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Original article

# Seroprevalence of anti-SARS-CoV-2 antibodies and risk factors among healthy blood donors in Fayoum, Egypt

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**Abstract**

**Background:** More eligibility criteria have been added for blood donors to warrant safety of blood donations during the COVID-19 pandemic. The aim of this study was to assess the seroprevalence of antibodies to SARS-CoV-2 among blood donors and to study the lifestyle of asymptomatic cases.**Methods:** One thousand, three hundred twelve voluntary blood donors were enlisted in this study in the University Hospital from September to December 2021. Samples were tested for SARS-CoV-2 antibody. Donor's lifestyle was analyzed. **Results**: 95.4% of the studied group were males, the seroprevalence of SARS-CoV-2 antibody was 83.3% and related to gender, regular donation, type of donation, and more frequent when donors shared transport and accommodation. 9.5%

were found to possess cough/fever or a history of contact with COVID-19 patients. **Conclusion:** Blood donors proved to give an idea about virus spreading among healthy population. Additional risk factors can be identified to ensure safety of transfusion.

## 1. Introduction:

In late 2019, a cluster of cases of viral pneumonia of unknown etiology was reported in Wuhan, Hubei Province, China [1]. This new viral pneumonia SARS-CoV-2 pandemic has shown diverse characteristics in various communities, and such epidemiological aspects of different countries and population groups have necessitated a surplus of surveillance studies [2]. The Pandemic has dramatically affected the healthcare sector, in particular, it added a challenge to transfusion services in terms of adequate blood management to cover the demand [3,4].

There is evidence that SARS-CoV-2 is transmissible by infected asymptomatic and pre-symptomatic individuals [5,6]. Screening for infectious diseases in blood donors is essential mainly to reduce the potential risk of transmitting infectious diseases through blood transfusion [7]. Nevertheless, screening for SARS-CoV-2 in asymptomatic people has been little explored worldwide [8,9].

WHO has provided no direction regarding screening of the donors for SARS-CoV-2 by RT-PCR or immunoassays; however, it recommends temporary deferral for 28 days if any symptoms (cough, fever, and influenza) are present or if they have contact with confirmed COVID-19 patient or have moved to an epidemic area. The WHO also recommends that the potential donors also have to inform the blood bank if they develop symptoms within 28 days of donation [10]. In March 2020, the American Association of Blood Banks (AABB) issued a toolkit and further recommended on eligibility criteria and deferral guidelines [10-12].

During the pandemic of COVID-19, additional eligibility criteria have been updated according to the WHO, Food and Drug Administration (FDA), and local health authorities. Fayoum blood bank adopted the additional criteria to ensure safety of blood donors and patients receiving the blood.

This study aimed to investigate the seroprevalence of antibodies to SARSCoV-2 among voluntary eligible blood donors in Fayoum, Egypt and to further study the epidemiological characteristics of the seropositive donors. This can help to understand the effectiveness of the current eligibility criteria and identify additional risk factors which may support future decisions for safer blood transfusion.

## 2. Materials and Methods:

***Participants***

This study was performed at Fayoum University Hospital Blood Bank and approved by the Fayoum University Research ethics committee, which is a part of Egyptian Network Research Ethics Committee (ENREC). A total of 1,312 eligible voluntary blood donors were enrolled in this study from random donors visiting the hospital between September and December 2021. Donors had to fill up the donor history questionnaire, informed consent form and undergo brief medical screening.

***Eligibility Criteria***

Some criteria related to COVID -19 have been included, prospective donors could not have had flulike symptoms within the 30 days prior donation; had close contact with suspected/ confirmed COVID-19 cases or travelled outside Egypt in the past 30 days. Candidates presenting fever and/ or flu like symptoms on the donation date are also deferred.

All individuals classified as qualified for donation during the study period participated in the survey. We excluded those who refused to sign the informed consent form the study.

***Sample collection***

The serum used for testing infectious disease markers were used for SARS-Cov-2 antibody testing. Samples were collected and separated for each donor and used to measure the SARS-COV2 antibodies.

***SARS-COV-2 Antibody Testing***

Enzyme linked immunosorbent assay for the qualitative detection of SARS-CoV-2 IgG antibodies specific for spike S1-RBD protein were used (DIALAB, Germany), absorbance was measured at 450 nm using an ELx8000 microplate reader (BioTek, Winooski, VT, USA). All samples were carried out, cutoff values and limits were calculated according to manufacturers' instructions and specifications.

