A Study of Relationship between SARS-CoV-2 Antibodies Levels and Host Factors among General Population in Zakho City, Iraq

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Abstract

Objectives: The aim of this cross-sectional study is to evaluate the seroprevalence of total antibodies to SARS-CoV-2 and associated risk factors in Zakho City, Kurdistan Region of Iraq.

Methods: This cross-sectional study was performed at Zako City, Northern, Iraq. Blood samples were collected from different districts of Zakho City between January and March 2021. Immunoassays were performed to detect the total antibodies against SARS-CoV-2, and the associations between several variables were investigated.

Results: A total of 315 participants were agreed and enrolled in the study. The average age of the participants was 32.87 ± 13.25 years. Among the participants, 214/315 (67.93%) were found to have antibodies against SARS-CoV-2. Among those who had positive antibodies, 169/214 (78.97%) were asymptomatic and 45/214 (21.03%) had a history of COVID-19 related symptoms. The most common symptom was fever (95.56%), followed by loss of smell (84.44%) and myalgia (80.0%). We found that antibody levels significantly associated with age ($P = 0.021$). The presence of symptoms was significantly higher among subjects with a history of comorbidity diseases ($P = 0.038$), and older people ($P = 0.015$). A significant association was found between antibody levels and the marital status ($P = 0.014$), chronic diseases ($P = 0.001$), presence ($P = 0.015$) and duration of symptoms ($P = 0.028$).

Conclusion: A significant association between antibody levels to SARS-CoV-2 and age, chronic diseases, presence and duration of symptoms were found in this study. Seroprevalence studies of antibodies to SARS-CoV-2 among general population are of utmost importance to develop infection prevention programs in our society.

Keywords: SARS-CoV-2, antibodies, risk factors, Zakho City, Iraq

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic is considered the most important healthcare crisis around the world since the discovery. This virus causes coronavirus infection (COVID-19) which was first discovered as an outbreak in December 2019 in Wuhan City, China and then rapidly spread throughout the world.[1] The common clinical symptoms of the infection are fever, cough, shortness of breath, diarrheal, fatigue and myalgia.[2-6] The infection may cause a clinical syndrome that may include pneumonia, respiratory failure, thromboembolic phenomena and eventually death in severe cases.[7] In February 2020, the first cases of COVID-19 infection were reported in Kurdistan Region, Northern Iraq. With the appearance of the first COVID-19 cases in Iraq, strict control measures were implemented in the Kurdistan Region to stop the spreading of such infection.[8] After the measures were relaxed, a sharp increase in morbidity and mortality was recorded in the region. It was also reported that the re-infection rate of this virus in the region is very low.[9] This report aimed to evaluate seroprevalence rate of total antibodies to SARS-CoV-2 and association between host factors and the levels of antibodies among general people in Zakho City, Iraq.

Materials and Methods

Study Setting and Sample Collection

This cross-sectional study was performed at Zakho City, Duhok province, Kurdistan Region, Northern Iraq. Samples were collected randomly from different districts of Zakho City between January 10, 2021, and February 10, 2021. Five millilitres of venous blood samples were collected using aseptic condition using disposable syringes. The blood samples were immediately transported to the laboratory, and sera were then separated from the blood at 3500 rpm for 10 min and kept frozen at –20°C until required.

Inclusion Criteria

A people more than 16 years old and resident at Zakho City was included in the study, and agreed to participate in the study. The people who did not agree to participate and those who were absent on the day of sample collection were excluded in this study.

Measurement of COVID-19 IgG Antibody

Elecsys Anti-SARS-CoV-2 is used for the detection of total antibodies including IgG to COVID-19 virus in human serum. The assay procedure was performed according to the manufacturer's instructions (Roche Diagnostics International Ltd, Switzerland). Following the manufacturer, a cut-off index $\geq$ 1.0 indicates a positive result and <1.0 indicates a negative result.

Ethics

The study design and procedure were approved by the Ethics and Scientific Committee of the University of Zakho's College of Medicine. Informed consent was obtained from all subjects.

Statistics

A Chi-square test and Fisher's exact tests was used to analyze categorical data. When variables were continuous, unpaired student *t* test was used to study the relationship between the variables and antibody levels. The relationship between the studied variables and IgG levels was reported as mean ± standard deviation (SD). Statistical analysis was performed using the GraphPad Prism version 8. *P* value < 0.05 was considered significant.

