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Evaluation of Variations in the Various Blood Indices in COVID-19 Recovered Patients

T. Srinivasa Surya Sitaram [a≡], Palati Sinduja [a*ω], R. Priyadharshini [aω] and V. Meghashree [aω]

[a] Department of Pathology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-77, Tamil nadu, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Introduction: In December 2019, cases of pneumonia with an unknown cause were reported in Wuhan, Hubei Province, China. Novel coronavirus infectious disease (COVID-19) has been spreading worldwide and tracking laboratory indexes during the diagnosis and treatment of patients with severe COVID-19 can provide a reference for patients in other countries and regions. The disease is caused by the Severe Acute Respiratory Syndrome Coronavirus according to studies, and the World Health Organization just dubbed it coronavirus disease 2019.
Aim: The aim of this analysis was to evaluate COVID-19 patients' blood parameters changes in comparison with healthy controlled patients.
Methods: Blood samples were taken from 10 patients in which 5 are COVID-19 recovered patients and 5 are healthy controls. For these blood samples TBC (Total Blood Count) was taken and the readings of RBC, hemoglobin, WBC, lymphocyte, granulocyte and platelets count was recorded. Independent t-test was done to obtain the results. SPSS software Version 23 was used to give the output comparison as error bar charts.

[≡] *Undergraduate;*
[ω] *Assistant Professor;*
**Corresponding author: E-mail: sindujap.sdc@saveetha.com;*

Results: The patients have increased RBC count, increased hemoglobin and reduced WBC count with reduced lymphocytes and Granulocytes counts. Here it can be concluded that COVID-19 recovered patients should take care of themselves by having proper care, doctor consultation and follow up.

Conclusion: From this study it can be understood that COVID-19 recovered patients have increased RBC count and hemoglobin percentage. The recovered patients have reduced WBC, lymphocytes and Granulocytes percentage.

Keywords: COVID-19 recovered patients; RBC; Hemoglobin; WBC; lymphocyte; granulocyte; platelets; innovative technique.

1. INTRODUCTION

In December 2019, cases of pneumonia with an unknown cause were reported in Wuhan, Hubei Province, China [1,2]. The disease is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The World Health Organization (WHO) just dubbed it coronavirus disease 2019 (COVID-19). This novel coronavirus is very infectious and has a long incubation time [3]. In the early stages of COVID-19infection, patients may have symptoms such as fever, dry cough, and exhaustion, but eventually develop acute respiratory distress syndrome (ARDS), respiratory failure, shock, and multiple organ failure, all of which can be fatal [4,5]. The epidemic situation in China has been handled to some extent by a number of preventative control and medical treatment efforts, but cases of illness and mortality outside China have surpassed those in China and are on the rise [3,6]. As a result, COVID-19 is a serious worldwide health concern with a high rate of morbidity and mortality.

Lymphocytes are the primary immune cells responsible for viral elimination. The proportion of lymphocytes in peripheral blood normally increases during traditional viral infections. In severe pandemic H1N1 influenza A and Severe acute respiratory syndrome (SARS), however, peripheral lymphocytopenia was discovered. T cells are important players in adaptive immunity against influenza a virus infection and can help to lessen the severity of symptoms. In patients with influenza A/H1N1 in the acute phase, the total number of lymphocytes, CD3+ T-cells, CD4+ T-cells, and CD8+ T-cells all fell dramatically, according to a study [3,6,7]. The National Health Commission of China's seventh edition of the COVID-19 diagnosis and Treatment Scheme said that a steady reduction in peripheral blood lymphocyte count and a persistent decline in CD4+ T-cells and CD8+ T-cells were signs of a deterioration in the patient's condition [3,6–8].

