

Original Article

Seroprevalence of Antibodies to SARS-CoV-2 in Staff of Khyber Medical University, Peshawar

Dur-e-Nayyab,¹ Saima Nadeem,² Yasar Mehmood Yousafzai,³ Sunia Qasuria Khan,⁴
Quratulain Zafar,⁵ Mahnoor Siddiquie⁶

¹Hayatabad Medical Complex, Peshawar, Pakistan, ²Khyber Girls Medical College, Peshawar, Pakistan,

³Khyber Medical University, Peshawar, Pakistan, ⁴Ayub Teaching Hospital, Abbottabad, Pakistan,

⁵Nowshera Medical College, Nowshera, Pakistan, ⁶Khyber Teaching Hospital, Peshawar, Pakistan.

Abstract

Objective: The coronavirus disease-19 (COVID-19) pandemic emerged as a global health threat. Various studies conducted in different healthcare systems/setups indicated that healthcare workers are at increased risk for COVID-19. To find out the seroprevalence of COVID-19 in staff members of different institutions of Khyber Medical University, Peshawar.

Methods: This descriptive cross-sectional study was conducted at Khyber medical university Peshawar. The sampling was done from February 2021 to March 2021. A total of 352 samples were collected. Data was collected on a preformed questionnaire after obtaining written informed consent. 3ml of blood was collected in gel top to determine IgM and IgG antibody levels by indirect manual ELISA technique. Data were recorded and analyzed in SPSS version 24.

Results: Amongst the staff of KMU, a total of 54.8% cases were reported as asymptomatic, 14.4% as confirmed (with the highest IgG seropositivity of 86.2%), 14.4% as suspected, and 16.1% as probable cases of COVID-19. While out of confirmed cases of COVID-19, 86.2% with mild, 7.8% with moderate, and 5.8% cases with severe disease were documented, respectively. 1.7% of samples were seropositive for IgM antibodies, while 58.2% were found positive for IgG antibodies. Amongst the KMU's Faculty, the Administrative Staff group was found to have the highest seropositivity of IgG antibodies of about 60.7%.

Conclusion: KMU staff was at significant risk of getting in contact with the virus due to the operationalization of the university throughout the pandemic as well as the deployment of university staff at the public health reference laboratory (PHRL). Follow-up studies are required to assess the longevity of both IgM & IgG antibodies and to explore further the kinetics of antibodies

Keywords: Coronavirus diseases-19, health care workers, serological surveys, severe acute respiratory syndrome coronavirus 2

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Corresponding Author: Dr. Saima Nadeem

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Introduction

The coronavirus disease-19 (COVID-19) pandemic has emerged as a global health threat. It started with a report of a flu-like illness in December 2019 in Wuhan, China.^{1,2} It was declared a public health emergency by the WHO within a month and was later declared a pandemic on March 20, 2020.³ With the spread of such a deadly disease, healthcare workers have remained on the front lines from diagnosis to treatment of this infectious disease around the globe.³

Email: samnadeem1979@gmail.com

The COVID-19 pandemic is seen as a real challenge for society. HCWs are under extreme physical and psychological pressure, yet they still provide services in the greater interest of humanity, at the cost of their lives and the lives of their loved ones. A survey is conducted in almost all major medical facilities/hospitals to assess the extent of COVID-19 in HCWs. These are conducted to address multiple issues and formulate various policies to address these issues accordingly.^{4,5}

As the peak of the COVID-19 pandemic has passed in

many countries, serological studies are paramount to get a picture of the public health response. Although the real-time polymerase chain reaction (RT-PCR) test is used worldwide as a diagnostic approach for Covid infection, it has only diagnostic value and is an expensive test available in certain laboratory facilities.⁶ In addition, asymptomatic cases, and cases with mild illness or those recovering from previous infections often go undetected. On the other hand, serological tests can be used for mass screening, providing diagnostic, prognostic and therapeutic information simultaneously.⁷ The development of herd immunity can also be assessed using serological tests, which are less risky, inexpensive, and more convenient to perform.^{8,9}

Khyber medical university the only public research university located in Peshawar, Khyber Pakhtunkhwa rendered its services effectively and tirelessly through its trained skilled Staff, research scholars, and laboratory workers to combat against deadly covid-19. On one hand it was playing vital role by conducting covid tests through its skilled staff, and on other hand its staff was looking for various operational aspects of medical education in whole province throughout the pandemic. Keeping in view the documented statistics for increased risk of infection amongst health care workers, and the importance of continuing normal university functions of research and administration, the study for determining seroprevalence of antibodies (both qualitatively and quantitatively) against SARS-CoV-2 amongst medical university officials was needed. This study aided in finding out the true prevalence of covid infection in KMU and was helpful in keeping epidemiological surveillance. It was helpful in mitigating the chances for transmission of infection (in cases of asymptomatic carriers) and in identification of potential plasma donors from institute. Moreover, this was also beneficial for investigating cases of reinfection.

