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Seroprevalence of SARS-CoV-2 antibodies among the university population of Ngaoundere-Cameroon

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Abstract

Background: The extent of circulation of Coronavirus-2 Severe Acute Respiratory Syndrome in many African countries remains uncertain, underscoring the need for sero-antibody surveys to assess the cumulative attack rate as well as the risk of disease resurgence.

Objective: The aim of the study was to assess the seroprevalence of SARS CoV-2 at the University of Ngaoundere and the factors associated with seropositivity.

Methods: This was a cross-sectional study, carried out on a group of 192 people, from September 05 to 30, 2022. The study population consisted of students, teachers, support staff and all other persons regularly attending the campus. After obtaining informed consent, they were invited to complete a questionnaire, following which blood samples were taken for the detection of total serum anti-SARS-CoV-2 antibodies using the RADI COVID-19 IgG/IgM rapid test.

Results: Of the 192 study participants, 71.9% were men. Mean age was 26.16 [17.55-34.77]. Seroprevalence was 78.7%. All support staff (100%) in our study tested positive. Subjects under 26 years of age were more likely to be seropositive than those over 26.

Conclusion: This study has shown that most members of the Ngaoundere university community have met the virus either through contamination or vaccination; this could have a positive impact on community immunity and reduce the risk of resurgence of the disease on campus.

Keywords: Seroprevalence; SARS-CoV-2; Risk factors; University of Ngaoundere.

Abbreviations: CoV: CoronaVirus; COVID-19: Coronavirus Disease 2019; CPC: Centre Pasteur in Cameroon; FIND: Foundation of Innovative New Diagnostics; Ig: Immunoglobulin; RDT: Rapid Diagnostic Test; RR: Relative Risk; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; UN: University of Ngaoundere.

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Introduction

Emerging infectious diseases have always been a threat to public health worldwide [1]. Such is the case of this emerging zoonosis, which appeared at the end of December 2019 and was reported by the World Health Organization (WHO) as being responsible for cases of pneumopathy linked to a live animal market in the city of Wuhan, China [2]. This is a new coronavirus, designated as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus is responsible for an emerging infectious pathology called coronavirus disease 2019 (COVID-19).

Cameroon, like many countries in sub-Saharan Africa, has so far reported only a limited number of cases of COVID-19. The total number of reported deaths remains low. At the beginning of June 2022, there were 119,947 cases and 1,930 deaths in Cameroon (WHO AFRO.COVID-19, 2022), with 4.109 confirmed cases and 65 deaths in Adamaoua. This contrasts sharply with the hundreds of thousands/millions of deaths/positive cases reported in many high-income countries. This would mean that the true extent of COVID-19 in the community would be unknown and probably higher than reports indicate.

Yet diagnosing people exposed to or infected with SARS-CoV-2 is essential for controlling the global pandemic of COVID-19. In a city where the disease has spread, it is important to estimate the prevalence of the disease to assess herd immunity [3]. Indeed, the use of seroprevalence studies, which assess the number of people in a population who test positive for a specific disease based on blood serum, can help determine the number of infections at population level, identify the extent of undetected cases and assess the risk of disease resurgence. On the other hand, serological testing for the presence of anti-SARS-CoV-2 antibodies aims to identify previous SARS-CoV-2 infection, and can help confirm the presence of a recent infection in the event of PCR limitations [4-5].

In this vein, we set out to determine the seroprevalence of COVID- 19 within the campus and its various associated factors.

Methods

Study design, period, scope, and participants

A cross-sectional survey was conducted at the University of Ngaoundere- Cameroon. The study was conducted on a group of 192 people ranging from September 05 to September 29, 2022. The study population consisted of students, teachers, support staff and all other persons regularly attending the campus. After obtaining their informed consent form, they were invited to answer the questions in the questionnaire, after which the sample was taken. The inclusion criteria were any member of the Ngaoundere university community who agreed to take part in the study by signing the informed consent form and answering the questionnaire.

The sample size was calculated to 187, using the LORENTZ formula to ensure a minimum participant size. The estimated proportion of anti-SARS-CoV-2 antibody seroprevalence in Cameroon (IgG) was 4.6% [6] with an error of 3%, for a confidence limit of 95%.

