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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/18882

DOI URL: <http://dx.doi.org/10.21474/IJAR01/18882>



RESEARCH ARTICLE

ASSESSMENT OF PROINFLAMMATORY MARKERS IN TYPE 2 DIABETIC PATIENTS POSTCOVID-19 VACCINATION

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Manuscript Info

Manuscript History

Received: 14 April 2024

Final Accepted: 18 May 2024

Published: June 2024

Key words:-

SARS-CoV-2, T2DM, Proinflammatory Markers, TNF- α and IL-6

Abstract

Background: COVID-19 Caused by Severe Acute Respiratory Syndrome COVID-2 (SARS-CoV-2). Type 2Diabetes Mellitus(T2DM) is a metabolic disorder associated with poor clinical outcomes in COVID-19 patients. This study aims to compare proinflammatory markers, such as TNF- α and IL-6, between T2DM patients and healthy controls after COVID-19 vaccination.

Materials and Methods: This study was conducted at Teerthanker Mahaveer University, College of Paramedical Sciences, Moradabad. A total of 130 subjects were included, divided equally into two groups: 65 T2DM patients and 65 healthy controls. Blood samples were collected under aseptic conditions and analyzed in the laboratory. P-value less than 0.05 considered significance.

Results: The study included 43 males (66.15%) and 22 females (33.84%) in the Healthy control group, and 46 males (70.76%) and 19 females (29.23%) in the T2DM group. The mean TNF- α levels were significantly higher in the T2DM group (32.16 ± 5.11 pg/ml) compared to the control group (5.58 ± 1.02 pg/ml), with a Z-test value of -41.04 ($P < 0.05$). Similarly, the mean IL-6 levels were higher in the T2DM group (19.70 ± 2.26 pg/ml) compared to the control group (5.11 ± 1.02 pg/ml), with a Z-test value of -48.00 ($P < 0.05$).

Conclusion: T2DM patients exhibited significantly elevated levels of proinflammatory markers TNF- α and IL-6 compared to healthy controls after COVID-19 vaccination.

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Introduction:-

COVID-19 Caused by Severe Acute Respiratory Syndrome COVID-2 (SARS-CoV-2), (Hu et al., 2021)emerged as global public health crisis in early 2020 that was highly transmissible and pathogenic coronavirus, (Heald et al., 2023)presenting a significant threat due to its severity which leads to pandemic of acute respiratory disease named 'coronavirus disease 2019' (COVID-19). (Hu et al., 2021)T2DM is a metabolic disorder of carbohydrate metabolism due to inappropriate glycogenolysis, gluconeogenesis,(American Diabetes Association Professional Practice Committee, 2023)and interaction of different genetics and environmental factor resulting in

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hyperglycaemia(Rey-Reñones et al., 2022) and in the last decennary, is well known risk factors for poor clinical presentation in patients of COVID-19. (Nassar et al., 2021)According to World Health Organization T2DM will be seventh leading etiological agent of death by 2023 globally. (Mathers & Loncar, 2006)Continuing COVID-19 pandemic has notably higher significantly challenges in maintaining optimal plasma glucose levels in patients with DM.(Rey-Reñones et al., 2022)Patients of T2DM have an increased risk of infections due to chronic inflammation caused by hyperglycaemia and proinflammatory mediators, (van den Berg et al., 2022) chronic inflammation often associated with obesity, can lead to immune dysfunction, potentially contributing to the higher incidence of SARS-CoV-2 infection in individuals with diabetes.(Ssentongo et al., 2020) So the aims of the study is comparative analysis of Proinflammatory markers such as Tumour Necrosis Factor- α (TNF- α) and Interleukin 6(IL-6)in Healthy Controls (Group-I) and Type 2 Diabetes Mellitus (T2DM) (Group-II) after covid-19 vaccinations.

Material and Methods:-

This study was carried out in Teerthanker Mahaveer University, College of Paramedical Sciences, Moradabad, U.P. Indian.

A total of 130 subjects were included in the study, which divided into two groups 65 as T2DM and 65 subjects as Healthy (Control) group which was enrolled in OPD of the Teerthanker Mahaveer Hospital and Research Center Moradabad. T2DM diagnosed as per as American Diabetes Association criteria 2024. Venous blood samples were collected from all the participants as per inclusion and exclusion criteria from anti-cubital vein under aseptic precautions. All the samples were sent for analysis in laboratory.

Inclusion Criteria:

Vaccinated individuals diagnosed with type-2 diabetes patient, COVID-19 Vaccination, Patients of all sex group, Who give informed consent form, Who give informed consent form.

Exclusion Criteria :

Pregnant and lactating women, History of severe adverse reactions to vaccines, Patient not fitting into criteria, Unvaccinated and incomplete vaccination series.

Written ethical approval was taken from institutional ethical committee (PM/ETHICAL/COPS/2023/021) and informed written consent was obtained from all the patients after explaining in detail the entire research protocol.

