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Interleukin 1 and Interleukin 2 as Important Diagnostic Markers in Patients Infected with Salmonellosis

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ABSTRACT

Background: Salmonellosis is enteric disease caused by *Salmonella typhi* (*S.typhi*). Humans are infected with it and it is transmitted through contaminated foods**.**

Objective: The aim of the current study is to compare between two Interleukins (IL-1 and IL-2) levels in patients serum infected with *S.typhi*.

Patients and methods: A case control was conducted in our university hospital. The study included 60 patients with Salmonellosis and 30 healthy individuals as controls. ELISA technique was used to determine the concentrations of IL-1 and IL-2 in the serum of all individuals with acute and chronic typhoid based on a positive blood culture and IgM/IgG test. **Results:** A total of 33 patients with acute infection and 27 with chronic infection have been diagnosed. IL-1 and IL-2 in acute and chronic infections were higher than in the control group (P values <0.0001 and <0.032, respectively). **Conclusions:** Humans with Salmonellosis have higher serum levels of IL-1 and IL-2 depending on the severity and duration of the illness and may be used as a diagnosis marker.

Keywords: Salmonellosis, Interleukin-1, Interleukin-2, Acute infection, Chronic infection, Case control study, University of Kufa.

INTRODUCTION

Salmonella typhi is a bacterium that can cause salmonellosis, which is a foodborne illness. It is a bacterium that lives in and on poultry and beef products (e.g., raw eggs) as well as contaminated food and water **(1).** Foodborne illnesses are caused by consuming food or drink contaminated with pathogenic bacteria. Most people infected with *Salmonella typhi* usually develop a mild illness such as diarrhea, fever, nausea, and vomiting. Severe infections in young children can cause ear infections or pneumonia **(2).**

The infection is usually ingested from the animal's feces. It can also be transferred through contaminated water when hands come in contact with the meat and then the mouth. In recent years, the role of interleukins in immunity has been recognized as an important element in health, are a group of proteins that work together to regulate the immune response. There are a variety of types of ILs and each plays a role in protecting the body against infection and disease such as IL-17, IL-1 and IL-2 **(2).**

Depending on the strain and the host's immune system, the severity of infection caused by these bacteria varies **(3).**

S.typhi and *S.paratyphi* are only found in humans since typhoid fever is spread via oral transmission due to contaminated food and water **(4).** The pathogens responsible for these diseases have been considered a significant threat worldwide, especially in developing countries **(5).**

Typhoid fever causes about 27 million new cases yearly and approximately 90% of typhoid deaths occur **(6).** The immune system, both innate and cell-mediated, plays an important role in protecting the host against *S.typhi* infections, the interleukins in particular, play an important role in enhancing the defense of the host against acute and chronic infections led by *S.typhi* **(7).**

As a result of their role in promoting leukocyte survival under bacterial infection conditions, the role of mast cells, T-helpers 2, basophils, and eosinophils in imm unity and their role in stimulating B-cell differentiation, as a cytokine, interleukin-1 is released by mast cells, T-helper 2 cells, and basophils **(8,9).** When patients are infected with S.typhi, interleukin-2 plays an important role in preventing infection by recruiting neutrophils to the intestinal mucosa **(10).**

However, there were few studies about the role of IL-1 and IL-2 in human models due to a lot of published articles of the immune response in laboratory animals infected with salmonellosis. Study subjects were assessed for IL-1 and IL-2 levels in serum after acute and chronic *Salmonella typhi* infection. The aim of the current study is to compare between two Interleukins (IL-1 and IL-2) levels in patients serum infected with *S.typhi*.

PATIENTS AND METHODS

A case control was conducted in our university hospital. The study included 60 patients with Salmonellosis and 30 healthy individuals as controls.

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Microbiological tests and Vitek2® system tests were conducted on all S.typhi isolates to determine the diagnosis [11,12].

Acute and chronic typhoid patients have been diagnosed according to positive blood culture and IgM/IgG test [13,14]. Interleukin-1 and IL-2 has been measured in all individuals' serum using ELISA technique [15,16].

Ethical Considerations

This study was ethically approved by the Institutional Review Board of Kufa University's College of Science and General Teaching Hospital in AL-Najaf City. Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The study was conducted using Graphpad-Prism V.10 computer software [17,18]. Qualitative data were defined as numbers and percentages. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as means and standard deviation (SD), and independent sample t-test was used for comparison between groups. P value ≤0.05 was considered to be statistically significant [19,20].

RESULTS

Among 60 patients infected with *S.typhi*, 33 had acute infections and 27 had chronic infections.

Figure 1 indicated that there was significant increase (P-value 0.0023) in IL-1 level of total typhoid patients (335.11 ± 21.15 pg/ml) compared to the controls (211.88 ± 20.23 pg/ml), and significant differences (P-value 0.0382) between acute (236.72 ± 13.52 pg/ml) and chronic infection (484.34 ± 53.19 pg/ml).

Figure 2 demonstrated a very significant rise (P-value 0.0001) in IL-2 levels in all typhoid patients (249.95 ± 20.18 pg/ml) as compared with controls (51.054 ± 2.01 pg/ml) and a comparable substantial increase (P-value 0.032) was observed between acute infections (200.48 ± 21.21 pg/ml) and chronic infections (320.29 ± 23.15 pg/ml).

