

Evaluation of Interleukin -6, -10 and C-Reactive Protein Levels in Type 2 Diabetic Patients Without or With Consumption of Antioxidants

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Abstract: *The objective was to evaluate the levels of biomarkers especially IL-6, IL-10 and CRP in T2DM patients compared to diabetic patients consumed antioxidant. Among total 60 patients who were presented T2DM where it was categorized group A (n=30) without consumption and group B (n=30) who consumed antioxidants. All the estimated data for IL-6, IL-10 and CRP were collected for group A and group B separately. Further processed for statistical analysis. When compared to group A (0.78 ± 0.19), a highly significant ($P < 0.0001$) decrease was observed in group B (0.53 ± 0.21) for IL-6 ($\mu\text{mol/dl}$). A highly significant ($P < 0.0001$) increase in IL-10 (pg/ml) was observed in group B (8.07 ± 0.85) when compared to group A (3.10 ± 0.52). When compared to group A (7.33 ± 1.45), group B (4.09 ± 0.97) exhibited a highly significant decrease in CRP (mg/L) ($P < 0.0001$). It is concluded that antioxidants have capacity to reduce the levels of biomarkers.*

Keywords: Biomarkers, Diabetes mellitus, Dietary antioxidants, Diabetes management

1. Introduction

T1DM's pathogenesis heavily relies on inflammatory processes, but those who advance to T2DM demonstrate signs of low-grade inflammation throughout the course of the disease. It is believed that this low-grade inflammation plays a role in the pathogenic processes that lead to T2DM. [1] Beta-cell failure to compensate for peripheral insulin resistance has been recognized as a characteristic of T2DM. [2] Both forms of diabetes mellitus (DM) are characterized by a complete or partial deficiency of insulin production required to preserve normal "glucose homeostasis". In T1DM, there is a whole or nearly full breakdown of the β -cells, but in T2DM, there is a steady decrease in cell function and a comparatively smaller mass of β -cells due to the rising rate of apoptosis. [3]

Moreover, "interleukin-6 (IL-6)" is a "pleiotropic cytokine" that plays a significant role in both "immunoregulation and nonimmune processes" in the majority of cell types and tissues outside the "immune system". [4] A rising trend in the level of IL-6, which is a predictor of the development of T2DM. [4-6] However, according to research examining both factors, and C-reactive protein (CRP) appears to be a more accurate predictor than IL-6. [4,6]

Numerous studies have shown the effects of IL-6 on "insulin sensitivity and secretion". [7-10] IL-6 is one of several proinflammatory cytokines that have been linked to insulin resistance in T2DM, where a 2 to 3-fold rise in circulating IL-6 has been seen, according to Senn et al. [7]

Additionally, it has been discovered that those who have T2DM have greater levels of CRP created by the liver, which is a delicate indicator of systemic inflammation. [1,2,11,12] The liver creates CRP, which has been shown to be a delicate and systemic indicator of inflammation. [3] According to a meta-analysis of 18 potential studies, the overall relative risk (RR) of T2D was 1.26 for each log mg/L increase in CRP levels. [4]

Nevertheless, in a meta-analysis, [4] the majority of the studies have been conducted in "US or European populations", and two studies were performed in Japanese adults. [6,13] The link between these markers and risk of new-onset T2DM in patients in eastern India, the study is lacking in this respect. The present study was evaluated to know the level of IL-6, IL-10 and CRP in T2DM patients compared to diabetic patients consumed antioxidant.

2. Materials and Methods

2.1 Study groups

In the present study, patients were categorised into 2 groups as per previous study. [14]

2.2 Collection of records for biochemical profiles

All the estimated data for IL-6, IL-10 and CRP were collected for group A and group B separately. Further processed for statistical analysis.

2.3 Statistical analysis

Statistical tool (PAST, version 3.25) was used for categorical variables and expressed them in percentage frequency distribution and continuous variable expressed as Mean \pm SD and comparison were made between group A and group B patients as per student 't' test. Less than 0.05 is regarded as a significant p value.

3. Results

Table 1 determines the distribution of IL-6 frequency (%) across patients in groups A and B. Group A had the highest frequency (25, 83.33%) for $< 1.0 \mu\text{mol/dl}$ and the lowest frequency (5, 16.67%) for $> 1.0 \mu\text{mol/dl}$, while group B had

the highest frequency (28, 93.33%) for <1.0 $\mu\text{mol/dl}$ and the lowest frequency (2, 6.67%) for >1.0 $\mu\text{mol/dl}$.

Table 1 determines the percentage distribution of IL-10 between patients in groups A and B. For group B, the maximum frequency (27, 90.0% and 30, 100.0%) was observed at >2.5 pg/ml, whereas for group A, the lowest frequency (3, 10.0% and 0, 0.0%) was recorded at <2.5 pg/ml.

