Seroprevalence of COVID-19 among Health Care Workers (HCWs) in Northern State, Sudan

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Abstract: Covid-19 is a highly infectious viral disease, which threaten human life and public safety. Recently has been identified as global health emergency. This study aimed to determine seroprevalence of COVID-19 among health care workers (HCWs) in northern state, from May 2020 to June 2021. A total of 394 serum samples randomly selected for this cross-sectional study. Participants were screened for COVID-19 antibodies (IgG) using SARS CoV-2 antibody test (Lateral Flow Method). Demographic data were collected using structured questionnaire. The risk analysis identified independent predictors of COVID-19 seroprevalence. The overall seroprevalence was found 1.77%. High prevalence was found among laboratory workers (52/ 6%) and more males (156/3.2%) were affected than females (238/0.8%). Moreover, age was found as a major risk factor and the median age of infection is around 50 years. Considering rapid growth and high transmissibility of the virus, it would be important to encourage all efforts to protect HCWs, in order to maintain health care system.

Keywords: Seroprevalence, COVID-19, Health Care, Workers, Northern State, Sudan

1.   Introduction

Corona is a disease caused by SARS – CoV-2, which belongs to the Coronaviridae family.   Corona viruses are naturally prevalent in mammals and birds (Payne P, 2017). The disease was first reported in December 2012, in Wuhan, China (Zhu *et.al* ,2020).   On March 2020 the World Health Organization (WHO) declared COVID-19 as pandemic caused by SARS-CoV-2 (Shivanika *et.al* ,2020).

The transmission of the disease to humans occurs through direct contact with droplets such as airborne transmission and also fecal and oral routes have been identified (Lai *et.al*, 2020). The incubation period of SARS CoV-2 infection is assumed to be in 14 days succeeding exposure, with most patients taking place around four to five days individuals of all ages may acquire SARS-CoV-2 infection, although middle age and older individual are the majority (Schoeman *et.al* ,2020). The usual clinical characteristics involve, fever, dry cough, fatigue, sore throat, rhinorrhea, conjunctivitis, headache, myalgia, dyspnea, nausea, vomiting and diarrhea (Mdentosh *et. al*, 2020).   Hence, there are no unique clinical features that yet dependably differentiate COVID-19 from other upper/ lower airway viral infections, (Biorender ,2021).

The clinical signs of the disease vary from patient to patient and sometimes maybe asymptomatic (Foresta *et.al* ,2020). Most of the mortal cases are happened in cases with advanced age or predisposing co-morbidities such as cardiovascular diseases, coronary heart diseases, diabetes mellitus, chronic lung diseases, hypertension and cancer (Letko *et.al* ,2020).   The virus has different variants identified in different countries.   Three important variants which have rapidly become dominant at UK-variant, South African-variants and Brazilian- variant. The emerging variants not only result in increased transmissibility, morbidity and mortality but also have ability to evade detection by diagnostic tests and exhibit decreased susceptibility to treatment (Dahama *et.al* ,2020).

The Pathogenesis of SARS- Cov-2 infection in humans manifest itself as mild symptoms to severe respiratory failure (Grasselli *et.al* ,2020). On biding to epithelial cells in the respiratory tract, the virus start replicating and migrating down the airways and enter the alveolar epithelial cells in the lung. The rapid replication of the virus in the lungs may trigger strong immune response. Cytokine storm syndrome cause acute respiratory distress syndrome and respiratory failure, which is considered the main cause of death in

patients with COVID-19 (Hojyo *et. al*,2020).   Histopathological changes in patients with COVID -19 occur mainly in lungs, showed bilateral diffused alveoli damages, hyaline membrane formation, desquamation of pneumocystis and fibrin deposits in lungs (Sharif *et.al* ,2020). Molecular detection of SARS CoV-2, nucleic acid, is the gold standard and many viral nucleic acid detection kits are commercially available.

The virus can be detected from variety of respiratory source, including throat swabs, posterior oropharyngeal saliva, nasopharyngeal swabs sputum and bronchial fluids. Chest CT was used to quickly identified patients when the capacity of the molecular detector was overload (Ong *et.al*,2020). The treatment of the disease is based on the symptoms and there is no exact treatment available to complete recovery in patients with COVID-19, however, wide range of possible therapies, including antiviral medicines, immunosuppressant, monoclonal antibodies and vaccines were used (WHO ,2020) .