***Statistical Analysis***

The IgG antibodies to SARS-CoV-2 result of all units tested were tabulated in an Excel spreadsheet, demographic data were extracted and kept anonymous along with donor response about lifestyle and then data were transported to (SPSS version 20 Inc., Chicago, IL, USA). The statistical association of the presence of IgG antibodies to SARS-CoV-2 to the demographic characteristics of the donors was checked and the $\chi 2$ test at 5% significance level was used to analyze the results.

## 3. Results:

A total of 1,312 samples eligible for blood donation were tested for SARS-CoV-2 IgG antibody. The population analysis and demography are shown in Table 1. The majority (95.43%) of the donors were males and 96.8% were from age 18 to 41 years. Concerning frequency of donation, it was found that 60.52 % of the participants were regular donors, and majority were whole blood donors (96.57%) and 3.43 % were platelet apheresis donors. For the ABO typing, it was found that 35.21 % were O group, 30.18 % were A group, 22.41 % were B group, and the AB group was 12.2 %.

Regards the COVID IgG antibodies test results, 1093 (83.3 %) were found to be positive. Then, the demographic profile of donors who were positive was compared with the donors with negative results, shown in Table 2. It was found that gender, frequency of donation, and type of donation had significant association with positive test results for SARS-CoV-2 IgG, while age and blood groups had no statistically significant association.

For SARS-CoV-2 IgG positive results, many factors were analyzed to identify the possible related risk factors for COVID infection as shown in table 3. It was found that 3.39 % had a history of cough, fever, or flu symptoms during the last 2 months before their blood donation visit. 90 % have had contact with COVID-19-positive patients, and 2.1% have worked with COVID-19 patients as health care professionals. 93.5% were living in shared accommodations and 93.88% used shared transportation. 91.31% attended gathering without masks or other safety protective measures and none gave history of travelling outside Egypt in the past 3 months.

**Table 1:** Demographic analysis and profile of 1,312 eligible donors

| Characteristic | Variables | n | % |
|---|---|---|---|
| **Gender** | Male | 1252 | 95.43 |
| | Female | 60 | 4.57 |
| **Age, Years** | 18- 30 | 958 | 73.02 |
| | 31- 41 | 312 | 23.78 |
| | 42- 55 | 42 | 3.2 |
| **Frequency of Donation** | First Time Donor | 518 | 39.48 |
| | Regular Donor (> 1 donation) | 794 | 60.52 |
| **Type of Donation** | Whole Blood | 1267 | 96.57 |
| | Platelets Apharesis | 45 | 3.43 |
| **Blood Group** | O | 462 | 35.21 |
| | A | 396 | 30.18 |
| | B | 294 | 22.41 |
| | AB | 160 | 12.2 |
| **Total** | | 1,312 | 100 |

**Table 2:** IgG anti-SARS-CoV-2 test results

| Characteristic | Variables | Positive IgG | Negative IgG | Total tested | Positive % | P value |
|---|---|---|---|---|---|---|
| **Gender** | Male | 1088 | 164 | 1252 | 86.9 | <0.001 |
| | Female | 5 | 55 | 60 | 9.1 | |
| **Age, Years** | 18- 30 | 819 | 139 | 958 | 85.47 | N.S |
| | 31- 41 | 243 | 69 | 312 | 77.88 | |
| | 42- 55 | 31 | 11 | 42 | 73.80 | |
| **Frequency of Donation** | First Time Donor | 473 | 45 | 518 | 91.3 | 0.05 |
| | Regular Donor (> 1 donation) | 620 | 174 | 794 | 78.1 | |
| **Education Level** | No Higher Education | 651 | 50 | 701 | 92.87 | 0.03 |
| | Higher Education | 463 | 148 | 611 | 75.78 | |
| **Type of Donation** | Whole Blood | 1082 | 185 | 1267 | 85.4 | 0.05 |
| | Platelets Apheresis | 11 | 34 | 45 | 24.44 | |
| **Blood Group** | O | 381 | 81 | 462 | 82.47 | N.S |
| | A | 331 | 65 | 396 | 83.59 | |
| | B | 248 | 46 | 294 | 84.35 | |
| | AB | 133 | 27 | 160 | 83.13 | |

