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Reduction of IL-10 Serum Level after 4 Months of Pfizer-BioNTech Vaccine Administration of 2nd Dose in Students at Al-Iraqia University

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ABSTRACT

Background: Vaccination is considered to be the most significant kind of control over the pandemic. Currently, the in-use Pfizer vaccine is considered to be the most effective prevention method to control this pandemic.

Aim: Our study aims to estimate serum levels of interleukin-10 in fully vaccinated students with the Pfizer/ BioNTech vaccine after one month and four months.

Methodology: 90 Samples were randomly taken from two different groups of students from Al-Iraqia University, who were Pfizer-BioNTech completely vaccinated. A 5 ml was drawn from 45 volunteered students after 1 month of vaccination and the other 45 after 4 months of complete vaccination. Serological analysis was carried out for measuring interleukin-10 of human serum by using the Human Interleukin-10 ELISA Kit. Demographic data were also collected from participants including age and gender.

Results: The serum levels of Human Interleukin-10 after 2nd dose of the Pfizer/BioNTech vaccine have significantly dropped in four months ($P<0.05$) compared with one month of administration.

Conclusion: Human Interleukin-10 serum levels significantly decreased in the 4th month of the 2nd dose of the Pfizer-BioNTech vaccine.

Keywords: Interleukin-10, SARS-COVID-19, Pfizer-BioNTech vaccine, Medical students, Al-Iraqia University.

INTRODUCTION

According to the WHO, until 2022 there were about six hundred thousand confirmed cases of COVID-19 reported globally, with approximately six million and a half deaths while Iraq recorded two million and four hundred thousand COVID-19 infected cases besides twenty-five thousand deaths which placed Iraq third among Eastern Mediterranean Sea countries that suffer from COVID-19 [(1)].

As vaccines have a dynamic role in providing adequate protection against infectious diseases by provoking antigen-specific antibodies of long-term responding for plasma cells along with developing of existed B- and cell and T-cells [(2)], the Pfizer-BioNTech vaccine has been used to limit the worldwide spread of COVID-19.

It's well-known that vaccines will change the cytokines responses, which are small proteins important in cell signaling and have particular effects on cell interaction or communication. Many cell populations produce cytokines, but the chief producers are helper T cells (Th) and macrophages. Proinflammatory cytokine is liberated mainly by stimulated macrophages to play a significant role in inflammatory response regulation [(3)].

Interleukin-10 is considered to be an anti-inflammatory cytokine [(4)], it is generated by activated immune cells, specifically monocyte/macrophage as well as T-cells, which acts vital roles in preventing inflammatory and autoimmune pathologies. IL-10 inhibits antigen presentation and reduces the production of inflammatory mediators [(5)].

Further studies suggest that it might have a potential role as a pro-inflammatory cytokine. It performs numerous activities, promotes or inhibits inflammatory processes, and promotes immune response [(6)].

This study aims to assess immune response in the COVID-19 Pfizer BioNTech fully vaccinated students from Al-Iraqia University after 1 and 4 months of the vaccination by achieving the objective of estimating the serum level of IL-10.

MATERIALS AND METHODS

Sampling

Two groups of ninety randomly selected volunteers were involved in our study; the First group included forty-five volunteered students who accepted to contribute 5 ml of their blood 30 days (one month) after the administration of (Pfizer-BioNTech) 2nd dose of the vaccine while the Second group which included also forty-five volunteered students who accepted to give 5 ml of their blood after 120 days (four months) of administration of Pfizer-BioNTech vaccine.

The drawn blood was put inside a gel tube and centrifuged for serum, after that, the serum was moved

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into a Plain tube to be kept in a refrigerator. Our study work started from October 2021 until February 2022.

Serology

Following the protocol of the manufactured company, an indirect ELISA (enzyme-linked immune-sorbent assay) test was done for assessing serum levels of Human Interleukin-10 ELISA Kit (catalog number E0102Hu) with a (BioTek/ USA ELISA system) microplate reader to calculate the results.

For the sandwich, IL-10 ELISA kit, seven standards were made according to the instructions of the manufacturing company to be used for quantification and analysis of serum IL-10 levels (pg/ml). Data were counted by determining of mean absorbance for each duplicated measurement, and concentration (pg/ml) was plotted for each calibrator concerning the human interleukin-10 ELISA kit to obtain the mean calculation.

