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Physiological study of (IL-6 and IgG) immune responses related to iron deficiency patients in Babylon City

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Abstract:

Iron deficiency's significance is an issue of public health that depends on its consequence on health. The effects of iron shortage on haemoglobin (Hb) have been the subject of the most investigation. Level and immune function, Iron-deficiency, or decreased Hemoglobin (Hb) levels are the main reason for anaemia in patients included in this study. Data on how iron deficiency affects immune function are frequently ambiguous and contradictory. This study aims to assess the impact of iron deficiency anaemia on immune responses (IL-6 and IgG); a total of (40) subjects, 20 patients with IDA (10 male & 10 female), and a healthy 20-control group (10 females & 10 males) were included from Babylon Teaching Hospital\ Iraq. All patients were subjected to clinical examination for Hb, IL-6 and IgG serum assay levels. Patients had considerably lower IL-6 and IgG levels compared to control groups, even though there was no noticeable difference between the control group and the patients. The relationship between serum iron and IL-6 levels was considerably positive (P-Value = 0.001). We recognized that IL-6 & IgG are

influenced among IDA patients more than in the control group. Iron can adjust Hemoglobin (Hb), innate and adaptive immunity elements such as ILs and antibodies.

Introduction

Health balance in the human body depends on maintaining iron levels [1]. The body needs iron because it uses it to make Hb, a vital element of red blood cells [2, 24]. Reducing the amount of haemoglobin in the blood is one of the symptoms of anaemia. It is a significant public health issue that affects both developed and developing nations, significantly impacting people's health and economic and social development [3]. Iron deficiency anaemia (IDA), a hidden but severe health issue, is widespread in developed nations [4]. A decrease in red blood cells and the blood's Hb content characterises this

condition [5].

According to recent studies, iron can potentially treat immune-related diseases [6]. Numerous studies on CMI and humoral have been conducted on iron insufficiency in animals and humans, primarily in vitro. Although CMI impairment in IDA humans has been thoroughly characterised, there is minimal proof of severe humoral deficits. Some people with iron deficiency, an unknown cause, be more susceptible to infections. It is generally known that both humans and experimental animals with iron deficiencies have weakened immune systems. Therefore, clinical and basic studies must examine the connections between immune control and iron levels [7].

Interleukin-6 (IL-6) has humoral and cellular immunological impacts on host defence, inflammation, and tissue injury [8]. Infection is just one of the many things that cause it to be produced, INF-a and TNF [9,10]. This study aimed to evaluate the iron deficiency effects on significant depression in some immune responses such as IL-6 and IgG in patients with anaemia than in healthy control persons.

Materials and Methods

Study demography & population:

This randomized study was conducted from November 2022 to March 2023. A total of (40) subjects were included; (20) IDA patients (10 male & 10 female), also (20) healthy control group volunteers (10 male & 10 female) aged (25-55) years who attended Hematology & Microbiology Units at Babylon Teaching Hospital at Babylon City\ Iraq.

Collection of blood samples:

Venipuncture was used to obtain a blood sample of (5 ml) from every participant, and the remaining (2 ml) was taken and placed in an EDTA vacutainer tube to estimate the Hb level (Haematological Analysis) [11].

The other (3 ml) were collected in a plain tube, and blood was allowed to clot. Serum separated and stored at $\pm 20^{\circ}\text{C}$ until used for the serum IL-6 & IgG immune responses estimation (Immunological Analysis) [12].

Considerations of Ethics:

The ethics committees of Iraqi medical institutes granted their consent, and every school was chosen as a place for the collection of samples. Before participating in the current research, informed consent was obtained from each participant and their family.

Statistical Analyses:

The following methods were used to analyse the data: Standard Deviation (SD) and done to detect data significance at (P-Value=0.001).

Results & Discussions:

The present randomized study was conducted from November 2022 to March 2023. A total of (40) subjects; (20) IDA patients (10 male & 10 female), also (20) healthy control group volunteers (10 male & 10 female), all aged between (25–55) years, were included in this study, who attended to Hematology & Microbiology Units at Babil Teaching Hospital at Babylon City\ Iraq.

Table (1) shows the Standard Deviation (SD) values of hematologic outcomes Hb g/dl or iron level of patients & Control healthy groups in both sexes, where patients had significantly lower Hb (serum iron) levels, with (P-Value=0.001) than controls in both sexes, with (P-Value=0.001).