Although several clinical investigations have identified peripheral lymphocytopenia in COVID-19 patients in laboratory testing, dynamic changes in peripheral blood lymphocyte subsets in COVID-19 patients have been described infrequently. Several biomarkers have been proposed to predict severity and outcomes [4]. However, the predictive role of each markers measurement at presentation, including D-dimer, has not been consistent [9]. Recent studies showed SARS-CoV-2 alters platelet gene expression and activity resulting in platelet hyperreactivity, raising the question of the role of thrombopoiesis in COVID-19 [9]. Routine complete blood analysis is an inexpensive, widely available and valuable tool which can be used for assessment of the systemic inflammatory response related COVID-19 infection and may help to discriminate between patients with or without severe disease. Mostly RBC will increase as a protective action against the infection and inflammation [8], [10]. Post COVID-19 usually the test shows the rise of RBC because the oxygen levels will be reduced in the body. The white blood cells (WBC) count of patients with confirmed COVID-19 cases decrease and a definite clinical outcome (death or discharge) may be predicted. The aim of this analysis was to figure out how COVID-19 patients' blood parameters changed and comparison with healthy control individuals.

2. MATERIALS AND METHODS

The present cross sectional study was conducted in Saveetha Dental College & Hospitals in AUGUST 2021 and involved normal healthy individuals and patients affected with COVID-19 and recovered three months ago.

2.1 Patients Selection and Recruitment

The samples were recruited from the COVID-19 recovered patients, who has visited the college for other dental treatment. Clinical history was taken from COVID-19 recovered patients. It was also ensured that patients with systemic comorbidities or terminally ill patients were not included for the study. All the patients included in the study belonged to the same ethnic group of Tamil Nadu. Informed consent was obtained from the patients for inclusion in the study and it was also ensured that the patient's anonymity was maintained. All the patients completed a questionnaire covering medical, residential, and occupational history.

2.2 Variables

Dependent variables was the Hb, RBC, WBC, Lymphocytes, and Platelets whereas independent variable was age and sex of the patient.

2.3 Statistical Analysis

The study method used is random controlled sampling. The inclusion criteria is sampling's are COVID-19 recovered and health controls individuals. The exclusion criteria are patients who recovered from COVID-19 more than 3 months and patients with systemic disorders. The dependent variables are age which is 18-20 years and post COVID-19. Independent variables are gender. The mean values of each parameter were tabulated along with the significant values and plotted in the form of bar graphs using SPSS. Independent t-test analysis was used to compare the results that were obtained.

3. RESULTS

The samples were collected from 10 patients in which 5 were COVID-19 recovered patients and other 5 were healthy controls. The age of the patients is in the range of 18-20 years old. The patient's blood was collected and a complete blood count test was done and results were analyzed.

In the present study, the parameters such as Hb, RBC, WBC, Lymphocytes, and Platelets were taken to analyze the changes in the Blood indices in COVID-19 recovered patients. The p value of the parameters were calculated using SPSS software and tabulated (Table-1-6). The independent 't' test values Hb, RBC, WBC, Lymphocytes, Platelets after categorizing of COVID-19 recovered patients and healthy controls were compared and depicted in the form of a bar graph (Fig. 1-6).

Table1. Mean and Standard deviation of the WBC count was analyzed

Group	Mean	Standard deviation	Standard Error mean	Sig. P value
COVID-19 recovered	4.2200	.54498	.24372	<0.005
controlled	9.3400	.68411	.30594	

Table 2. Mean and Standard deviation of the RBC count was analyzed

Group	Mean	Standard deviation	Standard Error mean	Sig. P value
COVID-19 recovered	5.8960	.49707	.22230	<0.005
controlled	4.5660	.39444	.17640	

Table 3. Mean and Standard deviation of the Lymphocyte count was analyzed

Group	Mean	Standard deviation	Standard Error mean	Sig. P value
COVID-19 recovered	1.6400	.28810	.12884	<0.005
controlled	2.8200	.37683	.16852	

Table 4. Mean and Standard deviation of the Granulocyte count was analyzed

Group	Mean	Standard deviation	Standard Error mean	Sig. P value
COVID-19 recovered	4.6200	.89833	.40175	>0.005
controlled	6.0800	1.00349	.44878	