Globally the disease is continuing to infect millions of people and is resulting in death; the government of Sudan has increased its efforts and taken extensive steps in proper identification and treatment of those who have been infected by the virus. The disease in Sudan was reported in March 2020 by the Federal Ministry of Health and the distribution varies between different states. An incidence of 7% was reported in Khartoum State and 3%, 6%, 2%, in Algazera, Kassala and North Drafur respectively (Ayman *et.al*,2021).

In Northern state, COVID-19 was prevalent in Dongola, Marwee, Dabba, Algoled and Halfa localities and new cases were regularly reported but the situation of the disease is unknown. This study was carried out to investigate the prevalence of this infectious disease in high-risk groups in Northern state.

2. Material and Methods

2.1 Study area:

This study was conducted from May 2020 to June 2021 in Northern state, Northern Sudan. It is 450 Km Northern to Khartoum. Situated 16-35,22-19 N and 25-30,32-10 E with relative humidity of 25%. The state receives an annual rainfall of 25mm and temperature ranging from 31to 45°C.

2.2 Study population:

The study was focused on high-risk groups mainly phycian, nurses, laboratory workers, hospital workers, medical students and other workers(Paramedical) in the seven major hospitals in the study area.

2.3 Study design:

Across-sectional study was conducted to determine the prevalence of COVID-19 among high-risk groups during the epidemic of the disease. The minimal sample size was found to be 385 using a sample size calculator (www.calcolator.net) with a 95% confidence level and 5%margine of error. Convenient sampling technique was used and the health care workers working in any one of the selected 6 hospitals and who were willing to participate in the study were included .A structured questionnaire was administered to get relevant information about the study population. For serological test approximately 4ml blood was   taken from each subject and the serum stored at-20^{0}C for up to 9 days.

2.4 Serological Test:

SARS Cov-2 Antibody Test (lateral flow method) was used to detected antibodies against COVID-19 (Wondfo Biotech. Belgium).

Test procedures:

1- A low the device, buffer and specimen to equilibrate to room temperature prior testing.
2- Remove a test cassette form the foil pouch by tearing of the notch and place it on a level surface.
3- Add 10 uL of serum specimen for the sample well (small well) and then ad 2- 3 drops (80ul) of buffer solution to the buffer well (large well).
4- As the test begins to work you will see purple color move across the result window in the center of the test device.
5- Wait for 15minutes and read the results. Do   not read the results after 20 minutes.

Positive Result:

Color bands appear at both test line (T) and control (C). It indicates a positive result for the SARS CoV-2 antibodies in the specimen.

Negative Result:

Color band appear at control line (C) only. It indicates that the concentration of the SARS CoV-2 antibodies is zero or below the detection limit of the test.

Invalid Result:

No visible colored band appeared at control line after performing the test.

Results:

Of the 400 individuals of high- risk groups examined by SARS-CoV-2 Antibody test, 394 of them returned their questionnaire with a response rate of 98,5%. Six questionnaires were subsequently found to be incomplete and were there for excluded from the final analysis. The samples of the study included 156 (39.6%) males and 238 (60.4%) females with range of 30 and 50years old.

The samples were collected form physician 73 (18.5%), nurse 81(20.5%), laboratory workers 52(13.3%) hospital workers 70 (17.7%) medical students 66 (17.7%). The overall seropositiviy of COVID-19 infection in the study area was 1.77%. A high prevalence of 6.00% was found among laboratory workers.

Regarding age, gender, occupation and locality the seroprevalence of Covid-19 infection in study area were showed in Tables (1) and (2) and Figures (1), (2)

