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SEROPREVALENCE OF SARS-COV-2 SPECIFIC IGG ANTIBODIES AMONG BLOOD DONORS

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Abstract

INTRODUCTION : The Severe Acute Respiratory syndrome (SARS-CoV-2) manifests as asymptomatic to mildly symptomatic illness but at times becomes so severe to the extent of leading to death. The study on seroprevalence of SARS-CoV-2 among the voluntary blood donors, who represent the hale and healthy individuals in the community will be a useful indicator of community prevalence of the infection. As the disease significantly impairs blood supply, understanding the prevalence helps in implementing necessary safety measures in places like blood bank.

METHODOLOGY : This cross-sectional study was carried out between January 2021 and December 2021 during which 100 donors who were not vaccinated and without any prior Covid-19 infection were included. After obtaining informed consent from the blood donors willing to participate in the study, SARS-CoV-2 IgG antibody screening was done using chemiluminescence immunoassay.

RESULTS : The prevalence of SARS-CoV-2 IgG antibodies among the blood donors were 45%. 55.4% of the donors from the age group of 21-30 years and 29% of the donors in the age group of 31-40 years were reactive. 59.5% of the first-time donors, 51.3% of the infrequent donors and 12.5% of the regular donors were found to be reactive. There was a statistically significant relationship between the age and the frequency of donation with the seropositivity rate.

CONCLUSION : Study on seroprevalence among the asymptomatic individuals serves as an indicator for the transmission of virus across the community, to implement measures to prevent the spread of virus among the population and to implement vaccination programmes.

KEYWORDS : Severe acute respiratory syndrome, SARS-Cov-2, antibodies, Seropositive

INTRODUCTION

The pandemic of Severe Acute Respiratory Syndrome (SARS-CoV-2) is reported to have originated at Wuhan in China in November 2019 and have been spread across the globe. The symptoms range from mild fever, cough, sore throat to severe respiratory illness and manifests as asymptomatic to mildly symptomatic illness in many affected individuals but at times becomes severe to an extent of leading to death in some individuals. There is no report of SARS-CoV-2 to be transmitted through blood or blood products.[1] Yet, the study of seroprevalence of SARS-CoV-2 among voluntary blood donors who represent the hale and healthy individuals in the community will be a useful indicator of community prevalence of SARS-CoV-2 infection.[2] As the disease significantly impacts blood supply through reduced blood donation and by affecting health care workers, understanding the prevalence of SARS-CoV-2 in the local community helps in implementing data driven precautionary and safety measures in places like blood banks, while ensuring effective supply of highly essential blood and blood components. Screening helps in assessing the spread of the virus and the level of antibody protection against the virus at the population level. As individuals with asymptomatic and mild infections may be missed, it could be obtained by screening the population for specific antibodies by using validated serological assays.[3] The screening of blood donors for SARS-CoV-2 is not mandatory as per National blood transfusion guidelines.[4] But the screening helps in assessing the spread of the virus and the level of antibody protection against the virus at the population level.

The SARS-CoV-2 IgG antibodies were measured by using Chemiluminescence immunoassay method after obtaining informed consent from the participants.

SUBJECTS AND METHODS

AIM AND OBJECTIVE : To estimate the seroprevalence of antibodies to SARS-CoV-2 (IgG) among blood donors.

METHODOLOGY : This was a cross sectional study carried out between January 2021 and December 2021 in a tertiary care hospital in South India, in which all eligible donors from 18 to 65 years, who were not vaccinated and without any prior infection of covid were included in the study. The study

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is approved by Institutional Ethics committee in December 2020. As per the Institutional Ethics committee guidance, this study is registered in Clinical Trial Registry prospectively with CTRI Number CTRI/2021/01/030455.