All the results were analyzed by SPSS software version 17.0. P- Value of less than 0.05 was taken as significant.

Result:-

Table 3.1:- Distribution of Subject.

Groups	Frequency (n)
Group I	65
Group II	65

Table 3.1 shows that group-I (control group) and group-II (T2DM Group) had 65 subjects in each group.

Table 3.2:- Frequency and Percentage of Distribution of Subject according to Gender.

Groups	Gender	Frequency (n)	Percent (%)
Group I	Male	43	66.15
	Female	22	33.84
Group II	Male	46	70.76
	Female	19	29.23

Table 3.2 shows that Group -I (Healthy Control) had 43 males(66.15%) and 22 female (33.84%) while in Group-II (T2DM) the frequency of male 46 (70.76%) and female 19 (29.23%).

Table 3.3:- Assessment of Tumour Necrosis Factor- α .

Group	Mean (pg/ml)	StDev	Median
Group-I	5.58	1.02	6
Group-II	32.16	5.11	33

Table 3 and Graph 3.1 shows the mean of TNF- α in Group-I (Healthy Control) was 5.58 pg/ml with 1.02 SD, while in Group-II (T2DM) was 32.16 with 5.11 SD and median in Group-I 6 while in Group-II 33.

Graph 3.1:- Assessment of Tumour Necrosis Factor- α .

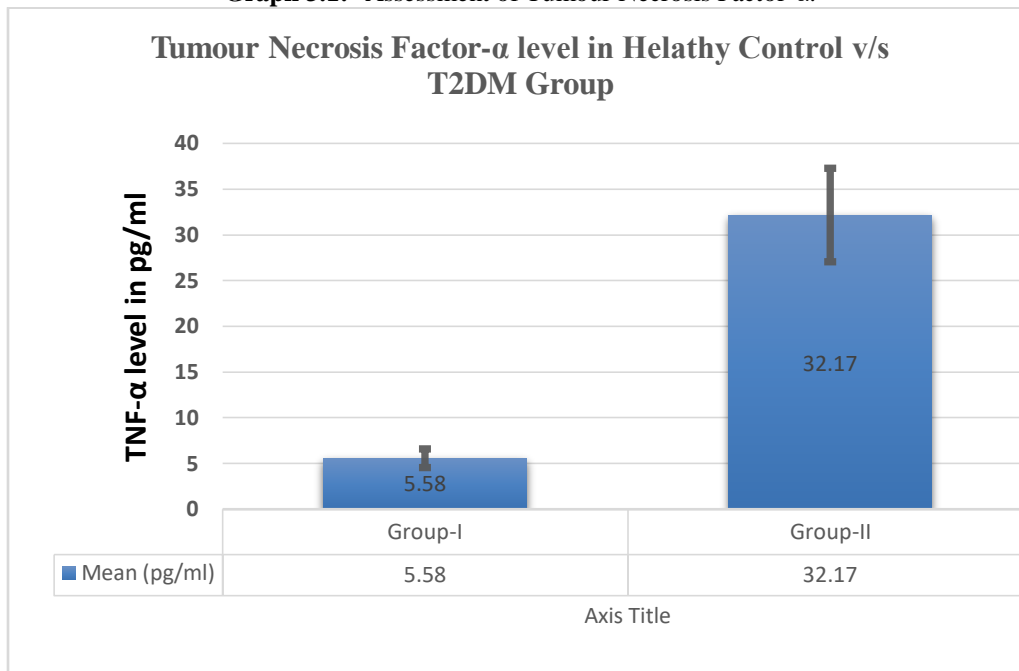


Table 3.4:- Assessment of Interleukin-6.

Group	Mean (pg/ml)	StDev	Median
Group-I	5.10	1.02	6
Group-II	19.70	2.26	19

Table 3.4 and Graph 3.2 the mean of IL-6 in group-I (Healthy Control) was 5.10 pg/ml with 1.02 SD, while in group-II (T2DM) was 19.70 with 2.26 SD and median in group-I was 6 while in group-II was 19.

Graph 3.2:- Assessment of TNF- α .