Methods

This is a descriptive cross-sectional study that aimed to determine the seroprevalence of the COVID-19 antibodies in the staff of Khyber Medical University (KMU). The samples were collected from different non-clinical staff members of KMU, Peshawar. The collected samples were processed at the haematology and physiology lab of the institute of basic medical sciences (IBMS), KMU. The duration of the study was 06 months, starting from February to July 2021.

Whole strength of all non-clinical staff (including faculty, lab workers, administrative staff, and supporting staff) of KMU and its constituent institutes of the Peshawar was enrolled in study. The study used the convenient sampling technique for all the staff members that fall in the inclusion criteria. All non-clinical faculty members,

lab workers, administrative staff, and supporting staff were included. If anyone had COVID-19 infections previously were also included. Both symptomatic, as well as asymptomatic individuals were included. Non-Consenting participants were excluded.

After approval from the advanced medical and research board, research and ethical committee, the study was started. After willingness of participants to participate in the study, written informed consent was taken, and a preformed questionnaire was provided to fill in regarding demographic data, job duties and location, symptoms of COVID-19 if experienced any, history of the previous infection, and Details of previous testing /screening if carried out any. Relevant needed information was entered into the laboratory information management system (LIMS), and a receipt was generated and saved for result entry. 5ml of blood was drawn and was collected in labelled gel top. Soon after blood collection, the sample was kept in a refrigerator to sustain its viable biological properties for analysis. In the laboratory, following recommended biosafety guidelines, samples were processed. Stored samples were centrifuged within 2 hours of collection at 4500 RPM for approx. Serum was then transferred into Eppendorf tubes and was kept in a refrigerator at -20 until the moment of use. Both immunoglobulin IgG and IgM antibodies against SARS-CoV-2 Antigen and M protein were measured (qualitatively and quantitatively) using IDvet and vircelle ELISA kits as per manufacturer instructions. The result against each sample was uploaded using LIMS for information of the concerned participant.

Data was recorded and analyzed using SPSS v 26. By using Descriptive statistics, Percentages and frequency were made from categorical variables. For Analytical statistics, ANOVA was used. The P-value of <0.05 was kept as significant. Pearson correlation was used to measure the statistical association between continuous variables.

Results

Amongst total participants, the male was 311 (88.4%) while 41 (11.6%) were female. Age ranges from 20-60 years with a mean age of 35.54±12.0 Years. The participants were divided into four age groups. Group I (21-30 years) includes 134 (38.06%) of the participants, Group II (31-40 years) includes 147 (41.76%), Group III (41-50 years) includes 61 (17.32%), and in Group IV (51-60 years) 9 (2.55%) of university employees were included. By statistical analysis between different variables with IgG seroprevalence, it was found that the stratification of gender, age group was not significant in any case with a p-value of >0.05 (Table 1).

Table 1: IgG seroprevalence correlation with Age Groups and Gender

| Variable | IgG Seroprevalence | | P-value |
|-------------------|--------------------|--------------|---------|
| | IgG Positive cases | IgG Negative | |
| Age Groups | | | |
| 20-30 | 77 (21.9%) | 57 (16.2%) | 0.44 |
| 31-40 | 82 (23.3%) | 65 (18.5%) | |
| 41-50 | 41 (11.6%) | 20 (5.7%) | |
| >50 | 04 (1.4%) | 05 (1.5) | |
| Gender | | | |
| Male | 184 (52.3%) | 127 (36.1%) | 0.21 |
| Female | 21 (6%) | 20 (5.7%) | |

Employees of the university were divided into 04 categories comprising of faculty, admin staff, lab staff, and supporting staff category. The designation-wise participation in our study was 79(22.4%) from faculty, 135 (38.3%) from admin staff, 66(18.7%) from lab staff, and 72 (20.4%) were from the supporting staff group. The highest IgG seroprevalence was noted in the admin staff group was 60.7%. Whereas highest confirmed COVID-19 cases were found in the faculty group i.e., 20 cases (Figure 1).

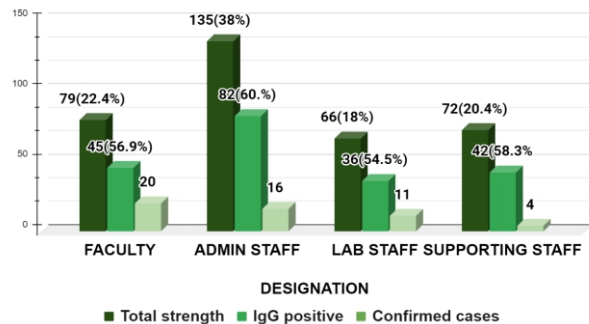


Figure 1: Designation wise participation and IgG seroprevalence of the University Employees

In our study, IgM seroprevalence was 1.7%. out of 352 university employees, just 06 cases were reported positive for IgM antibodies, 07 cases as equivocal while the rest of the 339 cases were negative for IgM. While regarding IgG seroprevalence, 205 (58.2%) cases as positive, 37 (10.5%) as equivocal, and 110 (31.3%) cases were reported negative for IgG antibodies in KMU (Table 2).

Table 2: IgG and IgM Seroprevalence in University Employees

| Parameters | IgG (Total 352) % (n) | IgM (Total 352) % (n) |
|------------|--------------------------|--------------------------|
| Positive | 58.2 (205) | 1.7 (6) |
| Negative | 31.3 (110) | 96.3 (339) |
| Equivocal | 10.5 (10.5) | 2.0 (7) |

By applying Anova on the test variables it was noted that symptoms, confirmed cases, history of contact was significantly correlated with IgG seroprevalence with a p-value of <0.005, however, the rest of the variable was not significant, with a p-value of >0.05 (Table 3 & 4).

Table 3: Showing IgG Seroprevalence Correlation with History of COVID-19 Infection, Symptoms of COVID-19, History of Contact and Comorbidity

| Variables | IgG seroprevalence | |
|-------------------------------|--------------------|------------|
| History of COVID-19 infection | Positive | Negative |
| Yes(n=92) | 72(78.2%) | 20(21.7%) |
| No(n=260) | 133(51.1%) | 127(48.8%) |
| Symptoms of COVID-19 | | |
| Yes(n=155) | 117(75.4%) | 38(24.5%) |
| No(n=197) | 88(44.6%) | 109(55.3%) |
| Covid cases | | |
| Confirmed(n=51) | 44(86.2%) | 7(13.7%) |
| Suspected(n=51) | 36(70.5%) | 15(29.4%) |
| Probable(n=59) | 40(67.7%) | 19(32.2%) |
| Asymptomatic(n=191) | 85(44.5%) | 106(55.4%) |
| History of contact | | |
| Yes(n=200) | 132(66%) | 68(34%) |
| No(n=152) | 73(48%) | 79(51.9%) |
| Co morbidity | | |
| No(n=300) | 175(58.3%) | 125(41.6%) |
| Yes(n=52) | 30(57.6%) | 22(42.3%) |

Table 4: ANOVA of IgG seroprevalence with study variables

| Study variables | Sum of Squares | Mean Square | Frequency | Significance |
|---------------------|----------------|-------------|-----------|--------------|
| Symptom | 8.346 | 8.346 | 37.258 | 0.000 |
| Confirmed | 3.248 | 3.248 | 4.856 | 0.029 |
| History of contact | 2.815 | 2.815 | 11.791 | 0.001 |
| Infection in family | 0.546 | 0.546 | 2.816 | 0.094 |
| Symptoms | 0.000 | 0.000 | 0.000 | 1.000 |

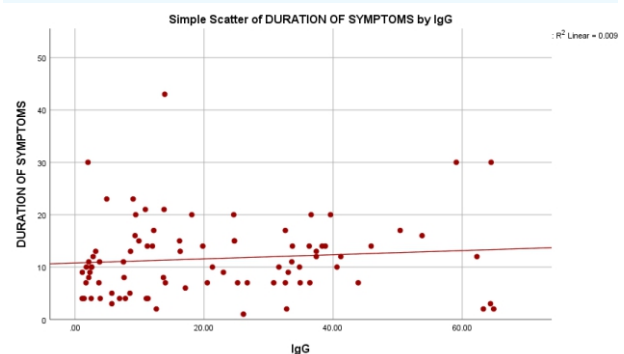


Figure 2: Correlation of duration of symptoms with IgG level

By correlating the duration of symptoms with the IgG level, it was noted that, with increased duration of symptoms the level of IgG was positively correlated ($r = 0.191, p < 0.001$) (Figure 2).

Discussion

Detection of antibodies (IgM or IgG) to COVID-19 in a population provides comparatively more useful information than virus testing, as antibodies to the virus are likely to persist longer. For this reason, our study focused more on the seroprevalence of IgG antibodies. In our study, a 1.7% seroprevalence of IgM antibodies was observed, while contrary to our results, the seroprevalence of IgM antibodies was positive in 7.2% of participants, which is slightly higher than our results. Regarding IgG levels Javed et al., found 4.8% of cases positive for IgG antibodies and 3.2% equivocal.¹⁰ In another study from the University of Alicante, IgG antibody seropositivity was 2.64% of all participants.¹¹ In contrast to our results, Naiyar et al., found a seroprevalence for IgG antibodies of 16.96%, which is also lower than our study results. Another study conducted for Iranian health workers showed a seroprevalence of IgM and IgG antibodies of 5.6% and 33.4%, respectively.¹² The justifications for greater seroprevalence of antibody observed in our study may be due to the prevalence in the common population is probable to upsurge with time and this study was conducted at pandemic's peak in Pakistan than other countries. It might be due to higher seroprevalence of antibodies may be related to the lack of a standard quarantine system in our country compared to other developed countries.¹²

In addition, our study also found a higher seroprevalence of IgG antibodies in males compared to females, but this increase was not statistically significant in correlation with the seroprevalence of antibodies. This finding correlates well with other studies conducted in Denmark,¹³ Iran (42.8% vs. 37.2%)¹⁴, and California (5.18% vs. 3.31%)¹⁵. This result may be better explained by the fact that men are more susceptible to infection, as men hold more administrative and faculty positions than women. For this reason, a higher IgG seroprevalence of 60.7% was found among the administrative staff, as they have a greater interaction with the infected patients. The results of this study confirm this, as the analysis showed an increased possibility of infection when the frequency of interactions with customers or patients increased.¹⁶ In our study, we found slight discrepancies in the stratification of serologic tests in participants with different age groups, and a slightly higher seroprevalence of 67.2% was found in those in age groups between 41 and 50 years than in the rest of the age groups. These results are in good agreement with another study in which the seroprevalence was higher in the 35 to 54 age

group.¹⁵ According to other studies, anti-COVID-19 IgG antibody seroprevalence was highest in the following age groups: 20 to 49 years old in a Swiss population, 20 to 34 years old in a Spanish population, 35 to 54 years old in a population Californian population and older than 60 years in a South Korean population.¹⁷

Our study found a statistically significant association between IgG levels and the duration of symptoms. The seroprevalence of IgG antibodies increased with the duration of the symptoms. These results show that people with increased symptoms of the infection may have longer exposure to the virus and have a more severe inflammatory response. By correlating time since infection, we found that IgG levels and duration of infection were not statistically significant, with increasing time IgG levels tended to decrease with a negative correlation of ($p = 0.331$). Likewise, our results and other study results have reported that SARS-CoV-2 IgG levels may decrease over time; however, it is uncertain whether the remaining antibodies are suitable for virus neutralization.¹⁸ As reported, the concentration of surviving IgG antibodies may decrease over time, the quality of the remaining IgG antibodies improves after the onset of symptoms when retained by the avidity or functional affinity of the antibodies.¹⁹

There are certain limitations to this study. The calculation of seroprevalence was subject to potential sampling error since our study population was not recruited by random sampling. The sample size is small, which cannot provide a full picture of disease severity at the community level. The sensitivity of a serological test is also affected by the length of time since the onset of the disease. Because specimens collected from infected individuals outdoors can be falsely negative at the time of antibody response, the seroprevalence found in our study may underestimate the true prevalence rate of the disease. This type of study is crucial for numerous reasons such as to monitor the infection and track its spread within the community; to determine the rate of asymptomatic people in public; to build support for more widespread surveys across the country that will quantify the true prevalence of SARS-CoV-2 in all regions and reflect a complete picture of the spread of the disease.

Conclusion

In our study, despite the small number of COVID-19 cases, a high prevalence of IgG positivity was observed. The highest IgG seroprevalence was observed in asymptomatic individuals, demonstrating the crucial role of asymptomatic carriers in the spread of the disease. Therefore, more vigilant health screening, compliance with precautionary measures and COVID-19 sops, and guidelines for administering booster doses of COVID vaccines at regular intervals are recommended. This

study found a statistically significant association between IgG levels and the duration of symptoms. Therefore, further studies on the longevity of antibodies in relation to the severity and duration of the disease can be carried out.

Conflict of Interest: *None*

Funding Source: *None*

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