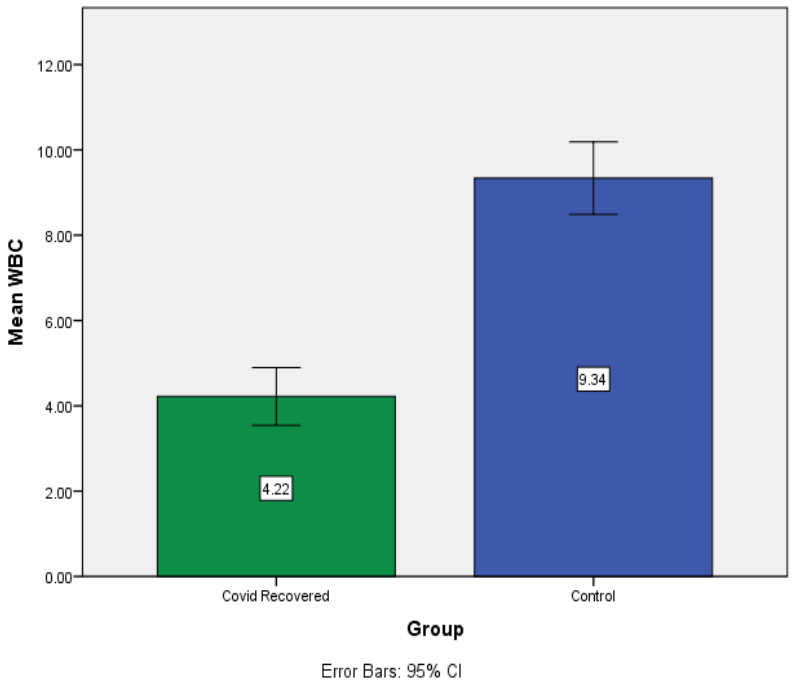

Fig. 1. Bar graph representing the association between groups with mean WBC. The X-axis represents the group and Y-axis represents the mean WBC. Age group of 18-20 years, the level of control was 9.34× 10^3/µL (blue) and the level of COVID-19 recovered was 4.22× 10^3/µL (green). P value <0.005