Ethical approval

The Scientific Committee of the Medical College of Al-Iraqia University has approved this work that involved participants with positive serum Anti-Spike IgG antibodies against the Pfizer-BioNTech mRNA vaccine after one and four months of full vaccination.

Statistical analysis

The obtained data were analyzed using the Kolmogorov–Smirnov, Shapiro–Wilk, and Mann–Whitney U-tests by the SPSS Software at a significant difference of $P<0.05$ [7].

RESULTS

The two groups were students who volunteered from Al-Iraqia University, from various stages and faculties. The demographic variables included gender and age; the study population' mean age was 25.8 ± 2.35 years, and the gender distribution (**Tables 1, 2**).

Table (1): The Frequency and Percentage for Gender (after 1 month)

Gender	Frequency	%	Valid %	Cumulative %
Female	17	37.8	37.8	100
Male	28	62.2	62.2	37.8
Total	45	100	100	

Table (2): Frequency and percentage (%) for gender (after 4 months)

Gender	Frequency	%	Valid %	Cumulative %
Female	25	55.6	55.6	100
Male	20	44.4	44.4	55.6
Total	45	100	100	

After ELISA results of IL-10 serum levels for both groups were obtained, the data were analyzed as they were non-parametric.

Table (3): Test of normality for Interleukin-10 after 1 month which was not normally distributed

Variable		IL-10
n		45
Normal-Parameters [a, b]	**Mean**	349.7785
	Standard Deviation	45.97675
Most-Extreme Differences	**Absolute**	415
	Positive	415
	Negative	282
Test Statistic		415
P (2-tailed)		0.001[c]

Table (4): Test of normality interleukin-10 after 4 months which was not normally distributed

Variable		IL-10
n		45
Normal Parameters [a, b]	**Mean**	178.1315
	Standard Deviation	19.07948
Most Extreme Differences	**Absolute**	.320
	Positive	.320
	Negative	-.316
Test Statistic		0.320
P (2-tailed)		0.001[c]

a. **Test distribution is Normal.**
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Because all data were not normally distributed, non-parametric tests were used to test the research hypothesis using Mann-Whitney Test. The data revealed a significant reduction ($P<0.05$) in levels of IL-10 post 4 months in comparison to 1-month post the 2nd dose of Pfizer-BioNTech vaccination (**Table 5**).

Table (5): Independent two samples Mann Whitney test for (human IL-10) serum levels after 1 and 4 months

Variable	Time since vaccination	Mean Rank	P-value. (2-tailed)
IL-10	1 Month	54.02	0.002
	4 Months	36.98	

DISCUSSION

IL-10 is one of the important cytokine types in the case of COVID-19 infection, which can inhibit proinflammatory production such as IL-1, 6, TNF

(Tumour Necrosis Factor), and INF (Interferons) in different types of cells. Furthermore, IL-10 can block IL-12 [8], which in turn inhibits the maturation of DCs (dendritic cells), [9]. In the COVID-19 pandemic, studies have shown that IL-10 can regulate the cytokine storm response in severe COVID patients by inhibiting IL-6, IL-1β, and IFN and blocking IL-12 [10].

IL-10 in humans has been related to the protection of tissue against an exaggerated antimicrobial immune response in viral, bacterial, and also parasitic infections but even so to microbial persistence outside as well as inside of the lung [11].

In some studies, a dramatic early elevation of Interleukin-10 accompanied by cytokine storm has been shown in COVID-19 severe infected individuals which can be explained as a mechanism of negative feedback to inhibit inflammation [12]. In contrast, numerous lines of clinical data from human studies proposed that the early-dramatic increase of IL-10 upon SARS-CoV-2 infection might alternatively play a role of the detrimental pathological part as a pro-inflammatory in COVID-19 severity [13].

The BNT162b2 (Pfizer/BioNTech) mRNA vaccines have been highly effective in preventing COVID-19 in real-world practice [14, 15].

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CONCLUSION

Our study showed that IL-10 serum levels significantly drop ($P<0.05$) after 120 days (4 months) of complete vaccination. The increase in IL-10 at the beginning of vaccination could be explained as an attempt to temper hyper-inflammation and protect tissue. This might be due to the anti-inflammatory property that IL-10 levels were expected to be raised as soon as the vaccine is administered to act to prevent any inflammatory reaction against local vaccine lesions.

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