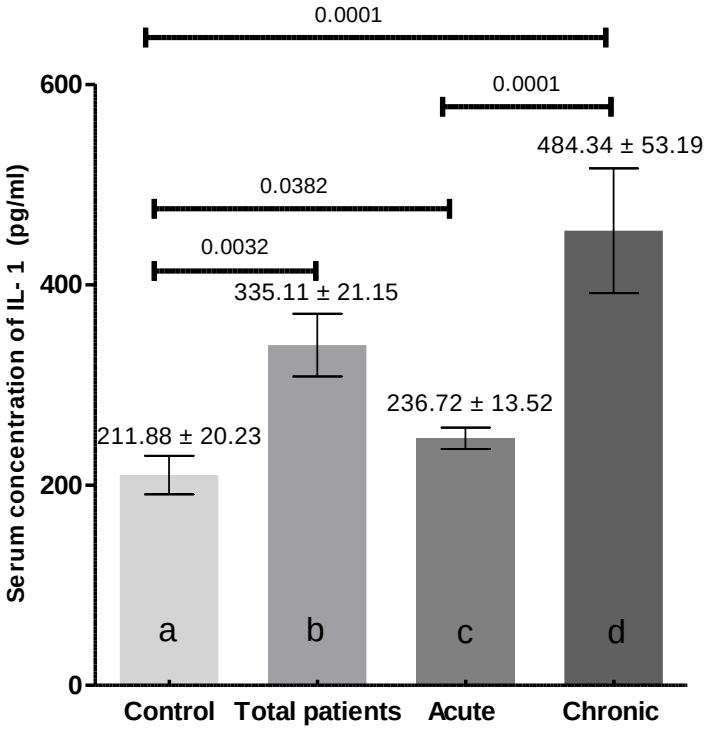

Figure 1: IL-1 levels in patients and controls.

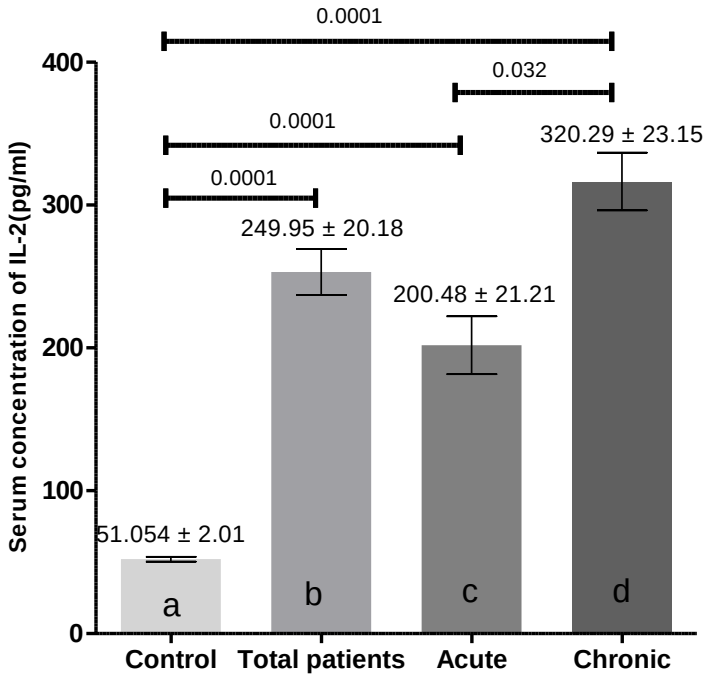

Figure 2: IL-2 levels in patients and controls.

DISCUSSION

As an initial line of defense against different infections such as salmonellosis, innate immunity plays an important role in responding to bacterial infections [(21)]. In the early stages of infection after salmonellosis, the innate immune system has a number of mechanisms that ensure the host's survival, including: increasing macrophages, neutrophils, and dendritic cells, preventing bacterial replication, and releasing cytokines, which activate inflammatory cells and recruit them to the infection site [(22)].

Acute and chronic salmonellosis infections are examined in the current study in order to assess IL-1 and IL-2 levels. Compared to control patients, patients infected with acute and chronic salmonellosis infections were significantly more likely to have high levels of IL-1. Interleukin-1 is a cytokine produced by mast cells, basophiles, eosinophiles, and T-helper 2 that aids in preventing macrophage, lymphocyte, and endothelial cell apoptosis, as well as helping to regulate cell division [(23)]. As a result of increased neutrophil responses against bacterial infections, IL-1 receptor signaling has been shown to play an important role in immune response type 2, inhibiting neutrophil formation outside traps and inhibiting the effects of granulocyte colony stimulating factor on neutrophils. IL-1R signaling protects the body from neutrophil-induced damage and bacterial infection by interacting with neutrophils in a positive manner [(24)]. As shown in **Figure 2**, acute and chronic salmonellosis patients showed a significant increase in interleukin-2 concentration when compared with controls. Interleukin-2 is produced by epithelial barrier cells. As a result, it plays an essential defense role in the host against both extracellular and intracellular bacterial infection, whether acute or chronic [(25)].

There are two important mechanisms by which interleukin-2 protects the body from infection; its production of antibacterial peptides is dependent on the interactions between IL-2 and IL-22 on epithelial cells, as well as its ability to induce chemokines in gut and lung epithelial cells, which attract neutrophils to infections [(26)].

CONCLUSIONS

It may be possible to use the interleukin 1 and 2 serum levels as a diagnostic marker in patients infected with salmonellosis depending on the duration and severity of the illness.

Conflict of interest: Not found.
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