

# Detection of secondary syphilis among blood donors and evaluation of gamma interferon levels

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## ABSTRACT

**Background.** Syphilis is one of the important blood transfusion disease that has 3 stages and characterized by latency phase. The goal of this study is detection of demographic categories related to syphilis and cell-mediated immunity in denotation of gamma interferon.

**Methods.** The study was done in the main blood bank in Thi-Qar province-Iraq during the period from January 2020 to December 2021, the demographic data including age, gender, address and occupation. The infection was diagnosed by using TPHA technique, while, gamma interferon concentration was detected by ELISA technique according to the manufacturer instruction.

**Results.** The study record low level of syphilis (0.5438%) among blood donors, high significant differences in the parameters of study, the age group 31-40 revealed high percent of infection (44%) and high percent of infection occur in male (99.7%). Also, high significant differences were recorded in distribution of infected donors according to occupation, where gainers (72.5%) represent the most infected group than others and the blood donors that inhabits urban area (70.19%) were most exposed to syphilis infections than those in rural areas. The IFN- $\gamma$  level was high significance in the infected donors ( $19.651 \pm 9.009$ ) when compared with the controls under ( $p$  value= 0.000).

**Conclusion.** In brief, syphilis has low prevalence among blood donors in Iraqi community, with significant differences among categories of demographic data. The study revealed strong cell-mediated immune response in infected blood donors characterized by high levels of gamma interferon.

**Keywords:** secondary syphilis, risk factors, blood safety, gamma interferon, blood donors

## INTRODUCTION

Syphilis is a multistage illness with asymptomatic periods of latency. The primary and secondary phases of syphilis are distinguished by a painless chancre at the original site of infection, followed by a non-pruritic rash, both of which cure spontaneously [1]. The World Health Organization (WHO) takes on a survey of the incidence of four sexually transmitted diseases: *Chlamydia trachomatis*, *Neisseria gonorrhea*, *syphilis*, and *Trichomonas vaginalis*. It was discovered that syphilis accounts for around 10% of these sexually transmitted infections [2].

Blood donation is a vital operation that saves millions of lives every year. Unsafe transfusion techniques, on the other hand, raise the possibility of transfusion-transmissible diseases (TTIs). A hazardous blood transfusion is both economically and humanely costly, not just for the patients but also for their families and communities [2,3].

The risk factors for syphilis-infected blood donors are likewise risk factors for other blood-borne illnesses [3,4]. Currently, screening for high-risk groups prior to blood donation is solely dependent on pre-donation health consultation. They donate

blood or need to postpone and withdraw from blood donation based on the medical history and harmful conduct of blood donors [5].

Interferon-gamma (IFN- $\gamma$ ) a cytokine having several functions in innate and adaptive immune responses. T cells, NK cells and NKT cells are the principal producers of IFN- $\gamma$ , which has a wide range of effects in both host defense and immunological control, including antiviral, antibacterial, and anticancer activities, IFN- $\gamma$  has been demonstrated to be critical in the function and maturation of a variety of immune cells. IFN- $\gamma$  is required for Th1 immune responses and governs T cell development, activation, expansion, homeostasis, and survival. T cells must produce IFN- $\gamma$  to destroy intracellular infections. NK cells release IFN- $\gamma$  early in host infection, promoting immune cell recruitment and activation. IFN- $\gamma$  also stimulates NK cells, increasing their cytotoxicity and cell-mediated immune responses [6].

MATERIALS AND METHODS

Blood donors

The data and blood specimens were collected from the blood donors in the main blood bank in Thi-Qar province during the period from January 2020 to December 2021, the demographic data including age, gender, address and occupation.

Ethical consideration

All formal procedures of the acceptance had been taken from the scientific committee of the microbiological department of college of medicine – Thi-Qar University, and research and development unit of the Thi-Qar health Directorate, and management office of main blood bank/Thi-Qar province.

Specimens

Diagnosis of syphilis

The infection was diagnosed by using the TPHA technique by commercial kit provided by (Foresight –USA) and the test performed according to the manufacturer.

Gamma interferon assay

A total of 60 serum specimens from blood donors that gave a positive result for syphilis detection test (TPHA) and 30 apparently healthy male as control group were included in this study. The interferon- $\gamma$  levels were detected by using a kit provided from (RayBio – USA) and this was accomplished according to the manufacturer instruction.

Statistics

The statistical package for the Social Sciences (SPSS) program (version 19) is used for the mana-

gement of data by Chi square and ANOVA tests. The correlation between parameters was performed by Pearson correlation coefficient test.

RESULTS

The study showed a low percentage of syphilis occurrence (0.5438%) among blood donors in Thi-Qar province-Iraq.

TABLE 1. The frequency of secondary syphilis among blood donors

Syphilis \ Frequency	No.	Percent (%)
Infected	302	0.5438
Non infected	55530	99.4562
Total	55832	100

Table 2 revealed high significant differences in the parameters of study, the age group 31-40 showed a high percentage of infection (44%) when compared with other groups and the majority of infections occur in male 301 donors, out of 302 donors were male blood donors who showed a higher frequency of infections than female donors (99.7%). Also, high significant differences were recorded in the distribution of infected donors according to occupation where gainers (72.5%) represent the most infected group, the blood donors that inhabits urban areas (70.19%) were more exposed to syphilis infections than those in rural areas.