2.5 The situation of Covid-19 infection in the Northern state.

The disease was first reported in Dongola locality, since that time, the disease was reported form the seven localities of the state. The incidence of COVID-19 infection in the Northern state during 2019-2022 increased form 157 /cases/10.000 people in 2019 to 216 cases/ 10.000 in 2022 with a peak of cases/800 in 2021 Fig.1
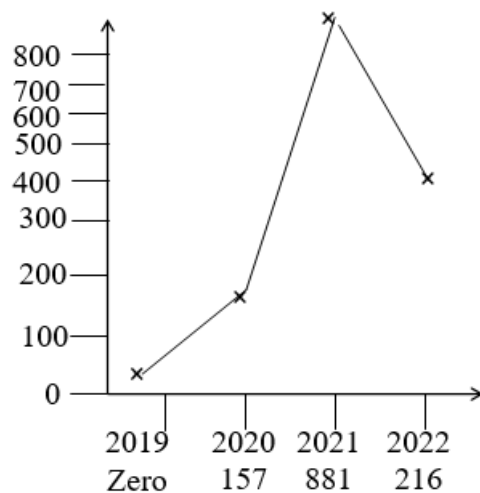
Fig (1) Incidence of COVID-19 infection between 2019-2022 in Northern state. Sudan. Source Ministery of Health.

Table No. (1) Age and gender distribution of seoprvalence of COVID -19 infections in study area:

Variable	Number examined	Number Positive	Percentage (%)
1. Age group			
18-30	201	2	0.99%
30-50	162	3	1.86%
>50	31	2	6.45%
2. Gender			
Male	156	5	3.20%
Female	238	2	0.84%

Table No. (2) Seoprvalence Covid-19 infection in study area according to Occupation and Locality :

Variable	Number examined	Number Positive	Percentage(%)
1. Occupation			
- Physician	73	1	1.36%
- Nurses	81	1	1.23%
- Lab workers	52	3	6.00%
- Hospital labors	70	2	2.85%
- Medical students	66	-	-
- Others (paramedical)	52	-	-
Total	394	7	1.77%
2. Locality(Hospitals)			
- Dongola	64	1	1.56%
- Alborgage	75	2	2.66%
- Marawe	162	1	0.61%
- Halfa	36	1	0.61%
- Dalgo	7	-	-
- Algoled	49	2	4.08%
Total	394	7	1.77%

Figure (2): Showed demographic characteristics of the participants used in COVID-19 seroprevalence in study area.

(A) Age group of the participants (B) Gender of the participants (C) Occupation of the participants (D) Residence of the participants.
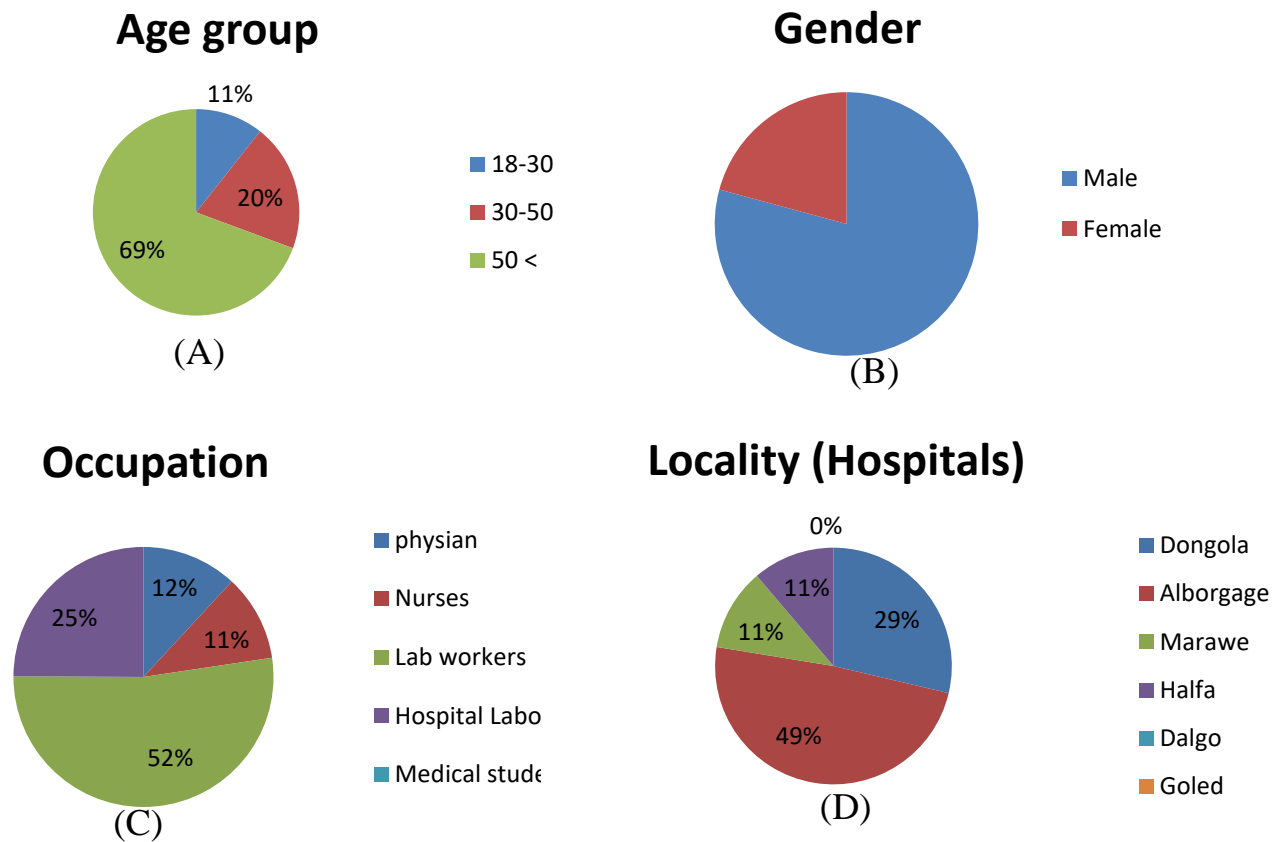
3-Discussion