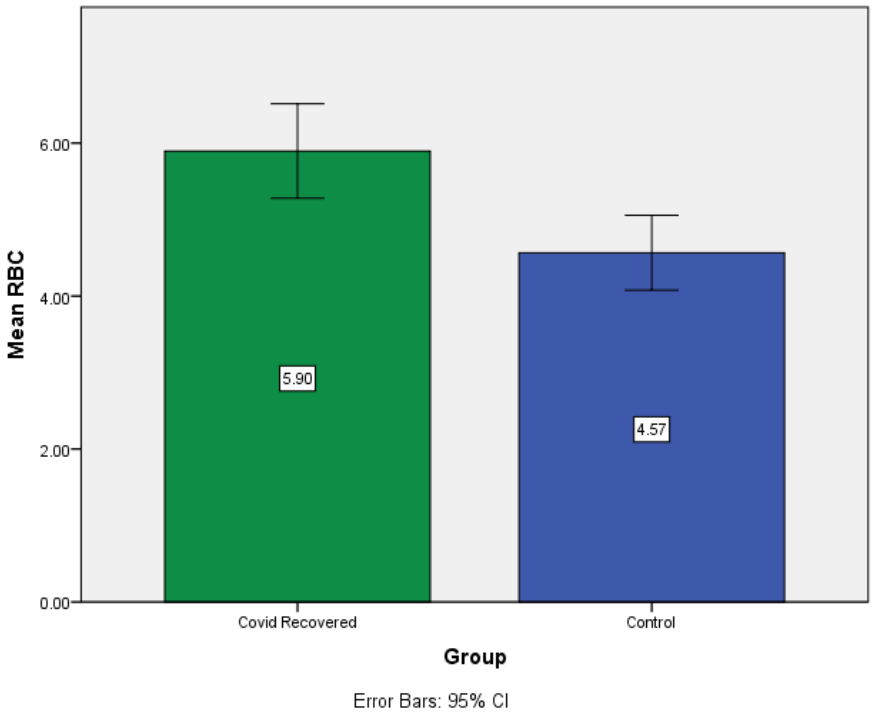

Fig. 2. Bar graph representing the association between groups with mean RBC. The X-axis represents the group and Y-axis represents the mean RBC. Age group of 18-20 years, the level of control was 4.57 10^6 /µL (blue) and level of COVID-19 recovered was 5.90 10^6 /µL (green). P value <0.005

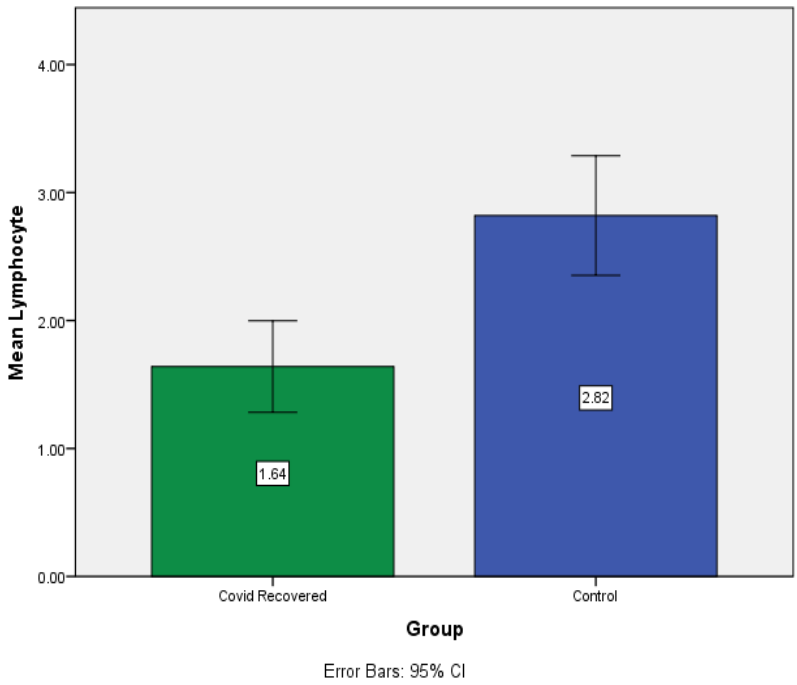

Fig. 3. Bar graph representing the association between groups with mean Lymphocytes. The X-axis represents the group and Y-axis represents the mean Lymphocyte. Age group of 18-20 years, the level of control was 2.82x10^3/µL (blue) and level of COVID-19 recovered was 1.64 x 10^3/µL (green). P value <0.005