TABLE 2. The distribution of syphilis infected blood donors according to demographic parameters

Characteristic		Frequency	Percent (%)	X <sup>2</sup> . p value <0.05
Age groups	<20	3	1.0	189.755, 0.000
	21-30	22	7.3	
	31-40	133	44.0	
	41-50	96	31.8	
	>50	48	15.9	
	Total	302	100.0	
Gender	Male	301	99.7	298.013, 0.000
	Female	1	.3	
	Total	302	100.0	
Occupation	Gainer	219	72.5	691.536, 0.000
	Officer	36	11.9	
	Retired	10	3.3	
	Militarism	19	6.3	
	Policeman	17	5.6	
	Student	1	0.3	
	Total	302	100	
Address	Urban	212	70.19	220.735, 0.000
	Rural	90	29.81	
	Total	302	100.0	

**TABLE 3.** The relationship between age groups and occupation among infected blood donors

Age \ Occupation	Gainer	Officer	Retired	Militarism	Policeman	Student	Total	X <sup>2</sup> , p value
<20	3	0	0	0	0	0	3	37.447, 0.010
21-30	16	1	1	0	4	0	22	
31-40	94	20	0	8	10	1	133	
41-50	70	11	3	10	2	0	96	
>50	36	4	6	1	1	0	48	
Total	219	36	10	19	17	1	302	

The results showed significant relation between age and occupation ( $X^2 = 37.447$ ,  $p$  value = 0.010), while there was no relation to other parameters.

The results in table 4 revealed high levels of IFN- $\gamma$  in the infected donors ( $19.651 \pm 9.009$ ) when compared with the controls ( $7.096 \pm 4.931$ ) with high significant differences ( $p$  value= 0.000).

**TABLE 4.** The concentration of IFN- $\gamma$  in the syphilis infected blood donors and controls

Cases	Mean pg/ml	$\pm$ St. D.	Minimum	Maximum	Sig., P value <0.05
Patients	7.096	4.931	3.802	20.301	0.000
Control	19.651	9.099	3.610	43.006	

## DISCUSSION

Some infectious diseases such as hepatitis B and C viruses, HIV and syphilis are being tested in the world's blood banks to prevent transmission to patients who receive blood. Transport is one of the most important risk factors for transmitting these diseases, which represents a public health problem facing health institutions [7,8].

Syphilis is a sexually transmitted disease mainly caused by bacteria *T. pallidum*. It can also be transmitted through blood transfusions. The complications of the disease in the absence of treatment include damage to the eyes, bones and brain, which may be fatal [9,10].

The infection rate among the donors under study was low (0.5438%), which is similar to what was found by a number of researchers [11,12] and this may be due to the presence of similarities in social habits, economic conditions and cultural level. In addition to the religious factor that prohibits illegal relations. While the study did not agree with previous studies, this may be due to the difference in cultures and customs between societies and the difference in the size of the samples studied [13].

The infection rate of males was much higher than females, and this is due to the nature of the Iraqi society, which gives a wide area of freedom to males compared to females, a society in which there are imposed controls and customs on females that prevent their contact with males, in addition to the

country's openness to other countries and the frequent travel to other countries, which leads to an increase in the incidence of diseases [13,14]. Different rates of infection were few, one of which is syphilis, in addition to the low material income, which leads to a reluctance to marry and an increase in cases of illegal sexual intercourse.

The study proved a significant increase in injuries among people who engage in self-employment (the earner) compared to other groups with a high moral difference which is not accepted by other studies [15] that detected high prevalence of infection in the students. This may be due to the fact that this group is more free and connected to other groups of society and has a more direct interaction with females than other groups under study such as the military and police. They are subject to strict controls and instructions that greatly reduce their contact with the opposite sex, in addition to the weak cultural and educational level of members from this group, especially sexual education, compared to other groups [16].

The infection of blood donors living in cities was higher than their counterparts from urban areas, that are accepted by some studies [17] and this may be due to the large size of the civil society and its increased contact with other societies, with the availability of a space of freedom for urban residents that the rural residents lack. They are subject to strict social and tribal ties and customs that reduce contact between the sexes and prevent women from contact with men, which leads to fewer injuries to the rural population.

The study showed a significant increase in the concentration of gamma-interferon in the affected donors compared to the control group, which is consistent with the findings of previous studies [18,19] and there is evidence of the immune system controlling the infection and preventing the emergence of symptoms, especially since the patients in the second stage of infection (secondary syphilis), which is characterized by a strong cellular response that limits the development of infection, as this cytokine plays an important role in the response of T helper cells 1 to infection and the production of important cellular cycles such as before which contributes to

defense against bacteria in addition to the ability of this to activate phagocytic cells to charge the causative bacteria and make the bacterial infection inactive [20-22].

## CONCLUSION

In brief, syphilis has low prevalence among blood donors in Iraqi community, with significant differences among categories of demographic data.

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