Primary and secondary parameters

The primary endpoint was to assess the seroprevalence of SARS CoV-2 antibodies (IgM and IgG) in the individuals studied and the secondary endpoint was to determine the risk factors associated with seropositivity for these antibodies.

Study instrument

Established survey instruments were used to obtain information on participants' sociodemographic data (e.g. age, gender, status, faculty, level of education and residence), COVID-19-related symptoms (e.g. fever), exposure (e.g. participation in festivities) and behavioral factors (e.g. compliance with COVID-19 public health measures). The specific public health measures studied included social distancing (in private and public contexts) and wearing a face mask in public. The type and frequency of source used to retrieve information relating to COVID-19 was investigated by asking respondents, "How often do you use social media for information relating the disease. All study materials were provided in English and French.

Data were collected via a physical questionnaire consisting of four parts. The first part consisted of the participants' socio-demographic characteristics (age, gender, residence, status, faculty, and level of study). The second section consisted of clinical status to obtain information on COVID-19-related symptoms, hospitalization, and vaccination.

The third section concerned the set-up and sharing to obtain information on travel made and contact with international travelers and contact with positive and/or suspected cases. The fourth section dealt with the results of examinations related to COVID-19, TDR/PCR COVID-19 test results and anti-SARS CoV-2 IgG, IgM serology.

Biological analysis

A 3 ml venipuncture into an EDTA tube was performed on the participant. After centrifugation, the plasma was used for qualitative detection and differentiation of anti- SARS-CoV-2 IgM and IgG antibodies using the RADI COVID-19 IgG/IgM rapid chromatographic immunoassay. Sensitivity and specificity are 90% and 100% respectively. No cross-reactivity has been observed with this test.

Operational definitions

In the present study, SARS-CoV-2 seropositive subjects were those in whom anti-SARS- CoV-2 IgG and/or IgM antibodies were detected. The isolated presence of IgM antibodies indicated recent exposure to SARS-CoV-2 of between 3 and 6 days, and the presence of IgG antibodies indicated prolonged exposure of more than 8 days [5].

Data collection and quality assurance

Data were entered into Sphinx Plus² - Edition Lexica-V5 and analyzed in Excel 2010 (Microsoft office 2010). Qualitative and quantitative variables are presented respectively as percentages with 95% confidence intervals (CI=95%). The chi-square test ($\chi 2$) was used to compare proportions. The threshold of statistical significance was set at a p-value <0.05.

Ethical consideration

The study was approved by the Comité National d'Ethique de la Recherche pour la Santé Humaine du Cameroun (N°2022/03/1443/CE/CNERSH/SP). In addition, written informed consent was included in the survey. Participation in the study was voluntary.

Results

Socio-demographic characteristics of study participants.

A total 192 participants were included in our September 2022 study, mainly male. The average age was 26.2 with a more represented (30.27%) age range located between 22-26. Our participants mainly had student status (Table1).

IgG/IgM antibody rapid tests were performed and revealed a positivity frequency of 78.7% (151/192). Of the 151 positives, 79 participants had developed anti-SARS-CoV-2 IgG, synonymous of previous contact with the virus. This represents an IgG seroprevalence on RDT of 41.2%. In addition, 13 volunteers representing 6.8% had developed IgM antibodies synonymous of recent infection at the initial phase, while 59 (30.7%) had both IgG and IgM antibodies, i.e. infection in the intermediate phase of the disease (Figure 1).

Seroprevalence according to socio-demographic characteristics

Among the studied variables, only the variable "status" was significantly (p=0.043) associated with the seroprevalence (Table 2). Indeed, for an overall seroprevalence of 78.7%, the support staff were mostly affected (100%) while the shopkeepers and moto taxi drivers were less (50.00%). In other terms, the support staff were twice more likely to test positive than the shopkeepers and moto taxi drivers. IgG/IgM seroprevalence was equally high among (81.80%).