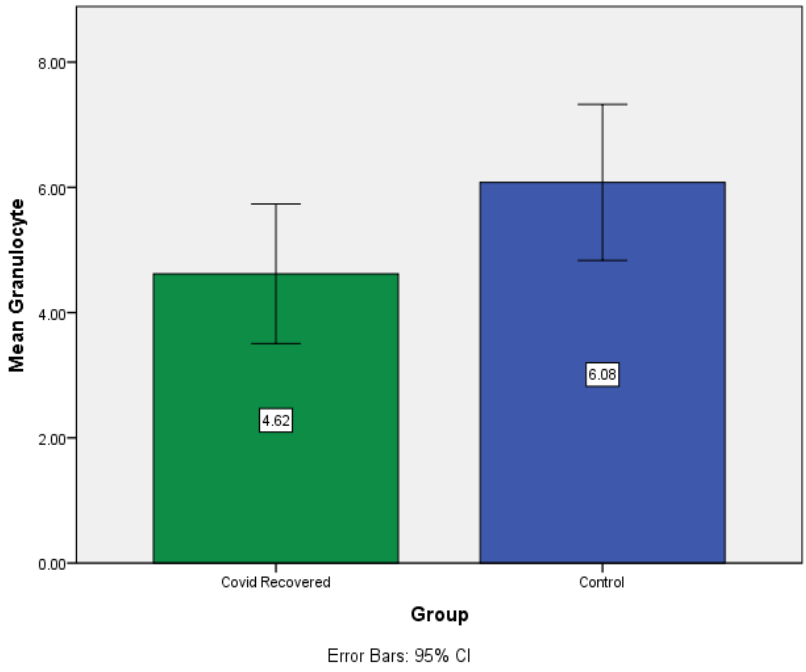

Fig. 4. Bar graph representing the association between groups with mean Granulocyte. The X-axis represents the group and Y-axis represents the mean Granulocyte. Age group of 18-20 years, the level of control was 6.08 10^3/µL (blue) and level of COVID-19 recovered was 4.62 10^3/µL (green). P value <0.005

Table 5. Mean and Standard deviation of the Hb count was analyzed

Group	Mean	Standard deviation	Standard Error mean	Sig. P value
COVID-19 recovered	16.04	.9939	.444	<0.005
controlled	11.8	2.057	.9200	