Table (1): Standard Deviation (SD) values of hematologic outcomes Hb g/dl of patients & Control groups in both sexes at (P-Value= 0.001).

Parameter	Sex	Animatic patients	Control	P-Value
Hemoglobin (Hb) g/dl	Male	11.13±0.8	15.11±1.2	0.001
	Female	10.03±0.7	12.10±0.6	0.001

Table (2) shows the Standard Deviation (SD) values of immunologic outcomes (IL-6 & IgG) of patients & Control groups in both sexes, were patients had considerably lower “IL-6” and IgG immune response levels than in control, even though there was no apparent distinction between controls and patients in other IL-6 and IgG than in controls in both sexes, at (P-Value=0.001). While serum iron and other immunological parameters did not significantly correlate, there was a substantial positive connection between IL-6 and serum iron (as IgG level) in both sexes, at (P-Value=0.001) [13].

Table (2): Standard Deviation (SD) values of immunologic outcomes (IL-6 & IgG) of patients & Control groups in both sexes at (P-Value= 0.001).

Parameter	Sex	Animatic patients	Control	P-Value
Interleukin-6	Male	6.45±3.2	11.89±0.8	0.001
	Female	6.10±1.4	10.12±0.5	0.001
IgG	Male	8.23±3.2	12.13±0.4	0.001
	Female	9.12±1.4	12.03±0.4	0.001

These findings imply that IDA impacts immunity to humour and the function of cytokines, which are crucial to numerous stages of the immunogenic mechanism. According to experimental findings from recent years, iron is essential for the proper growth of the immune system; the ability to mount a sufficient immune response is impacted by its absence.

In our study, IDA patients had considerably lower serum IL-6 levels versus controls. An exciting finding was that, despite little connection between serum iron and other immunological indicators, there was a highly favourable correlation between serum iron and IL-6 [14], reported lower levels of IL-6 in IDA patients [15].

Although iron deficiency affects some cytokines' release, cytokines are crucial for preserving intracellular iron stability. During our research, the IDA group's serum IL-6 levels were considerably lower than those of the control group. A cytokine called IL-6 activates B cells. Numerous researchers observed decreased levels of various cytokines. Patients with IDA have lower levels of IL-6, according to Feng-Xue et al. In the study by Sipahi et al., there was no difference between IDA's serum levels of IL-6 before and after taking iron supplements [16]. At the same time, Jason et al. found that IL-8 levels fell, and IL-6 levels increased in their study of kids with chronic IDA [17].

Others claim that iron supplementation did not affect the level of IL-6 [18]. The recognised reciprocal (cause-effect) connection between iron and cytokine production can explain the strong positive correlation between iron and IL-6 discovered in our investigation [19]. Although the precise methods of iron deficiency affecting the immune system are still unknown, some writers have proposed that changed amounts of some ILs and cytokines (e.g., IL2, IL1, IL6, TNF-a, IL-4, IL-12, and IL-10) may compromise IDA patients' immune systems [20].

IgG levels in our study were substantially lower in patients compared to controls, although IgA and IgM levels did not significantly differ between controls and patients. IgG, IgM, and IgA subclass serum levels in IDA patients were studied by Ekiz et al. [21,22,23].

To investigate humoral immunity, we examined the serum levels of IgG in both the control and study groups. There was a statistically significant difference in the IgG levels in the control and study groups. He also displayed a decline in levels of serum immunoglobulin in 1975. IgG and IL-6 levels were dramatically lowered, according to Ekij et al. The tiny subject population in both of this research is a

significant limitation. However, a different study found that humoral immunity, which seems less impacted by iron shortage than cellular immunity, is unaffected by iron insufficiency. Nevertheless, it might decrease a few aspects of innate and adaptive immunity.

Conclusions

1. Iron deficiency or decreased Hemoglobin (Hb) levels are the primary reason for anaemia in patients included in this study.
2. In our study population, iron insufficiency is a relatively common condition. In-depth research is required to enhance the country's iron supplementation programs and children's diets.
3. Both IL-6 & IgG immune responses are decreased in IDA patients than in the healthy control group in both sexes.
4. Iron, essential for living cells, could control Haemoglobin (Hb) levels and innate and adaptive immune components, including ILs and antibodies. Reviewing iron deficiency's connection to infection risk becomes more crucial due to its contradicting impact on defence mechanisms.

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