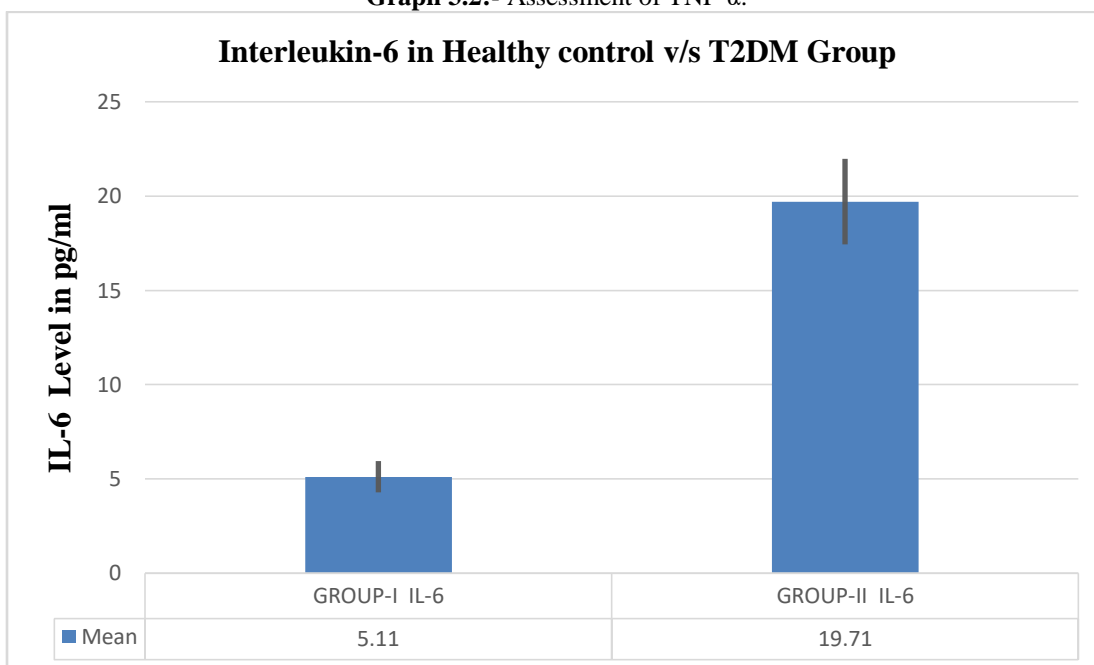


Table 3.5:- Z test.

Variables	Group	Mean \pm SD	Z test	P-value
TNF-α	Group-I	5.58 \pm 1.02	-41.04	<0.001
	Group-II	32.16 \pm 5.11		
IL-6	Group-I	5.11 \pm 1.02	-48	<0.001
	Group-II	19.70 \pm 2.26		

Table 3.5 Show mean of TNF- α in group-I (Healthy Control) was 5.58 (\pm 1.02) and in the group-II 32.16 (\pm 5.11), this indicates a highly significant differences between the group-I and group-II (T2DM) and given the very high z-value (-41.04), with a P-value less than <0.001 suggest that TNF- α levels are markedly elevated in T2DM patients. Similarly, the mean level of IL-6 was 5.11 (\pm 1.02) compared to 19.70 (\pm 2.26) in group-II. The z-test showed a z-value -48.00 with a p-value less than of <0.001 of IL-6 confirmed the significant difference between the two groups.

Discussion:-

Inflammation is one the most common factor in pathogenesis of COVID-19, during the acute phase infection of SARS-CoV-2 the elevation of cytokine and chemokine concentration has been found to be associated with higher risk of disease severity and mortality.(Zhu et al., 2023)

In last decades many effective and protective measure are taken against SARS-CoV-2 and its variants but the vaccination is one the best and effective in preventing method against SARS-CoV-2 and its variants.(Sivaprakasam et al., n.d.) SARS-CoV-2 infections evoked the both innate and adaptive immunity to clear the infection. (Mohammad, 2021)

In current study we divided the 130 enrolled subjects into two groups, each group had 65 subjects, the first group were control group second group were case group (T2DM).

The distribution of subjects across the control group (Group I) and the Type 2 Diabetes Mellitus (T2DM) group (Group II) was equal, with each group consisting of 65 individuals as shown in Table 3.1. In examining the gender distribution presented in Table 3.2, it is evident that there is a higher proportion of males in both groups. Specifically, Group I, the control group, comprised 43 males (66.15%) and 22 females (33.84%). Similarly, Group II, the T2DM group, included 46 males (70.76%) and 19 females (29.23%). This gender imbalance indicates a greater prevalence of male subjects in the study population.

The mean of TNF- α in control group was 5.58 \pm 1.02 and in case group was 32.16 \pm 5.11 so, the means level of TNF- α is higher in case group with a Z-value and p value respectively -41.04 and 0. And the mean of IL-6 in control group was 5.11 \pm 1.02 while in case group was 19.70 \pm 2.26 with a strongly z-value -48 and p-value 0 which suggested highly significant. According to study conducted by **Devaraj et al. 2010** showed the higher activity proinflammatory marker (IL-1, IL-6 & TNF- α) in diabetic patients. (Devaraj et al., 2010) Another study published by **Wang et al. 2013** including 10 prospective studies, with a total 19,709 participants and 4,480 cases, estimated a significant dose-response association of IL-6 levels with type 2 diabetes risk. (Wang et al., 2012)

Conclusion:-

In our study we found that, Type 2 Diabetes Mellitus groups had higher level of proinflammatory markers such as TNF- α and IL-6 than healthy controls, with a highly significance p-value.

Conflict of interest statement

The authors stated that they have no conflicts of interest regarding the publication of this article.

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