Table 1: Socio demographic characteristics of respondents

Variables		Number	Percentage (%)
Sex of participants	Male	138	71.90
	Female	54	28.10
Age of participants	Less than 20	27	14.59
	[20;24]	56	30.27
	[24;28]	52	28.11
	[28;32]	22	11.89
	32 and more	28	15.14
Status of participants	Students	157	81.8
	Teachers	11	5.7
	Support Staff	12	6.3
	Other	10	5.2

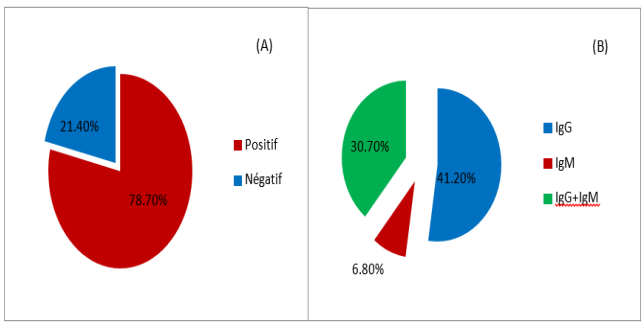

Figure 1: Seroprevalence (A) and distribution of positive cases (B) and study sample.

Table 2: Cross tabulation between seroprevalence and status of the volunteers.

Variables	Terms and conditions	Seroprevalence		
		Positive (%)	RR (Risk Ratio)	Negative (%)
Status	Student	123(78.60)	1,57	34(21.40)
	Teacher	9(81.80)	1,64	2(18.20)
	Support staff	12(100)	2	0(0.00)
	Other	5(50.00)	1	5(50.00)
	TOTAL	151(78.7)		41(21.4)

Socio-demographic characteristics associated with seropositivity history

The frequency distribution of detected antibodies according to age and gender is shown in Table 3. Age (P=0.0019) and gender (P=0.0415) were significantly associated with the type of antibodies detected.

In the age variable, IgG antibodies were more frequently detected in subjects under 20 years of age (85.7%), [20-24] (57.1%) and >32 years of age (56.5%). On the other hand, IgG+IgM antibodies were more common in subjects aged [24;28[(56.1%) and [28;32[(61.1%). Comparatively, the frequency of IgG 2.57-, 1.71- and 1.70-fold significantly higher in the above classes than in the [28;32 [class, where they are relatively less represented. On the other hand, IgG+IgM antibodies are significantly higher 3.92 times and 4.27 times respectively in classes [24;28 [and [28;32 [than in the lowest value class <20 years.

For the gender variable, females have a higher rate of IgG positivity (68.20%), compared with males, while males have a uniform distribution of IgG and IgG+IgM.

However, it should be noted that all participants who had been in contact with a confirmed COVID-19 case, whatever the method of confirmation, were seropositive (100%).

Clinical and other factors associated with seroprevalence.

The distribution of clinical signs according to seroprevalence is shown in Figure 2. Although this distribution does not show a significant difference, we note that all our participants (100%) who had odynophagia, anosmia/hyposmia, agueusia/dysgeusia or even myalgia during the year tested positive.

Discussion

COVID-19 is still one of the world's major public health concerns. This cross- sectional study of SARS CoV-2 antibody seroprevalence among the university student population revealed that 78.7% of the university population had evidence of previous infection with SARS CoV-2. This value is much higher than that reported in many previous studies, notably [7] University of Yaounde 1, where seroprevalence was 4.6%. These result was much higher than the equivalent prevalence SARS CoV-2 in all the university campus of Cameroon (0.8%) and University of Ngaoundere (1.15%), according to the report of the FIND COVID TDR-Ag CPC project, conducted in the same period with the present study.

Table 3: Positive seropositivity according to age and sex.

Variables	Terms and conditions	Priority of infection					
		Former IgG (%)	RR (Risk ratio)	Recent IgM (%)	RR (Risk Ratio)	Intermediate IgG+IgM (%)	RR (Risk ratio)
Age class	Less than 20	18(85.70)	2,57	0 (0.00)	0	3(14.30)	1
	[20;24]	24(57.10)	1.71	7 (16.70)	3.79	11(26.20)	1.83
	[24;28]	14(34.20)	1,03	4 (9.80)	2.23	23(56.10)	3.92
	[28;32]	6(33.30)	1	1 (5.60)	1.27	11(61.10)	4.27
	32 and more	13(56.50)	1.70	1 (4.40)	1	9(39.10)	2.73
Gender	Male	49(45.80)	1	10 (9.40)	1.38	48(44.90%)	1.80
	Female	30 (68.20)	1.49	3 (6.80)	1	11 (25.00)	1

