



## Research Article

# Sero-Detection of Sars-Cov-2 Antibodies and some Associated Risk Factors among Staff of Federal University Gusau, Zamfara State, Nigeria

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### ABSTRACT

This study was aimed at detecting the level of SARS-CoV-2 antibody response among the staff of Federal University Gusau, Zamfara State. A cross-sectional study design and clustered-stratified-random sampling strategy were used to sample staff of the University comprising academic, technical and non-academic staff. SARS CoV-2 antigen Rapid Tests were carried out using on the spot analysis of nasopharyngeal and blood samples of the participants using SARS-CoV-2 antigen RDT kits and total antibody ELISA kit. None of the samples collected was positive to the antigen RDT kit, however further confirmation with ELISA kit revealed a prevalence of 32.8%. This study showed that academic staffs are more exposed to SARS-CoV-2 viruses due to high incidence of antibodies detected among the academics; however the difference in the prevalence between academic and non-academic staff was not statistically significant. Knowledge of SARS-CoV-2, belief, behaviour towards COVID-19 protocols, contact history and flu-like symptoms were risk factors that predispose one to SARS-CoV-2 viruses.

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## INTRODUCTION

Coronaviruses (CoVs) belong to the family of a large group of non-segmented positive single-stranded RNA (27-32Kb genome length) viruses. These groups of viruses cause significant respiratory and gastro-enteric diseases in humans such as severe acute respiratory syndrome (SARS) and other infections in an increasingly large variety of mammals and birds (Denison *et al.*, 2011). Corona virus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome corona virus 2 (SARS CoV-2) and can be transmitted through facial openings which include the mouth, nostrils and eyes.

On 31 December 2019, a cluster of cases of pneumonia of unknown aetiology was detected in Wuhan City, Hubei Province, China (Gralinski and Menachery, 2020). On 7 January 2020, the Chinese authorities identified and announced a novel type of coronavirus as the cause of the disease (WHO, 2020). On 30 January 2020, the World Health Organization (WHO) declared the 2019-nCoV outbreak a Public Health Emergency of International Concern (Sohrabi, 2020) and a few days later announced the official name of the virus as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and the disease as Coronavirus Disease 2019 (COVID-19) (Zhao, 2020). COVID-19 was declared a pandemic on 11 March 2020 by the WHO. Nigeria had its index case on the 27th February 2020 at the Infectious Disease Hospital, Yaba, Lagos. The index case was a 44-year-old Italian male expatriate who returned from a family visit in Italy (Ayorinde *et al.*, 2021).

It has been reported that healthcare workers (HCWs) are exceptionally at risk of the pandemic since they are in the frontline and therefore at high exposure rate to the virus (El-Sokkary *et al.*, 2021). University staff are similarly at high risk of been exposed to the virus since they deal with large population of

students constantly (Pérez-Tanoira *et al.* 2021). Assessing the prevalence of infection (either past or recent) among HCWs and university staffs is valuable in identifying the exposure level and determining the high-risk groups (Lancet, 2020). Most researchers have reported high prevalence among healthcare workers, there is paucity of data for prevalence the disease among university lecturers being among exposed population. Sero-conversion of total antibodies takes a median time of between 9 to 14 days but some researchers have reported early sero-conversion of between 3 to 5 days in immune-competent individuals (Gaddi *et al.*, 2020).

Across the six WHO regions, over 21 million new cases including about 50,000 new deaths were reported, representing the highest number of weekly cases recorded since the beginning of the pandemic. As of 23 January 2022, over 346 million confirmed cases and over 5.5 million deaths have been reported in total (WHO, 2022). Rapid COVID-19 identification is crucial to public health policies but it is difficult due to lack of distinctive symptoms. Disease models that include speedy definitive clinical findings and tests can stratify at-risk population for diagnosis, isolation and contact tracing system (Padoan *et al.*, 2020; Sun *et al.*, 2020). Reverse Transcriptase Polymerase Chain Reaction (RT-PCR), which is used to detect viral nucleic acids, has reduced sensitivity (almost by half) in the second week of symptom visibility, if nasopharyngeal samples are used only as samples (Yu *et al.*, 2020). It is therefore imperative to employ the use of antibodies to help study the disease progression and diagnosis. This study aimed to detect the level of SARS-CoV-2 antibodies and associated risk factors among the staff of Federal University Gusau, Zamfara State while the specific objectives were to detect the level of antibodies to SARS-CoV-2 among staff of Federal University Gusau,

Zamfara state, determine socio-demographic factors responsible for the spread of COVID-19 disease in the population of study and to ascertain the associated risk factors predisposing the study population to SARS-CoV-2 infection.