The eligibility criteria for the selection of blood donors were as per Drug and cosmetic rules, 1945 (amended March 2020). Additionally, those with prior Covid infection and those who have been vaccinated were excluded from the study. After obtaining the informed consent, all eligible blood donors were screened for SARS-CoV-2 IgG antibodies using Chemiluminescence immunoassay using VITROS immunodiagnostic ANTI-SARS-CoV IgG immunoassay, which is intended for the qualitative detection of IgG antibodies to SARS-CoV-2 in the human serum. A 5ml of donor whole blood sample was collected in an EDTA vacutainer, which was centrifuged and separated and the test was performed with 3 ml of donor plasma sample. 2 VITROS Anti SARS-CoV-2 IgG controls were used namely anti SARS-CoV-2 IgG non-reactive and anti-SARS-CoV-2 IgG reactive. Results were based on the E ratio (S/Co), with values <1 as non-reactive and >1 as reactive as per the manufacturer guide. The test is intended for use as an aid in identifying individuals with an adoptive immune response to SARS-CoV-2 infection. Individuals may have detectable virus present for several weeks following seroconversion. Participants age, gender, frequency of donation and ABO blood groups were noted. Data were presented as mean, standard deviation, frequency and percentage. Categorical variables were compared using Pearson chi-square test. Significance was defined by P values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Science Inc., Chicago, IL).
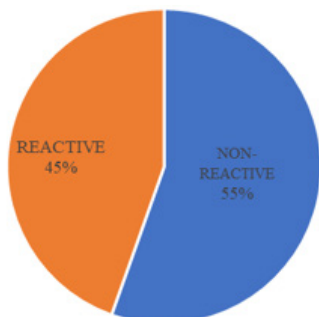
RESULTS

Figure 1 : Seroprevalence of SARS-CoV-2 IgG antibodies among the study participants

Among 100 donors, 45% (95% CI is 35% to 55%) of the donors were reactive for SARS-CoV-2 IgG antibodies (Fig 1). The age group distribution, gender, frequency of donation and blood group of the donors participated in the study stratified by SARS-CoV-2 IgG antibodies is illustrated in the table 1 and 2.

Table 1 : Cross tabulation of seroprevalence of SARS-CoV-2 IgG antibody with gender, age group and frequency OD blood donation

GENDER		SARS-CoV-2 IgG ANTIBODY				TOTAL
		NON - REACTIVE (<1)	REACTIVE (>1)			
	MALE	54 (55.7%)	43 (44.3%)			97
	FEMALE	1 (33.3%)	2 (66.7%)			3
AGE GROUP		NON - REACTIVE	S/Co 1-5	S/Co 5.1-10	S/Co >10.1	
	18-30	29 (48.3%)	22 (71%)	7 (22.6%)	2 (6.5%)	60
	31-40	22 (70%)	5 (55.6%)	2 (22.2%)	2 (22.2%)	31
	41-65	4 (44.4%)	2 (40%)	2 (40%)	1(20%)	9
	TOTAL		29 (64.4%)	11 (24.4%)	5 (11.1%)	45
FREQUENCY OF DONATION		NON-REACTIVE	S/Co 1-5	S/Co 5.1-10	S/C >10.1	
	FIRST TIME DONORS	15 (40.5%)	13 (59.1%)	6(27.3%)	3 (13.6%)	37
	INFREQUENT DONORS	19 (48.7%)	14 (70%)	4 (20%)	2 (10%)	39
	REGULAR DONORS	21 (87.5%)	2 (66.7%)	1 (33.3%)	0	24
	TOTAL		29 (64.4%)	11 (24.4%)	5 (11.1%)	45

There was no statistically significant corelation between the gender and the seropositivity rate (p value- 0.444). There was a statistically significant corelation between the seropositivity rate and the age (p value- 0.026) and the frequency of donation (p value- 0.001)

Table 1 : Cross tabulation of seroprevalence of SARS-CoV-2 IgG antibody with blood group of the donors.

		NON-REACTIVE	REACTIVE	TOTAL	p-value
Blood group	A Positive	11 (57.9%)	8 (42.1%)	19	
	AB Positive	1 (20%)	4 (80%)	5	
	B Negative	0	1 (100%)	1	0.204
	B Positive	12 (46.2%)	14 (53.8%)	26	
	O Positive	31 (63.3%)	18(36.7%)	49	
Total		55 (55%)	45 (45%)	100	

DISCUSSION

Hundred donors were included in the study, where 97% were male and 3% were female. The maximum participants were observed in the age group of 21 to 30 years (56%). This may be explained by the fact that these group of population were able to travel and be eligible for blood donation despite all the restrictions implemented during the pandemic compared to the elderly age group. Among the study participants,24% of the donors were regular blood