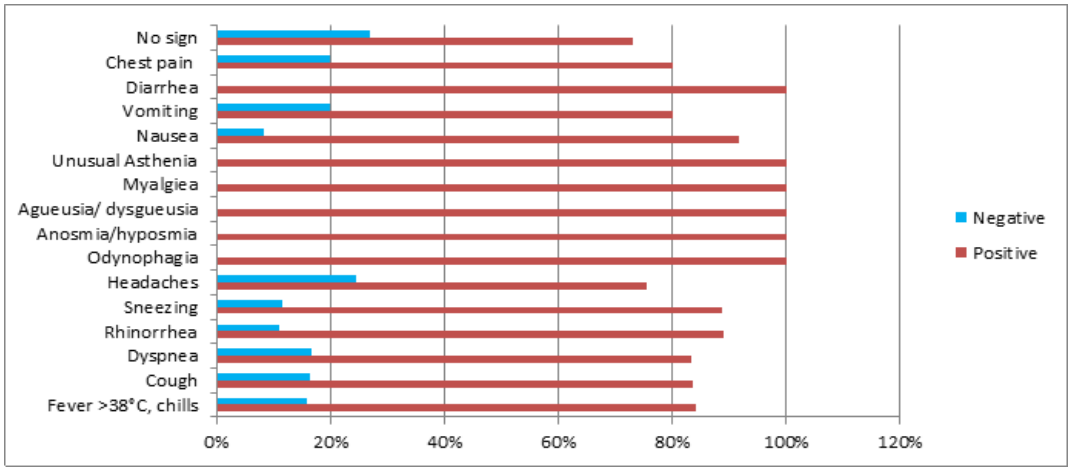

Figure 1: Distribution of COVID-19 clinical signs according to seroprevalence positivity.

In our population, the proportion of men 138/192 (71.9%) was higher than that of women 54/192 (28.1%) with an average age of 26.16. These results differ from those obtained in the study of healthcare workers in health establishments [6] conducted in Yaoundé, where 58.8% were male and 41.2% female, with an average age of 33. Recent study by Esther et al (2021) on mass screening of the community of Ngaoundere found a fairly parity with male representing 51.2% and female 48.2%, with an average age of 43.1 years. In our study, men and youngers were more likely to participate. This could be explained by the fact that the population community within the University of Ngaoundere is mainly made up of students and men who are young people. Men were probably more receptive to this type of survey than women, or they are more likely to continue their study at the university level, but this needs to be investigated.

The majority of our participants (40.60%) had reported being asymptomatic, with the most common signs among symptomatic cases being fever >38°C + chills (22.90%), cough (31.80%), rhinorrhea (23.40%), sneezing (22.90%) and headache (29.70%). The low number of people reporting symptoms may be because symptomatic people may have stayed at home in accordance with Cameroonian government guidelines. This may also be due to their actual immunity due to their ancient contact with the virus.

The seroprevalence of SARS-CoV-2 infection in the Ngaoundere university community for anti-SARS-CoV-2 IgG, IgM and IgG+IgM antibodies was 41.2%, 6.8% and 30.7% respectively. These results were in concordance with those of Katchunga et al. (2020) who revealed a seroprevalence SARS-CoV-2 IgG of around 40.8%. We observed that seroprevalence was associated with status: support staffs were observed to be all in the past in contact with the virus, which could be explained by their proximity to both teachers and students, putting them at greater risk. Seropositivity, on the other hand, was associated with age, with those under 20 having a higher IgG seropositivity (85.7%).

These results differed from those of Katchunga et al., 2020 [8] where the independent predictors of anti-SARS-CoV-2 antibodies were age >60 years. Female sex was also associated with IgG seropositivity (68.2%), which differs from the results obtained in the study carried out in Yaoundé-Cameroon [9] where men were more IgG-positive.

Conclusion

The seroprevalence of anti-SARS-CoV-2 antibodies is very high (78.7% [95% CI: (72.9-84.4)]) in the Ngaoundere University community. The most prevalent population status is the support staff, and the most recent affected age is person under 24 years. The observed high seroprevalence reflects massive exposure to SARS-CoV-2 in the university population, which has had a positive impact on community immunity, then a lower risk of resurgence of severe cases of the disease.

Declarations

Conflict of interest: None

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