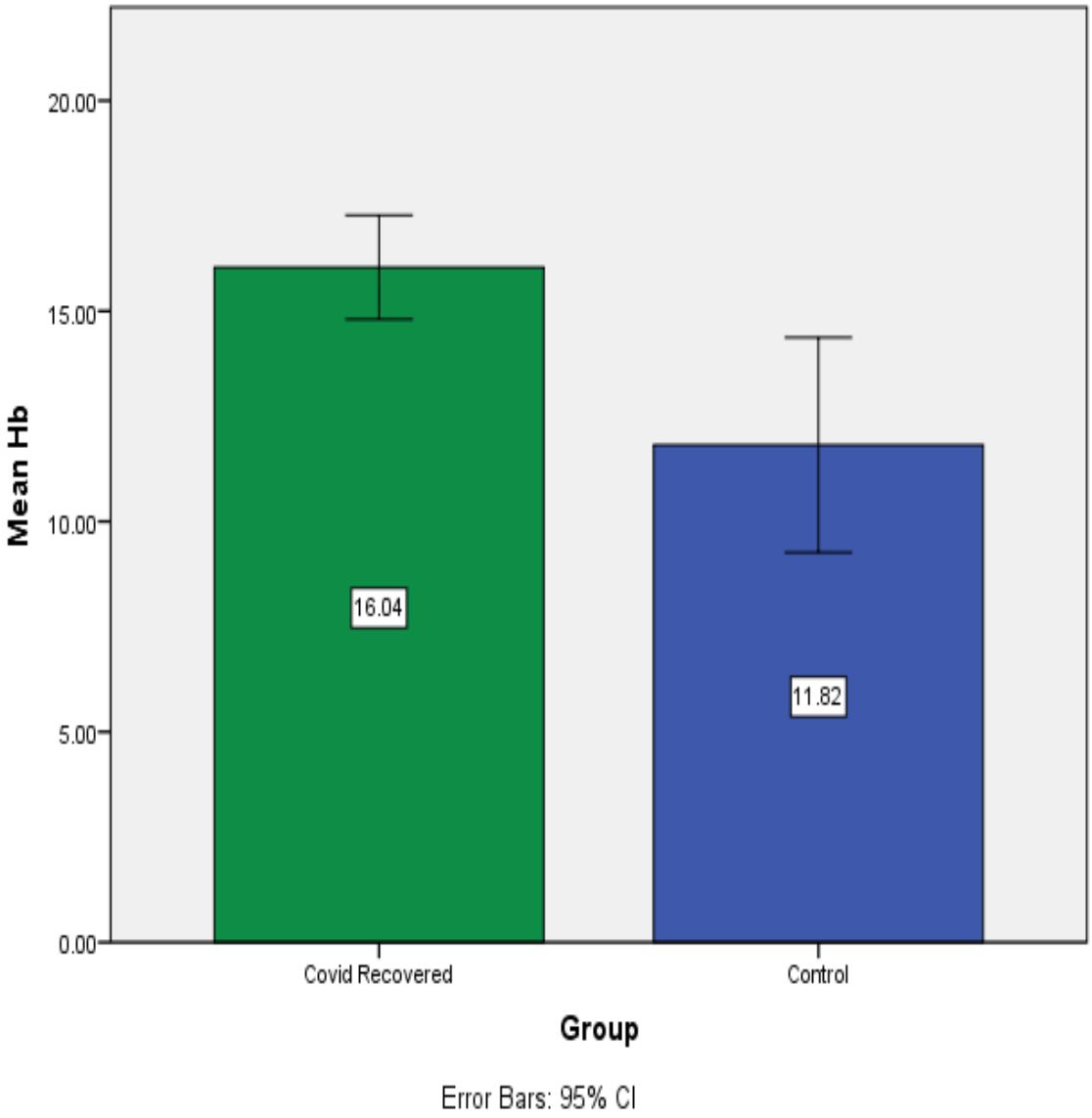

Fig. 5. Bar graph representing the association between groups with mean Hemoglobin. The X-axis represents the group and Y-axis represents the mean Hemoglobin. Age group of 18-20 years, the level of control was 11.82 g/dl (blue) and level of COVID-19 recovered was 16.04 g/dl (green). P value <0.005

Table 6. Mean and Standard deviation of the platelets count was analyzed

Group	Mean	Standard deviation	Standard Error mean	Sig. P value
COVID-19 recovered	337.2	40.096	17.19	<0.005
controlled	184.2	65.480	29.28	