donors, 37% and 39% of the blood donors were first time and infrequent blood donors respectively. None of the donors in our study reported to have any comorbidities. Around 49% of the participating donors were 'O' blood group. Considering the 'Rh' status 99% of the donors were Rh positive.The seropositivity rate for the SARS-CoV-2 IgG antibodies was found to be 45% (Fig 1). A study by Ram Jaiswal et al., had a seropositivity rate of 43% which is similar to the reports in our study.[5] A similar study by Srinivasa Rao Chunchu et al., reported a seroprevalence of 49.4% with a sample size of 1034 donors.[6] A study by Sahar Saeed et al., which was conducted during the first wave of Covid 19 reported a seroprevalence less than 1%, which signifies that proportion of population exposed to the virus without any symptoms were less during the spread of the first wave.[7]Among the study participants, 44.3% of the male donors among the 97 male donors and 66.7% of the female donors among the 3 female donors were reactive for SARS-CoV-2 IgG antibodies. A similar study by Srinivasa Rao Chunchu et al., reported 49.2% of the male donors to be seropositive and 71.4% of the female donors to be seropositive.[6] Tulika Chandra et al., in their study reported none of the female participants were seropositive.[8] In our study, the percentage of female donors becoming seropositive is high when compared to the male donors inspite of the smaller number of female participants included in the study which is similar to other studies. But there was no statistical significance between the gender and the seropositivity rate in our study. In the present study, none of the donors less than 20 years of age were found to be seropositive. 55.4% of the donors within the age group of 21-30 years and 55.6% of the donors above 40 years of age were found to be seropositive. 29% of the donors in the age group 31-40 years were found to be seropositive. A similar study by Pratibha Kale et al., reported that 46.6% of the donors in the age group of 26-35 years were found to seropositive followed by 28.2% of the donors in the age group of 18-25 years, 19.4% of the donors in the age group of 36-45 years and 5.8% of the donors who were more than 45 years were found to be seropositive.[9] Cruz S. Sebastiao et al., in their study found that maximum seropositivity rate was found in the age group less than 20 years and they have stated that seroprevalence rate was found to be increased over time.[10] Srinivasa Rao Chunchu et al., in their study found that higher antibody responses were found between the age group of 30-45 years in comparison to 18-29 years.[6] A similar study by May Raouf et al., reported 48.6% of the donors in the age group of 17-35 years were found to be seropositive.[11] In our study, 31 among the 56 donors in the age group 21-30 years were found be reactive and 5

among the 9 donors in the age group more than 40 years were found to be reactive which shows that donors within the age group of 21-30 years have had some asymptomatic exposure and had shown high immunological response. There was a statistically significant relationship between the age of the donors and seropositivity rate from our study. In comparing the seroprevalence with the frequency of blood donation in our study, 59.5% of the first-time donors were found to be seropositive followed by 51.3% of the infrequent donors and 12.5% of the regular donors were found to be seropositive. In a similar study by Pratibha Kale et al., 26.1% of the repeat donors were found to be reactive.[9] Srinivasa Rao Chunchu et al., in his study reported that 50.6% of the replacement donors were found to be seropositive followed by 47.6 % of the voluntary donors to be seropositive.[6] May Raouf et al., in his study reported 10.7% of the regular donor were found to be seropositive and 16.7% of the first-time donors were found to be seropositive. He also stated that regular donors would be highly aware of the blood donation criteria and the precautionary measures to be taken before donating the blood.[11] Similarly in our study the first-time donors and infrequent donors were found to have more seropositivity rate compared to the regular donors which shows that first time donors and infrequent donors had some asymptomatic exposure compared to the regular donor who would be well aware of the covid protocols implemented in the blood center. There was a statistical significance between the seropositivity rate and the frequency of donation from our study. When comparing the seroprevalence with the blood group of the donors, 80% of the 'AB' blood group donors were found to be seropositive, 57.6% of the 'B' blood group donors were reactive followed by 42.1% of the 'A' group donors followed by 36.7% of the 'O' blood group donors. One donor was found to be Rh negative and was reactive for SARS-CoV-2 IgG antibodies. In our study 4 among the 5 'AB' positive donors were found to be seropositive. But there was no statistical significance between the blood group of the donors and the seropositivity rate from our study.Among the 45 reactive donors in our study, around 29 (64.4%) donors were observed to have a S/Co value ranging from 1 to 5. Around 11 donors (24.4%) were found to have a S/Co value between 5.1 to 10 and 5 (11.1%) donors with the S/Co value more than 10. A similar study by Pratibha Kale et al., categorized the antibody S/Co value from 1 to 5 as category 1 and around 41.8% of the donors were observed to have a S/Co of ranging from 1 to 5. The S/Co value more than 5 was considered as category 2. Around 58.1% of the donors were found to be with the S/Co value more than 5.[9] In a similar study by Srinivasa Rao

Chunchu et al., categorized the IgG antibody positivity rate as less than 3.5, 3.5-6, 6-12 and more than 12 and reported that donors with S/Co greater than 9.5 have significantly higher neutralizing capacity.[6] SARS-CoV-2 IgG antibody S/Co value does not have any statistical significance with age group (p value- 0.509), frequency of donation (p value- 0.909) and the blood group (p value – 0.997) among the reactive blood donors.