## **MATERIALS AND METHODS**

### **Study Population**

A cross-sectional study design of staff of the university comprising academic, non-academic and academic technologists was carried out. Stratified-random sampling was used based on the cadre of the population of study within the university and participants were selected randomly to participate in the study. Open Epiinfo Toolkit was used to calculate the minimum sample size for the study. The sample size was calculated using the formula  $N = Z^2 (1-p)/(pq)^2$  and prevalence rate of 45.1% by Olayanju *et al.*, 2021 in Ibadan, Nigeria. The calculated sample size was 94 but it was raised a total of 125 in order to have a proper representation of the study population.

### **Sample Collection and Processing**

SARS CoV-2 antigen Rapid Tests were carried out by collecting and carrying out on the spot analysis of nasopharyngeal samples of the participants using SARS-CoV-2 antigen RDT kits. It is a qualitative membrane-based immunoassay for the detection of SARS CoV-2 antigen in nasopharyngeal samples. Two millilitres (2mls) of the participant's blood was also collected and the serum extracted. The serum was stored at a temperature of  $-20^{\circ}\text{C}$  until use. Quantitative ELISA for total antibody detection was performed according to the

## **RESULTS**

### **Sero-prevalence of SARS-CoV-2 among staff using antigen RDT kits and ELISA antibody kit**

SARS-CoV-2 antibodies was not detected in any of the samples screened using the antigen RDT

manufacturer's instructions and the results were read using an ELISA plate reading machine. Sampling was carried out from November 2021 to January 2022.

### **Questionnaire Administration**

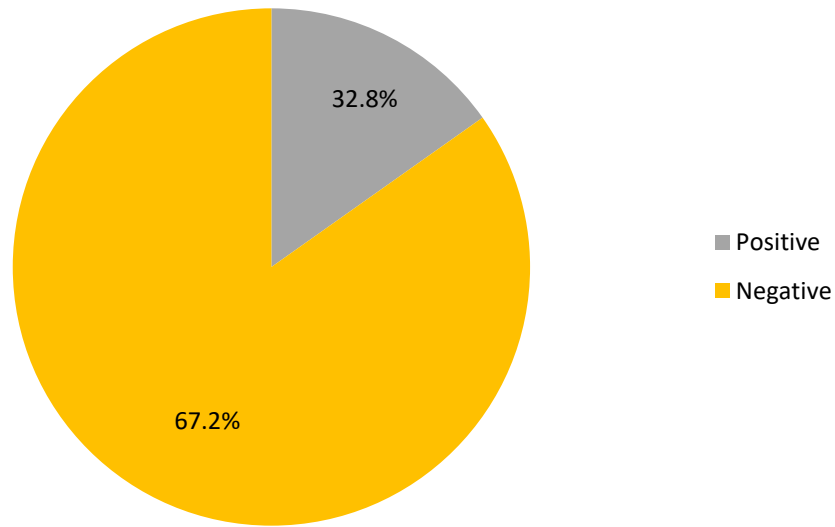
Structured questionnaires were issued to participants who consented to participate in the research. Participants were asked to sign an informed consent form or their guardians were asked to sign on their behalf. Demographic variables (residence, age and sex), knowledge of COVID-19, belief in COVID-19, overseas travel history and symptoms of COVID-19. The questionnaires were administered by trained research assistants and translation assistance was issued where necessary. The questionnaires were recovered immediately after response to ensure the complete return of the questionnaires.

### **Ethical Approval and Consent**

Ethical approval was sought from the university's Healthcare services and all participants were made to sign an informed consent form before samples were taken.

### **Statistical analysis**

We conducted all statistical analyses with Stata v16.0 (Stata Corp, USA). Results were expressed as in descriptive statistics using pie-charts, frequencies and percentages. Other inferential statistics were carried out using chi square and odds ratio (OR) at 95% confidence intervals (95% CI) to determine the association of different variables with the presence of positive serology for SARS CoV-2 (dependent variable). Statistical significance was considered as p-value less than or equal to 0.05 kits as all samples tested negative to the RDT antigen kit. However, a prevalence rate of 32.8% (41/125) was recorded for SARS-CoV-2 antibody using ELISA kit among the study population as presented in figure 1.



**Figure 1:** Sero-prevalence of SARS-CoV-2 among the study population using ELISA kits

**Distribution of SARS CoV-2 Antibodies among Staff of Federal University Gusau by Socio-Demographic Factors**

Of the 125 participants recruited for the study, 76 were males representing 60.8% of the total population while the rest of the 49 participants were females representing 39.2% of the total population. As presented in Table 1, male participants constituted a majority of the research population representing 60.8% (76/125) of the total population of the study. The level of SARS-CoV-2 antibody was also higher among the male participants with a percentage occurrence of 80.5% (33/41) while female participants had 19.5% (8/41). The difference in the percentage occurrence of the antibodies within sex was statistically significant ( $\chi^2=6.56$ ,  $df=1$ , 95% C.I.,  $p=0.01$ ).