Table 1: IL-6 and IL-10 distribution

IL-6 ($\mu\text{mol/dl}$)					
Group A	Frequency	%	Group B	Frequency	%
<1.0	25	83.33	<1.0	28	93.33
>1.0	5	16.67	>1.0	2	6.67
Total	30	100.00	Total	30	100.00
IL-10 (pg/ml)					
<2.5	3	10.0	<2.5	0	0.0
>2.5	27	90.0	>2.5	30	100.0
Total	30	100.00	Total	30	100.00

CRP frequency (%) distribution is evaluated between groups A and B patients in Table 2. The maximum frequency for group A was >5.0 mg/L (27, 90.0%), and the minimum frequency for group B was \leq 5.0 mg/L (3, 10.0%). For group B, the maximum frequency was \leq 5.0 mg/L (25, 83.33%), and the minimum frequency was >5.0 mg/L (5, 16.67%).

Table 2: CRP distribution

CRP (mg/L)					
Group A	Frequency	%	Group B	Frequency	%
\leq 5.0	3	10.0	\leq 5.0	25	83.33
>5.0	27	90.0	>5.0	5	16.67
Total	30	100.00	Total	30	100.00

A comparative study of the mean \pm standard deviation (SD) of IL-6, IL-10, and CRP biomarkers between diabetic individuals who did not consume antioxidants (group A) and those who did (group B) is shown in Table 3. When compared to group A (0.78 ± 0.19), a highly significant ($P < 0.0001$) decrease was observed in group B (0.53 ± 0.21) for IL-6 ($\mu\text{mol/dl}$). A highly significant ($P < 0.0001$) increase in IL-10 (pg/ml) was observed in group B (8.07 ± 0.85) when compared to group A (3.10 ± 0.52). When compared to group A (7.33 ± 1.45), group B (4.09 ± 0.97) exhibited a highly significant decrease in CRP (mg/L) ($P < 0.0001$).

Table 3: Comparative analysis of mean IL-6 and CRP level between group and B

Parameters (Mean \pm SD)	Group A (n = 30)	Group B (n = 30)	p-value
IL-6	0.78 ± 0.19	0.53 ± 0.21	0.0001
IL-10	3.10 ± 0.52	8.07 ± 0.85	0.0001
CRP	7.33 ± 1.45	4.09 ± 0.97	0.0001

4. Discussion

In this study, the biochemical markers viz. IL-6, -10 and CRP levels were significantly reduced in T2DM patients who had consumed antioxidant for a year.

Tangvarasittichai et al. [15] found that the frequency of T2DM in patients is strongly correlated with insulin resistance, CRP, and IL-6. In addition, the etiology of T2DM is greatly influenced by inflammatory mechanisms. Prior to the start of

diabetes mellitus (DM), all individuals who acquire T2DM display signs of low-grade inflammation. This low-grade inflammation in the pathogenetic processes that lead to T2DM reported by Yusuf et al. [16] Bashir et al. [17] recently revealed that the pro and inflammatory cytokines (TNF- α , IL-6, CRP) were involved in insulin signaling pathways, cross-linking, and the eventual development of insulin resistance in the β -cells of the pancreas, which increased the risk of T2DM. Nwadiugwu [18] on the other hand, stated that consuming healthy dietary supplements raised IL-10 levels and prevented the advancement of T2DM patients by boosting anti-inflammatory actions and suppressing inflammatory activities.

Many natural compounds that include antioxidants are known to be able to prevent inflammation in type 2 diabetes. According to a meta-analysis by Asbaghi et al., [19] drinking green tea considerably lowered CRP levels (weighted mean difference (WMD): -5.51 mg/dl, 95% CI: -9.18 to -1.83, $p = 0.003$). Healthy dietary supplement consumption may be able to protect DM patients from unfavorable consequences by lowering inflammatory activities and raising anti-inflammatory events, according to Nwadiugwu. [18]

The current study has supported some other findings that antioxidants have the potential to lessen IL-6 and CRP levels and raise IL-10 levels in T2DM. According to Zarezadeh et al., [20] Schell et al., [21] and Homayouni et al., [22] dietary supplements like ginger powder, dietary raspberries, and hesperidin were effective anti-inflammatory interventions.

According to Homayouni et al., [22] and Schell et al., [21] the IL-6 concentration dropped significantly ($p < 0.05$). However, Schell et al. [21] found no significant change in CRP after consuming "red raspberries", but they did report a consistent and significant ($p < 0.05$) reduction in IL-6 after consuming raspberries daily for four weeks.

5. Conclusions

The current research found that among the dietary antioxidants, those who had consumed natural antioxidants over the previous year benefited from preventing T2DM. In this study, dietary supplements containing natural antioxidants such as vitamins E and C, as well as alpha-lipoic acid, were shown to lower IL-6 and CRP inflammatory indicators while raising IL-10 levels. Although this research doesn't explain the mechanism underlying the antioxidant activity, no negative effects have been observed in patients who have used natural antioxidants. In the future, a clinical experiment is proposed to ascertain the effectiveness of natural antioxidants in treating T2DM.

Conflict of interest

Authors declare no conflict of interest.

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