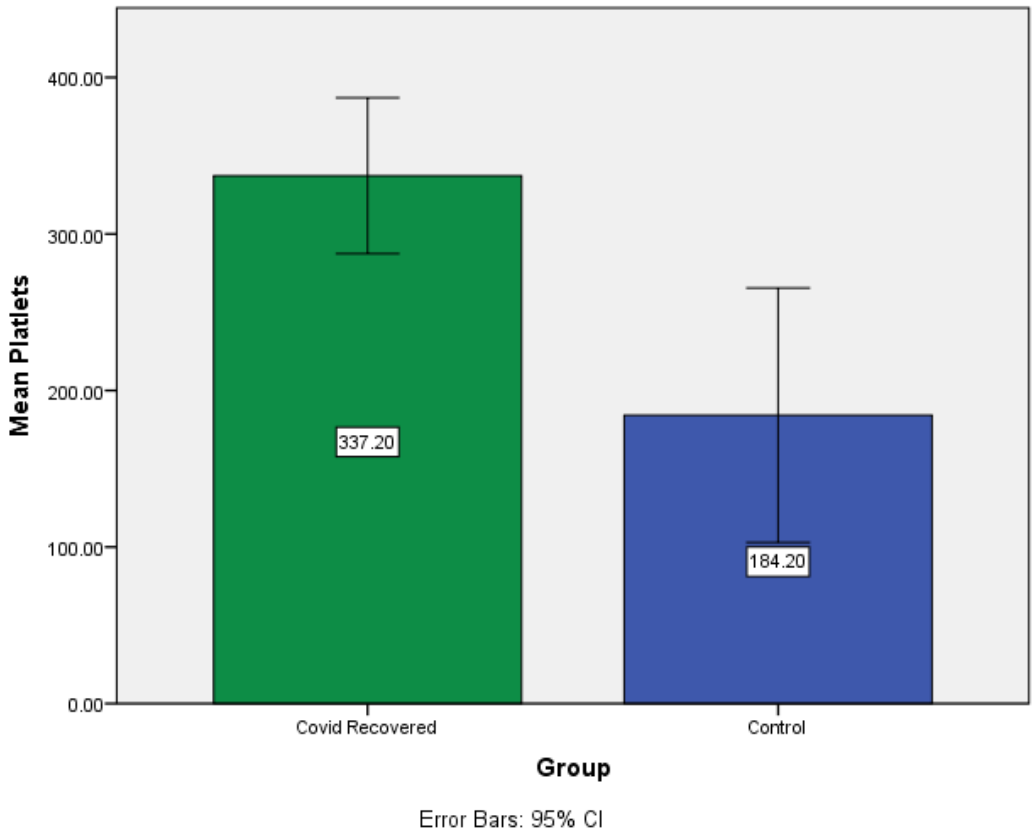

Fig. 6. Bar graph representing the association between groups with mean Platelet. The X-axis represents the group and Y-axis represents the mean Platelet. In the age group of 18-20 years, the level of control was 184.20 10^3/µL (blue) and the level of COVID-19 recovered was 337.20 10^3/µL (green). P-value <0.005

4. DISCUSSION

In this study, the comparison of blood indices is done with COVID-19 recovered patients and healthy control group in which different parameters were included like Hb, RBC, WBC, Lymphocytes, Platelets [11). Routine blood tests involve analyzing the amount of change and shape distribution in blood cells, such as white blood cells (WBCs), white blood cell categorization count, red blood cell count (RBC), hemoglobin (Hb), and platelets, to assess blood condition and disease. Many pathological changes are detectable by routine blood tests, which can help with diagnosis when the etiology of the disease is COVID-19 [12]. In addition, routine blood tests are a common sign of disease recurrence or recovery, as well as the evaluation of treatment or discontinuance. In the early stages of the disease, the total number of WBCs is normal or decreased, accompanied by decreasing lymphocytes and progressive lymphocytopenia in severe patients. Lymphocytes, monocytes, and eosinophils all dropped, while total WBC counts were normal. The patient's condition deteriorated, and the total count of WBCs, RBCs, lymphocytes, and granulocytes fell to a low [13]. The continuing drop in WBCs was attributed to the virus's direct invasion of hematopoietic cells or the worsening of apoptosis and hematopoietic suppression caused by infection of bone marrow stromal cells [14]. Platelet was within the reference range, the trend was similar with WBC too. PLT alterations could be attributed to PLT being an anti-inflammatory factor that increased as a result of recruitment. Furthermore, inflammation and immunological factors boosted thrombopoietin (TPO), which promoted platelet formation. As a result, the pattern was similar to that of neutrophils.

Here it can be understood that in coronavirus infection there will be chronic inflammation and wheezing and trouble in breathing. This leads to a decrease in oxygen levels in the body, to

increase the O2 in the body levels of RBC and hemoglobin are increased in the body. Due to foreign pathogenicity in the body, the body's immune system reacts to it and produces more WBC, lymphocytes, Granulocytes to fight the toxic organisms [15]. Platelets are increased to increase the clotting factors of blood. These all are protective steps taken by the body after recovering from coronavirus. Our team has extensive knowledge and research experience that has translate into high quality publications [16-35].

The sample size was small and the study was not included with monocyte count and percentage. These were considered as the limitations of our study. In the future, a larger sample size would be used to obtain improved results. Also, with relation to the PLT different other parameters can be taken into account apart from lymphocyte hemoglobin ratio and granulocyte count.

5. CONCLUSION

From the above study, it can be understood that COVID-19 recovered patients have increased RBC count, increased hemoglobin and reduced WBC count with reduced lymphocytes and Granulocytes counts. Here it can be concluded that COVID-19 recovered patients should take care of themselves by having proper care, doctor consultation and follow up. These individuals did not have any serious ailments during the entire duration of the infection and in spite of full recovery, there was significant variation in the blood indices which proves that the after-effects of the viral infection are present even post three months of recovery.

CONSENT

Informed consent was obtained from the patients.

ETHICAL APPROVAL

The study and sample collection were approved by the Institutional ethical committee with an approval number of IHEC/SDC/UG-1909/21/241.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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