Majority of the participants were resident in urban areas constituting 80.8% (101/125) of the total population of the study while the rest 19.2% (24/125) were resident in rural areas.

Participants residing in urban areas had a higher number of positive cases with 30 of the 41 SARS-CoV-2 positive participants (73.2%) while only 11 (26.8) of the remaining positive participants reside in rural areas. The difference in the percentage occurrence of both populations was statistically significant ( $\chi^2=12.87$ ,  $df=1$ , 95% C.I.,  $p=0.0003$ ).

Forty-eight (48) of the total numbers of participants were academic staffs constituting 38.4% of the total number of participants while the rest of the 77 participants (61.6%) were non-academic staffs in the university. The academic staff category had a higher occurrence of SARS-CoV-2 antibody with 68.3% (28/41) of this category being positive while the non-academic staff had a percentage occurrence of 31.7% (13/41) for SARS-CoV-2 antibodies ( $\chi^2=2.98$ ,  $df=1$ , 95% C.I.,  $p=0.08$ ) which implies the difference recorded is not statistically significant.

**Table 1:** Socio-demographic factors of participants and SARS CoV-2 antibodies (n = 125)

Variable	Group	Freq.	No. (%) n= 41	Positive No. (%) n= 84	Chi-square	p-value
<b>Gender</b>	Male	76	33(80.5)	43(51.2)	6.56	0.01
	Female	49	8(19.5)	41(48.8)		
<b>Residence</b>	Urban	101	30(73.2)	71(84.5)	12.87	0.0003
	Rural	24	11(26.8)	13(15.5)		
<b>Job cadre</b>	Academic staff	48	28(68.3)	20(23.8)	2.98	0.08
	Non-academic staff	77	13(31.7)	64(76.2)		

**Distribution of SARS CoV-2 antibodies among by knowledge, belief and attitude**

Considering some risk factors, respondents who claimed to be aware of COVID-19 in the state all had antibodies to the virus while those who believed COVID-19 is in Zamfara state had a lower occurrence (26.8%) of SARS-CoV-2 antibodies as compared to 73.2% recorded for participants who do not believe in the presence of COVID-19 in Zamfara State.

Participants who do not abide by COVID-19 protocols had a higher occurrence of 78.1% for

SARS-CoV-2 antibodies while those who claim to abide by the protocols had a lower occurrence of 22.0%. This claim is significant with statistical values recorded indicating significant association and significance ( $\chi^2=10.53$ , df=1, 95% C.I., p=0.001, OR=3.27).

The study recorded participants with overseas travel history; contact with overseas returnees and those with flu-like symptoms all had higher prevalence of SARS-CoV-2 antibodies with percentages of 63.4%, 68.3% and 75.6% respectively.

**Table 2:** Risk factors associated with SARS-CoV 2 Antibodies (n = 125)

Variable	Group	Freq.	No. Positive (%) n = 41	No. Negative (%) n = 84	Chi-square	p-value	OR
<b>Knowledge of COVID-19</b>	Aware of COVID-19	125	41(100)	0(0.0)	3.37	0.0008	
	Not aware of COVID-19	0	0(0.0)	0(0.0)			
<b>Belief COVID-19 in Zamfara state</b>	COVID-19 is in Zamfara state	90	11(26.8)	79(94.0)	4.93	0.03	2.18
	COVID-19 is not in Zamfara state	35	30(73.2)	5(6.0)			
<b>Behaviour towards COVID-19 protocols</b>	I do abide by COVID-19 protocols	85	9(22.0)	76(90.5)	10.53	0.001	3.27
	I do not abide by COVID-19 protocols	40	32(78.1)	8(9.5)			
<b>Travel history</b>	Travelled Overseas	29	26(63.4)	3(3.6)	0.03	0.86	1.06
	Not travelled overseas	96	15(36.6)	81(96.4)			
<b>Contact history</b>	Contact with overseas returnee	35	28(68.3)	7(8.3)	4.93	0.03	2.18
	No contact with oversea returnee	90	13(31.7)	77(91.7)			
<b>Flu-like symptoms from last month to date</b>	Experienced flu-like system	45	31(75.6)	14(16.7)	8.43	0.004	2.85
	Did not experienced flu-like system	80	10(24.4)	70(83.3)			

**DISCUSSION**

The non-detection of SARS-CoV-2 antigen in this study can be attributed to the non-usage of RT-qPCR for antigen detection as antigen to SARS-CoV 2 can mainly be detected through detection of the viral RNA in samples. This cannot be obtained in the methods used for this research.

