, Godo N, et al. Hematological abnormalities before and after initiation of cancer treatment among breast cancer patients attending at the University of Gondar comprehensive specialized hospital cancer treatment center. PLoS One. 2022 Aug 8;17(8):e0271895.

[10] Hu-Heimgartner K, Lang N, Ayme A, Ming C, Combes J-D, Chappuis VN, et al. Hematologic toxicities of chemotherapy in breast and ovarian cancer patients carrying BRCA1/BRCA2 germline pathogenic variants. A single center experience and review of the literature. Familial Cancer. 2023;22(3):283–9.

[11] Jameus A, Kennedy AE, Thome C. Hematological Changes Following Low Dose Radiation Therapy and Comparison to Current Standard of Care Cancer Treatments. Dose Response. 2021 Nov 15;19(4):15593258211056196.
[12] Ahmed HAF, Ahmed SHM, Mohamed SDA, Alamain SHA, Alhaj bakheet SAO, Aldeen ZKDS, et al. Evaluation of Hematological Parameters Pre and Post Chemotherapy in Breast Cancer Patients at the National Cancer Institute in Sudan at Khartoum state, Sudan. J Cancer Tumor Int. 2025 Feb 3;15(1):74–80.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY