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Assessment of Lymphocyte and Neutrophil Concentration with Many Types of Covid-19 Vaccine in Corona Patients

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Abstract

Coronavirus appeared to be increasing day by day, and the best way to confront this virus was by making effective and safe vaccines, so this study was conducted to compare the types of vaccines that were made against Corona disease in Diyala Governorate. One of the objectives of this study is to know the concentration and number of white cells, specifically lymphocytes and neutrophils, for two groups of people, first unvaccinated patients with corona and second, vaccinated corona patients. The study started from September 2021 to April 2022, and the Present study show there are significant differences ($p<0.05$) between Neutrophil and Lymphocytes parameters in the studied groups. The WBC count was achieved by full-auto hematology machine manidray technique. Neutrophils scored the highest mean value in vaccinated patients (75.74± 10.39 and 189.41±80.34), and the lowest mean value in healthy (58.32± 9.14 and 6.12±2.14) compared to unvaccinated patient groups. The Lymphocytes scored highest mean value in healthy groups (32.08± 7.64), and lowest mean value in unvaccinated patients' groups (24.76± 12.34) compared to unvaccinated patients' groups. The WBCs parameters did not score significant difference within study groups WBCs, Neutrophil, and Lymphocytes parameters showed no significant differences ($p>0.05$) among vaccine types. Taking into account the normal values and standard units of the results were as follows WBC account (4 – 10.6) x109 /L, the normal value of lymphocyte (20-40) % and neutrophil normal value (40 – 70) %.

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Keywords: Pfizer; AstraZeneca; Sinopharm; Neutrophil; Lymphocyte.

1. Introduction

In both animals and people, the covid19 virus can cause illness. It contains the largest RNA viral genome yet discovered [1]. the virus was formerly considered to have spread from animals to humans by way of an amplifying host. As of early February 2020, more than 31,000 verified human illnesses and 640 fatalities have been linked to human-to-human transmission, according to the World Health Organization's early February 2020 assessment [2]. The human respiratory system is a primary target of coronavirus, one of the most common viruses on the planet. Patients with SARS-CoV-2 infection are at risk of developing the coronavirus disease 2019, which is characterized by a variety of respiratory symptoms, including fever, dry cough, dyspnea, and pneumonia, as well as multiple organ failure and acute respiratory distress syndrome, necessitating hospitalization in an intensive care unit and even leading to death in some cases [3].

Although diarrhea was first observed in just a tiny percentage of cases, it has now become more prevalent in people with the disease [4]. COVID-19 symptoms can appear anywhere from two to fourteen days after infection, and the sickness can last for up to 27 days in certain individuals. However, according to Chinese experts, the typical incubation period is 2-5 days, which varies depending on the patient's age, health, and clinical factors [5]. Immune homeostasis and the body's inflammatory response are maintained by lymphocytes. Patients with COVID-19 are more likely to have this symptom, especially if their condition is severe. Lymphopenia is a common symptom of COVID-19 severe, and it may be used to gauge the severity of a patient's clinical outcome [6]. Patients with COVID-19 neutrophils have abnormally low levels of granulocytes and monocytes, and their neutrophil-to-lymphocyte ratios are significantly greater in severe cases than in non-severe cases [7]. Researchers reported elevated neutrophil levels in 38% of the 99 individuals studied from Wuhan in another investigation. In the meanwhile, individuals with severe disease had lower levels of eosinophils, basophils, and monocytes [8].

1.2 Aim of study

In this study set out to assess and study leukocyte count (neutrophil and leukocyte) in vaccinated and non-vaccinated COVID-19 patients.

2. Materials and Methods

2.1. sample

Nomenclature			
DNA	Deoxyribonucleic acid.	MCV	Mean corpuscular value.
RNA	Ribonucleic acid.	MCH	Mean corpuscular hemoglobin.
RT-PCR	Real time – polymerase chain reaction.	PDW	Platelet distribution width.
EDTA	Ethylene diamine tetra acetic acid.	COVID	Coronavirus disease.
CBCs	Complete blood counts.	CRP	C- reactive protein.
NLR	Neutrophil to lymphocyte ratio.	BNT162B2	Biontech 162B2.
COPD	Chronic obstructive pulmonary disease.	WBCs	White blood cells.

2.1.1. Study design

Between the beginning of September 2021 and the end of April 2022, health centers and hospitals in Diyala province gathered 450 blood samples from people (100 non-vaccinated and 300 vaccinated 50 control). Within the age range of 15-90 years, blood samples were split between patients who had received the COVID-19 vaccine (300) and those who had not (100). People with COVID-19 were tested in the RT-PCR machine at the Public Health Department-Baquba Teaching Hospital-Diyala Health Department and samples were collected. gender, age, vaccination type, and chronic conditions are all asked for on the patient questionnaires. The healthy samples of 50 people (24 men and 26 females) between the ages of 15 and 90 years were included. COVID-19 antibodies and RT-PCR results were negative in this patient's case, as was his asymptomatic state.

2.1.2. Procedure

The process of preparing the tests is done by drawing blood from both groups (patients and healthy people) and placing the drawn blood in EDTA tubes to prevent blood clotting. The tube is moved more than once to mix the blood with the anticoagulant. After that, (20 microliters) of blood are taken from the tube by the device, and the results are read on the screen of the device

2.2. Sampling

About two milliliters of blood was collected from covid19 patients then delivered to EDTA tubes to avoided the agglutination because we need to whole blood for white cells (lymphocyte. Neutrophil). By the automated hematology machine called Mindray technique. The blood tests were done using a mindray bc 3000 complete blood count (CBC) counter that analyzes the results of the following laboratory tests, hemoglobin, hematocrit, total and differential count of white blood cells, platelets, MCV red blood cells, MCH, PDW, this device is characterized by speed, sensitivity and high accuracy in reading the results.

2.3. Statistical analysis

To begin, the normality of all parameters was verified (Kolmogorov-Smirnov and Shapiro-Wilk test). No significant difference was found between the medians of parameters that met both normality tests and parameters that did not satisfy the normality tests (significant difference) using the Mann-Whitney test (for comparison between two groups). Percentage frequencies of the other parameters were analyzed using either Pearson-Chi-square tests or two-tailed Fisher exact probabilities (p). P-values of 0.05 or below were considered significant in this study's results.
The comparison of significant (p-value) is done as follows:

- P value <0.05 was deemed statistically significant (S)
- P value< 0.01 was deemed extremely significant (HS)
- P value >0.05 There was no significant difference when the P value was greater than 0.05.

2.4. Ethical approval

Before their blood was drawn for this study, all subjects provided written informed consent. approval of this study by the ethics committee of Baquba general hospital; under the date of 19/12/2021**.**

3. Results and Discussion

3.1. Relation of immunological parameters with study groups

The present study shows three significant differences (p<0.05) between Neutrophil, Lymphocytes and WBC parameters and study groups. the Neutrophil and WBC scored the highest mean value in vaccinated patients (75.74± 10.39) (7.24±3.51) and the lowest mean value in healthy (58.32± 9.14) compared to unvaccinated patients' groups. The Lymphocytes scored highest mean value in healthy groups (32.08± 7.64), and lowest mean value in unvaccinated patients' groups (24.76± 12.34) compared to unvaccinated patients' groups Taking into account the normal values and standard units of the results were as follows WBC account (4 – 10.6) $x10^9$ /L, the normal value of lymphocyte (20-40) % and neutrophil normal value (40 – 70) %. The WBCs parameters score significant differences within study groups (Table 1).

Table 1 comparative immunological parameters within study groups by using ANOVA (F test)

		Number of samples	mean	Std. deviation	P value
WBCs 10^9cell/L	Un vaccinated	100	7.70	3.25	p>0.05
	Vaccinated	300	7.24	3.51	
	Healthy	50	6.52	0.68	
Neutrophil %	Un vaccinated	100	73.24	11.70	
	Vaccinated	300	75.74	10.39	

	Healthy	50	58.32	9.14	P<0.01** LSD=4.15
	Un vaccinated	100	24.76	12.34	
Lymphocytes %	Vaccinated	300	26.54	9.49	P<0.05*
	Healthy	50	32.08	7.64	LSD=3.31

Total WBCs counts and neutrophils (part of WBC differential) increased almost with covid19 patients more than in healthy people, however, lymphocytes were found to be lower in patients than in healthy people. In COVID-19 patients [9]. The effects of COVID-19 on the number of peripheral blood cells have been well-documented. White blood cell and neutrophil counts rise in infected individuals, whereas lymphocyte and platelet numbers fall [10]. Lymphocyte cytopathic, cytokine storm suppression, metabolic acidosis, and atrophy of lymphoid organs are some of the hypothesised reasons causing this phenomenon [11]. The current investigation found no significant differences in WBCs between vaccinated and unvaccinated individuals, indicating that the vaccination had no effect on WBC differential characteristics [12].

3.2. *Relation of neutrophil and lymphocytes parameters with the gender of study groups*

The result of the current study shows there are significant differences (p<0.05) between Neutrophil and lymphocytes parameters and the gender of study groups. The Neutrophil scored the highest mean value in vaccinated females (76.14±10.26), and least mean value in healthy males (58.04±8.75), Lymphocytes scored the highest mean value in healthy males (33.63±7.75), and the least mean value in unvaccinated females (23.93±12.78), WBC scored highest mean value in vaccinated males (6.74±3.37), and least mean value in healthy females (6.50±0.51) compared to other values. The WBCs parameters do not score significant differences within gender study groups (Table 2).

Table 2 Comparative immunological parameters within the gender of study groups by using ANOVA (F test)

		Groups						P value
		Unvaccinated		vaccinated		Healthy		
		Mean	SD	Mean	SD	Mean	SD	
WBCs	Male	7.56	3.53	6.74	3.37	6.54	0.83	p>0.05
	Female	7.81	3.05	7.83	3.64	6.50	0.51	
Neutrophil	Male	70.21	10.37	75.40	10.68	58.04	8.75	P<0.01**
	Female	75.81	12.33	76.14	10.26	58.58	9.65	LSD=4.03
Lymphocytes	Male	25.73	12.00	25.41	8.54	33.63	7.75	P<0.05*
	Female	23.93	12.78	27.88	10.53	30.65	7.39	LSD=3.02

We observed a higher total leucocyte count in women than in men due to a highly significant difference in the absolute neutrophil count. have suggested that there is a cyclical variation of the neutrophil count with the menstrual cycle. These findings imply that the level of oestrogen or progestogen may be an important factor in regulating the neutrophil count. A rise in the neutrophil count is also associated with increased hormone levels in pregnancy [13]. Neutrophils, lymphocytes at COVID-19 patients all differed significantly by gender in this research. [14]. Boys showed larger lymphocyte, monocyte, eosinophil and basophil ratios than girls. [15]. Because of the existence of immunological genes on chromosome X [16]. found substantial variations in WBCs, Neutrophils, and Lymphocytes in COVID-19 gender. Neutrophil to lymphocyte ratio (NLR) [17]. The results of a previous study, which also found a link between higher WBC differential levels and decreased lung function in men and women with COPD, corroborated our findings. An increased link between systemic inflammation and male-specific lung function decrease was seen in the prospective analysis. A gender variation in lung function decrease processes might explain this [18]. NLR levels were substantially greater in patients with COPD than in age- and sex-matched healthy control participants and these values rose much more during acute COPD exacerbations as opposed to times of stability [19].

3.3. Relation WBCs, neutrophil, and lymphocytes parameters with vaccine types

WBCs, Neutrophil, and Lymphocytes parameters showed no significant differences (p>0.05) among vaccine types (table 3). WBC differential characteristics were not significantly different across vaccination types, Sinopharm vaccines have been shown to completely eradicate white blood cells and other inflammatory factors (e.g., CRP) after seven days, and the side effects last from several hours to 24 hours after the vaccine, which distinguishes Sinopharm vaccines from other vaccines and underscores their importance [20]. When compared to mRNA vaccinations, the AstraZeneca vaccine increased inflammation and platelet activation and generated more thrombin, but none of the subjects' acquired antibodies to Pf4. Certain components of AstraZeneca's adenovirus vector may act as initial triggers of (hyper)inflammation, platelet activations and thrombin synthesis, potentially lowering the threshold for an event cascade that triggers complications associated with excessive inflammation, platelet and coagulation activations as observed in epidemiological studies and promotes the development of Vaccine-induced Immune Thrombocytopenia and other immune disorders [21]. Short-term endothelial dysfunction can be restored after 48 hours of vaccination with the BNT162b2 mRNA (PFIZER) vaccine for COVID-19. The vaccine's direct or inflammatory-mediated effects can explain the impact. New information on the BNT162b2 mRNA COVID-19 vaccine's cardiovascular characteristics and safety may have ramifications for the whole class of mRNA vaccines [22].

Table 3 comparative immunological parameters within vaccine types by using ANOVA (F test)

		N	*Mean*	*Std. Deviation*	P value
	Sinopharm	100	6.87	2.96	
WBCs	Pfizer	100	7.31	3.76	P>0.05
	AstraZeneca	100	7.83	4.02	
Neutrophil	Sinopharm	100	74.05	10.07	P>0.05

	Pfizer	100	75.84	10.68	
	AstraZeneca	100	79.48	10.44	
	Sinopharm	100	26.29	7.81	
Lymphocytes	Pfizer	100	26.72	10.32	P>0.05
	AstraZeneca	100	26.32	10.73	

4. Conclusions

Neutrophils and lymphocytes have high sensitivity in the prediction of the occurrence of COVID-19 infection and are not effected by the covid19 vaccine types.

5. Recommendations

COVID-19 is life-threatening and immunization serves to reduce death. A booster dose should be taken as it aids to reduce the infection rate. It is possible to conduct a similar study provided that the same person collects his data when infected with corona before taking the vaccine and comparomg it with those data collected after the infection of the same person after receiving the vaccine and to confirm the type of vaccine.

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