The serological prevalence of SARS CoV-2 antibodies sero-positivity detected in this study (32.8%) is slightly lower than the 34.5% recorded among medical students at the University of Copenhagen in 2020 (Madsen *et al.*, 2021) and 45.1% recorded for asymptomatic frontline health workers at the University

College Hospital Ibadan, Nigeria (Olayanju *et al.*, 2021). A lower prevalence of 12.2% for total antibodies compared to the one detected in this study have been reported among healthcare workers at Al-Manial University Hospital (Cairo University, Egypt) (Kassem *et al.*, 2020). The difference in prevalence as compared with this research could be attributed to the difference in the population of study and also sample size. Male participants having a higher (80.5%) occurrence of SARS-CoV-2 antibodies imply the male gender is likely more exposed to COVID-19 risk factors than the female gender that had a prevalence rate of 19.5%. This makes the chances of the male gender being positive to

the antibodies higher. This finding contradicts that of Musa *et al.* (2021) in Egypt among health workers where female participants had a higher prevalence compared to their male counterparts. The female populations are at lesser risk of exposure to COVID-19 since they rarely go outdoors compared to the males especially in the study area. Generally, around the world, the case fatality of COVID-19 varied widely (1-20%) with more cases and fatalities observed in males compared to females (El-Sokkary *et al.*, 2021).

Participants who reside in urban areas having higher prevalence (73.2%) can partly be attributed to the rate of exposure to COVID-19 risk factors such as high population density and breach of COVID-19 protocols. The disease progress and infection curve of COVID-19 in Nigeria is a pivotal factor as reported by Nigerian Centres for Disease Control (NCDC, 2021) where cases usually break out in urban areas and take a while before getting to rural areas. COVID-19 preventive measures such as social/physical distancing (lockdown) and use of face masks were enforced most strictly in urban areas while these measures are virtually absent in rural areas. The reason why academic staff had higher occurrence than non-academic staff is not far-fetched as the academic staff members come in contact with a large number of students more often than non-academic staff, especially during lecture hours. Though this claim cannot be relied upon as the difference in the percentage occurrence of the two populations were not statistically significant.

It is as expected that all participants claimed to know of COVID-19 as the study area composed of learned individuals. The percentage occurrence observed among this population might be due to some other risk factors. Belief in COVID-19 is a critical factor in controlling the disease. The high level of disbelief, myths and conspiracy theories among people of Zamfara state which houses the study area contributes to the high percentage of the occurrence. COVID-

19 is still a myth to so many people within the study area even among the educated class and especially about the highly contagious nature of the disease. This singular factor why most people refuse to observe COVID-19 prevention protocols at outdoor facilities or gatherings. Myths and conspiracy theories spread all over the country are contributing factors why the populace hardly accept the severity of the pandemic and therefore refusing to take any step aimed at controlling the spread of COVID-19 seriously.

The population that claimed not to abide by COVID-19 protocols is bound to have a higher prevalence as observed in this study. Socio-economic factors such as poverty restricted the rate at which the society must abide by lockdown regulations. This implies that a greater chunk of the society must go out to fend for their lives daily. During the lockdown periods, markets are usually in operation even during evening periods with large crowds of people mingling with each other, financial transactions were usually carried out physically instead of electronic mode. These cause situations that defeated prevention protocols leading to the spread of the disease throughout the study area.

There is no efficient and robust housing and biometric data management systems within the study area and this have to contribute to the general population not being accounted for in case of interventions. If these are available, foods and other goods purchased online can be sent to houses with ease without necessarily having physical contact. In addition, utilities such as power, water and internet are in most cases in deficit, these have made it difficult for people to strictly observe lockdown in such situations.

Participants who have had contact with overseas returnees are more likely to be exposed to the virus than those who have not had this exposure. This is because but not limited to the fact that overseas returnees can be exposed to the virus

more than those here in Nigeria. Participants with flu-like symptoms in the past 6 months are indicative of asymptomatic conditions as reported by Long et al. (2020) (Long *et al.*, 2020) in China. Studies have reported that the majority of infected people with COVID-19 virus are usually asymptomatic (Day, 2020).

## CONCLUSION

This study could conclude as thus:

The level of antibodies among academics is higher compared to other cadres within the university. Though this claim was not statistically significant, it literally implies that academics are more prone to the disease and

increased vaccination steps need to be taken towards this population.

Gender and residence were observed to be the most predisposing socio-demographic factors to COVID-19 disease.

Parameters such as knowledge of COVID-19, belief, behaviour towards COVID-19 protocols, contact history and flu-like symptoms were risk factors that predispose one to contact COVID-19.

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