Results

Characteristics of Subjects

A total of 315 subjects were interviewed and recruited in present study. The average age of the subjects was 32.87 ± 13.25 years (range: 10–70 years), 190/315 (60.31%) were female. Among the studied subjects, 249/315 (79.05%) were married and 60/315 (19.05%) had a history of comorbidity diseases such as hypertension and diabetics (Table 1). Forty-three (13.65%) of the participants had a positive confirmed COVID-19 using RTPCR (Table 1).

Among the subjects, 214/315 (67.93%) tested positive for antibodies and 169/214 (78.97%) were asymptomatic and 45/214 (21.03%) had a history of COVID-19 symptoms (Table 2). The average duration of symptomatic subjects was 10.29 ± 5.21 days and the major symptom was fever 43/45 (95.56%), followed by loss of smell 38/45 (84.44%) and myalgia 36/45 (80.0%) and the minor symptom 6/45 (13.33) (Table 1). The presence of symptoms was significantly higher among subjects with a history of comorbidity diseases (*P* = 0.038), and older people (*P* = 0.015), but no significant associations were reported between antibody positivity and gender (*P* = 0.49) or marital status (*P* = 0.56) (Table 2).

Association Between Antibody Levels and Host Factors

The association between antibody levels and the age of the recruited participants was determined using Pearson's correlation coefficient. It was found that antibody levels significantly associated with age (Pearson's correlation coefficient; *r* = 0.156; R squared = 0.024; *P* = 0.021) (Figure 1).

Unpaired student *t* test was used to investigate the relationship between antibody levels and the studied factors including gender, marital status, chronic diseases, history of confirmed COVID-19, presence of symptoms and duration of symptoms (Table 3). We found a significant association between antibody levels and the marital status (*P* = 0.014), chronic diseases (*P* = 0.001), presence of symptoms (*P* = 0.015) and duration of symptoms (*P* = 0.028). However, no significant associations were found between antibody levels and gender (*P* = 0.83) (Table 3).

Table 1. **Characteristics of the participants recruited in this study (*n* = 315)**

Characteristics of participants		Frequency	Percent (%)
Age (Years ± STD)		32.87 ± 13.25	
Gender: Female		190	60.32
Marital status: Married		249	79.05
Positive confirmed COVID-19		43	13.65
COVID-19 antibody: Positive		214	67.93
Comorbidity diseases (Yes)		60	19.05
Symptoms		45	14.28
COVID-19 symptoms	Fever	43	95.56
	Loss of smell	38	84.44
	Myalgia	36	80.0
	Loss of appetite	28	62.22
	Shortness of breath	28	62.22
	Diarrhea	6	13.33
Duration of symptoms (Days ± STD)		10.29 ± 5.21	

Table 2. **Associations between variables and total antibody positivity among 214 subjects**

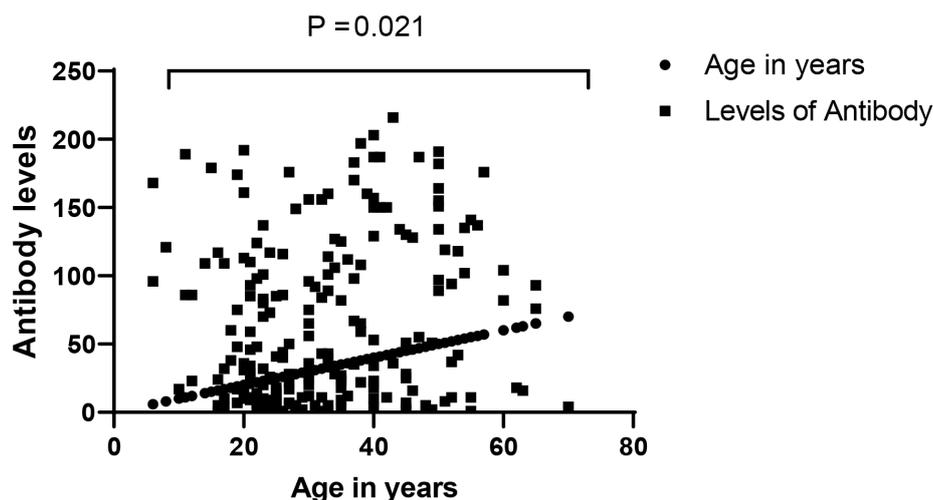| Variables	Asymptomatic Positive (*n* = 169)	Symptomatic Positive (*n* = 45)	*P*-value
	No. (%)	No. (%)	
Gender: Female	108 (63.91)	26 (57.78)	0.49
Marital status (Married)	127 (75.15)	36 (80)	0.56
Chronic disease (Yes)	30 (17.75)	15 (33.33)	0.038
Age (Year ± SD)	31.47 ± 12.57	36.73 ± 13.67	0.015