**Table 3:** IgG anti-SARS-CoV-2 positive donors' lifestyle and exposure history questionnaire

| Lifestyle and risk factors | yes | No | Donor's risk of exposure % |
|---|---|---|---|
| **Shared Accommodation** | 1022 | 71 | 93.5 |
| **Shared Transport** | 1026 | 67 | 93.88 |
| **Cough/ Fever** | 37 | 1056 | 3.39 |
| **Contact with Covid-19 positive Patient** | 984 | 109 | 90 |
| **Healthcare worker** | 23 | 1070 | 2.1 |
| **Attending Gatherings without Mask** | 998 | 95 | 91.31 |
| **Travel outside Egypt** | 0 | 1093 | 0 |

## 4. Discussion:

Seroprevalence studies are strongly recommended by WHO to evaluate the exposure of the general population to the novel COV-19 virus [9]. SARS-CoV-2 antibodies determination among asymptomatic blood donors is important to guide transfusion services decisions concerned with safety of donors, patients, and staff working in blood establishments. Blood donors' eligibility criteria have been revised and updated during this pandemic aiming to ensure availability and safety of donors and blood supply and to avoid collection from asymptomatic COVID patients [10, 11].

Herd immunity is a measure for prevention and control of COVID-19 pandemic against the encountered risk of mortality and morbidity with its burden on the healthcare authorities [12]. Seroprevalence of SARS-COV-2 can give important information regarding herd immunity that indicates the infection spread within the community and may also give a reference for guiding authorities decisions to start relaxing strict safety measures and to forecast possible coming outbreaks [8]. Moreover, seroprevalence studies can provide insights on risk factors, such as a patient's age, location, or underlying health conditions. It can also help in determination of immune reactions and response to the virus following infection of SARS-CoV-2 [3, 13]. In this study, the seroprevalence of SARS-CoV-2 IgG antibodies was found in 83.3% of random donors compared to a reported rate of 1–40% in similar studies from different parts of the world but in earlier period during this pandemic [2, 8, 10, 14]. Our prevalence indicates a considerable increase above the mean of reported range from different countries worldwide. In Egypt, the true prevalence of infection is believed to be several times more than the number of PCR-confirmed cases because of the large number of asymptomatic infections and/or mild infections that have gone untested, especially with the limited resources to perform the PCR testing on large scale. Males in our study constitute 95.43% of participants, which represent the usual percentage of males in our blood donor population. Our finding is like that of a large US cohort study showing that males were more likely to test positive for COVID-19 [15], but other similar studies on blood donors showed that COVID-19 positive IgG were sex independent [16-18]. It was found that there is a significant relation between positive IgG test results with first time donation (p value of 0.05). This can be explained by the fact that regular blood donors are continuously informed and updated about precautions to avoid COVID-19 infection, this may have played a role in having less seroprevalence in regular blood donors. Similarly, we found that whole blood donors are significantly showing higher seroprevalence when compared to the regular platelet apheresis donors ($p$ value $< 0.001$). This can be explained by the fact that platelet apheresis donors are donating more frequently and therefore are examined frequently as part of pre-donation [10]. It was also found that the lower the education level, the higher the odds of testing positive for SARS-Cov-2 antibody (p value 0.03). No significant relation was found between positive IgG test results and ABO blood groups which is like what has been reported in one study in Iran [19], the results of some studies reported that the highest risk of COVID-19 mortality was in people with blood group A [20]. All our donors who participated in this study had no travel history in the 3 months before donation. When studying the response of 1093 donors who were positive for the IgG antibodies test, we found that some were having a history of cough and/or fever, during the last month before their visit to donate blood, while others have had contact with COVID-19-positive patients or was caring for COVID-19 patients. Additional risks included living in shared accommodations, used shared transportation, and attending events without masks and other safety precautions which are expected lifestyle factors that carry risk of getting COVID-19 infection [21]. There were some limitations in our study, including the age groups represented as blood donors, excluding the children under the age of 18, the blood donors were mostly males and of younger age groups. Thus, the entire population was not included. More studies are recommended to include children and the elderly. In conclusion, high seropositivity for SARS-CoV-2 antibodies in the voluntary blood donors indicates community spread and many asymptomatic cases in Fayoum, Egypt. This high seroprevalence shows the increased exposure to the virus and lack of COVID appropriate behaviour.

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