Corona (SARS- CoV-2) is highly infectious viral disease constitutes a major public health problem in older age and underlying chronic medical conditions. The virus pandemic situation was evolving rapidly and world- wide distribution. In Sudan the disease was firstly reported in Khartoum state and distribution of the disease varies between different states .High incidence rate was reported in Khartoum state (72.2%), followed by Aljazeera state (8.4%), on March 2020 .Additionally the least one were reported in south Kordufan (0.001%)

Central Darfur (0,004%) and Northern state (0.041%) (Ayman *et .al*,2021). The total number of cases continued to rise sharply in early December 2020 at on average rate of more than 150 newly confirmed cases per day (Omer. *et.al*,2020). The present study showed (1.7%) Seroprevallence of (SARS.CoV-2) antibodies among front line health care workers (HCWs) in Northern state. This finding was lower than that reported from Poland (22.9%), North America (12.7%), Sweden (19.1%) and United Kingdom (45%),(Shields *et.al* ,2020).

In this study, Alborgage, Algoled and Dongola hospitals, were the three hospitals with high prevalence rates of the disease among health care workers compared with Marawe, Halfa and Dalgo hospitals. Aa observed in Agoled hospital, it appeared that there was high infection rates among health care workers (4.08%), this has the potential to destabilize more stringent health and safety standard operating procedures. On regarding occupation, the risk of the disease appeared high in laboratory workers (6.00%) Table (2), compared with other medical personnel, which might indicate inadequate supply and /or quality of personal protective equipment or inadequate training for infection prevention and control of the diseae.

The age group (>50) years was the most commonly affected with COVID-19 in this study. Comparable findings have been reported from Taiwan (mean age 48.SD 11.5 years) and Poland (49.SD 12.5 year), (Rostomi *et.al* ,2021). It appeared that age as a major risk factor and the median age of infecton is around 50 years.

On regarding gender, more males were affected than females, in our study and this is in accord with studies conducted by, Izabella *et.al* (2020), Majiya *et.al* .(2020) and Hessian *et.al*.(2021). The overall pooled odds ratio of 25 studies for association between gender and IgG antibodies against COVID-19 was 1.18 (OR= 1.18, 95% CI= 1.06- 1.31).

Indicating the odds of catching an infection in male HCWs was higher by 18% than female HCWs. This indicated that the behavioral factors and social roles which increase the risk of acquiring COVID-19 tend to be more common among men.

Other studies have, however, observed that the incidence of infection was relatively greater in females than males or roughly equal, such as studies conducted by Jun. *et.al* (2020), Akbar *et.al* (2020) and Hannah *et.al* (2020).

Despite the limitations of relatively smaller sample size as a result of extreme seroprvelance used to determine the sample size and the COVID-19 Spot Test currently not being found ideal, the study has provided voluble information on a very important problem of COVID-19 among HCWs. Considering the relatively high prevalence of COVID-19 as revealed by this study it would be important to prevent and control infection among HCWs to protect the health system. Further studies are needed to determine path ways to increase hospital settings for the current and future pandemics.

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