CONCLUSION

SARS-CoV-2 IgG antibody testing, has a potential to identify the asymptomatic spread of the virus among the healthy population in the community. It also helps the donors and the blood center to have an idea about implementing measures to prevent the spread of infection while blood donation and to implement strategies to provide safe blood components inspite of the pandemic. Studies on seroprevalence among the asymptomatic individual is very much essential as it serves as an indicator for the transmission of virus across the community. Herd immunity is associated with the extent of spread of virus among the community.[6] Though this study shows a higher seroprevalence of SARS-CoV-2 IgG antibodies, the seropositivity rate necessary to acquire the herd immunity is much higher. But the seropositivity rate helps us to implement measures to prevent the spread of virus among the population in the community by knowing the transmission, immunity levels among the population in a community, to develop therapeutic options and to implement vaccination programmes. Further, seroprevalence in blood donors assists us in implementing measures to arrest the spread of virus among the donors and to the blood center staffs and helps us in monitoring the risks and benefits, if at all that blood unit is transfused to the recipient.

REFERENCES

1. World Health Organization. Maintaining a safe and adequate blood supply during the pandemic outbreak of coronavirus disease (COVID-19): interim guidance, 20 March 2020. World Health Organization; 2020.

2. Amorim Filho L, Szwarcwald CL, Mateos SD, Leon AC, Medronho RD, Veloso VG, Lopes JI, Porto LC, Chieppe A, Werneck GL. Seroprevalence of anti-SARS-CoV-2 among blood donors in Rio de Janeiro, Brazil. Revista de saude publica. 2020 Jul 6;54:69.

3. Kevadiya BD, Machhi J, Herskovitz J, Oleynikov MD, Blomberg WR, Bajwa N, Soni D, Das S, Hasan M, Patel M, Senan AM. Diagnostics for SARS-CoV-2 infections. Nature materials. 2021 May;20(5):593-605.

4. Interim S. National guidance to Blood Transfusion services in India in light of COVID-19 Pandemic. India NBTCMoHaFWGo. 2020:12.

5. Jaiswal R, Sharma S, Singla A, Devpura N, Vohra R, Kakkar M, Rijhwani P, Sureka R. Seroprevalence of SARS-CoV-2 IgG antibody among healthy blood donors: a single centre study. Transfusion and Apheresis Science. 2022 Jun 1;61(3):103338.

6. Chunchu SR, Ravula U, Gente VK, Bacchu S, Pandu Ranga Rao S, Mooli S. SARS-CoV-2 seroprevalence among whole blood donors during first wave of covid-19 pandemic in India. Indian Journal of Hematology and Blood Transfusion. 2022 Jul;38(3):546-55.

7. Saeed S, Drews SJ, Pambrun C, Yi QL, Osmond L, O'Brien SF. SARS-CoV-2 seroprevalence among blood donors after the first COVID-19 wave in Canada. Transfusion. 2021 Mar;61(3):862-72.

8. Chandra T, Agarwal D, Himanshu D, Agarwal M, Puri B. SARS-CoV-2 IgG Surveillance in Asymptomatic Blood Donors and Health Workers. Advances in Medicine. 2021 Dec 29;2021

9. Kale P, Patel N, Gupta E, Bajpai M. SARS-Coronavirus-2 seroprevalence in asymptomatic healthy blood donors: indicator of community spread. Transfusion and Apheresis Science. 2022 Feb 1;61(1):103293.

10. Sebastião CS, Galangue M, Gaston C, Van-Dunen R, Quivinja J, Lunbungululo E, Alfredo D, Sozinho A, Teixeira A, Manico E, Machado D. Seroprevalence of anti-SARS-CoV-2 antibodies and risk factors among healthy blood donors in Luanda, Angola. BMC Infectious Diseases. 2021 Dec;21(1):1-0.

11. Raouf M, Rabeh M, Kaur S, Sharma R, Thottumkal N, Mohammed R. Seroprevalence of IgG Anti-SARS-CoV-2 among Voluntary Blood Donors in Dubai: Demographic and Risk Factors. Dubai Medical Journal. 2021;4(3):204-11.