P = 0.021

Fig. 1 **The association between antibody levels and age.** *P* value was calculated using Pearson's correlation coefficient. (*r* = 0.156; 95% CI, 0.023−0.285, R squared = 0.024; *P* = 0.021).

Table 3. **The association between various factors and antibodies level**

Variables	Levels of antibody positivity (Average ± STD)		*P*-value
Gender	Female (65.103 ± 61.65)	Male (66.91 ± 56.58)	0.83
Marital status	Married (71.42 ± 61.32)	Single (48.18 ± 50.14)	0.014
Chronic diseases	Yes (99.58 ± 65.49)	No (58.25 ± 55.76)	0.001
Symptoms	Yes (74.92 ± 69.44)	No (60.76 ± 56.11)	0.015
Duration of symptoms	<7 days (46.49 ± 46.54)	>7 days (89.97 ± 71.47)	0.028

Discussion

Up to date, SARS CoV-2 has infected more than 380 million people, globally. In Kurdistan Region of Iraq, more than 409 thousand people have been infected and over 7 thousand people have died.[10]

In this project we aimed at studying the prevalence of anti-SARS-CoV-2 in Zakho City. We found that 214/315 (63.88%) of the participants tested positive for anti-SARS-CoV-2 antibodies. It is important to mention that our samples were not random and a population-based study is needed to determine the prevalence of infection. However, this study gave an insight into the infection rate in the city. Recalling that reinfection is rare, the infection rate may start to decrease in the city. Nevertheless, it is important to note that it is unclear whether post infection immunity, specifically that provided by humoral immunity, protects people or generates strong immunity for long term, and further studies are required to explain this. The most common clinical features associated with COVID-19 infection have previously been reported to be fever, dry cough, shortness of breath, loss of appetite and smell.[3,11,12] In our study, the most common symptoms were fever, loss of smell, myalgia, loss of appetite and mild shortness of breath. Among those who tested positive for SARS-CoV-2 antibodies, 77% denied any history of symptoms. This indicates that the majority of infection was asymptomatic and did not require medical help. This might be due to that the majority of recruited samples were young and without comorbid diseases. In support of this, we found a significant association between the presence of symptomatic infection with age and comorbidities. Our results are in agreement with a study conducted in Iraq, they found that the antibody positivity levels increases gradually with the age.[13] Several studies have also confirmed that old patients with chronic diseases are at increased risk for more severe disease and adverse outcomes associated to COVID-19.[14-16] This might be explained by that the immune system is waned in elderly and with the presence of comorbidities allowing severer infection. In agreement with another study,[16] we found a significant association between the presence of symptoms and long duration of symptoms with higher antibody levels. This might be due to that severe long symptomatic infection induces stronger immune reaction and hence higher antibody levels. More studies are required to investigate the effects of different host factors and their association with antibody positivity levels in our locality.

We found no significant relationship between marital status and sex with the levels of antibody positivity, which is in line with the results of our previous study.[13] However, a study conducted in Iran reported that seropositivity was significantly associated with the female gender.[17] The discrepancy between the two studies could be due to their specific study population and relatively small number size of recruited in our study. More studies are needed to determine the reason for gender-related differences in the seroprevalence rate of infection.

Our study has limitations. First, our sample was not random therefore the result should be interpreted with

caution. Random sample collection was extremely difficult due to the restriction and pandemic control measures. Second, the sample size was relatively small. However, our results give an insight into the situation in the city until further research is performed.

In conclusion, a significant relationship between sero-positivity rate of COVID-19 infection and age, chronic diseases, presence of symptoms and duration of symptoms were observed in this study. Seroprevalence studies about COVID-19 infection among population are of utmost importance to develop infection control programs in our locality. A population-based study is needed to determine the accurate prevalence rate of the infection using large number of samples.

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