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Seroprevalence of people vaccinated or not against COVID-19 in the city of Conakry

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Abstract

The coronavirus pandemic (COVID-19) is a potentially fatal disease that has caused a global public health crisis. Its treatment is symptomatic because until now the WHO has not approved an effective treatment against this disease. This is why today hope is turned to vaccination to curb this global pandemic. The presence of anti-SARSCoV-2 antibodies in the serum of sick (symptomatic or asymptomatic) and vaccinated individuals must be evaluated for the proper understanding of natural or adaptive immunity.

We conducted a cross-sectional study of 6 months duration. The working methodology consisted in the determination of anti-SARSCoV-2 antibodies in the serum of unvaccinated (asymptomatic) and vaccinated persons by the Elisa method.

We found 33.66% positive cases in unvaccinated persons and 93.51% positive cases in vaccinated persons. The most affected commune in both groups (vaccinated and non-vaccinated) was Ratoma with respectively 35% and 65%. There were 57.14% males in the unvaccinated group versus 64.98% in the unvaccinated group. The age group that developed the most antibodies in both study groups was 20-39 years old with 35% and 65% respectively. The optical density was higher in vaccinated persons than in unvaccinated persons.

In sum, according to the results found in this study, we must remember that more antibodies are developed in the vaccinated population than in the non-vaccinated.

Keywords: COVID-19; Seroprevalence; G Antibodies; Optical Density

1 Introduction

COVID-19 is a zoonotic viral pneumonia caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), whose reservoir is poorly understood [1].

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This viral pneumonia is transmitted from one person to another through the production of oral and nasal secretions following direct or indirect contact with infected people [2]. The incubation period is estimated at between 2 and 14 days, with an average of 5 days [3].

According to the World Health Organization (WHO), 40% to 50% of people infected with COVID-19 in Europe are symptomatic, whereas 80% of people infected in Africa are asymptomatic [1].

The symptoms of COVID-19 include cough, fever, dyspnea, musculoskeletal pain, gastrointestinal problems and anosmia/dysgeusia, sore throat, rhinorrhea, nasal congestion, olfactory or gustatory problems, etc (4). Generally speaking, the elderly and people with chronic and underlying illnesses are affected by the severe or critical form of this disease, which increases the lethality in these groups of people [5].

On 31 December 2019, the WHO was informed by the Chinese authorities of the first cases of the new coronavirus whose disease was subsequently named COVID-19 by the WHO on 11 February 2020 [1].

Because of its major geographical, political and socio-economic impact, affecting a large number of the world's population, the World Health Organization declared the COVID-19 epidemic to be a public health emergency of international concern on 30 January 2020 and a global public health pandemic on 11 March [1].

On 14 October 2020, the world recorded 37888384 cases of COVID-19, including 1081868 deaths. The American continent had the highest number of cases, with 18090384 cases and 593,984 deaths, followed by Europe with 7108781 cases and 248498 deaths [6].

The African continent was the least affected, with an estimated 1237088 cases and 27540 deaths. South Africa was the worst affected country, with 693359 cases and 17863 deaths [6]. Egypt was the first country to record the first case of COVID-19 on the continent, followed by other countries in sub-Saharan Africa where the health systems are more or less fragile, with disparities in the dynamics of the epidemic [7].

However, the WHO has stated that African resistance to SARS CoV 2 is due to the fact that 80% of people infected with the virus in Africa are asymptomatic [7].

The world has also seen other coronavirus epidemics, such as severe acute respiratory syndrome [8]. SARS is a respiratory disease caused by a coronavirus that began to spread in southern China in 2002. Of animal origin, it was isolated from Rhinolophid bats that swarmed in the monumental caves of Yuman province [8]. It infected humans for the first time in Guandong province in the same year. Human-to-human contamination occurred via the air, through contact with saliva or nasal secretions [5].

A cumulative total of 7761 cases and 623 deaths have been reported from the 28 countries affected. Of this total, 5209 cases and 282 deaths are attributable to China. The World Health Organization issued a global alert calling for the isolation and quarantine of those affected in order to contain the epidemic [1].

Other diseases such as MERS (Middle East Respiratory Syndrome) is an infectious disease first identified in Saudi Arabia in April 2012. It mainly affects the respiratory tract and is responsible for fever and coughing, which can lead to death in around 30% of cases. It has infected 1219 people and caused 449 deaths [9].

In the Republic of Guinea, according to the National Agency for Health Security (NAHS), the country recorded its first case of COVID-19 on 12 March 2020, and had registered 11,188 cases by 13 October 2020 [10].

Data published on DHIS2 (the Ministry of Health and Public Hygiene's data platform) showed that tests were carried out disproportionately according to origin and gender. The 78% of tests carried out in Guinea were done in Conakry, i.e. 97,358 cases, and 12% in the prefecture of Kindia, i.e. 15,381 cases [10].

The detection and isolation of antigens from infected individuals and their contacts in record time is considered essential to curbing this unprecedented pandemic. [11] This strategy relies on robust, rapid and easy-to-use diagnostic tools that can be used to screen a large number of samples in a short space of time. To date, the recommended diagnostic method for SARSCoV-2 infection is real-time RT-PCR, which was introduced in January 2020 and is now being applied using the WHO protocol [12].

Today, serological tests are also used to detect people with COVID-19 [13].

To combat COVID-19, mass vaccinations are needed.

Since Friday 11 December 2020, the Comirnaty vaccine (also known as BNT162b2) created by the Pfizer and BioNtech laboratories has been validated by the WHO and many others such as Moderna, Sinopharm etc [14].

These vaccines are administered to enable the body to develop immunity to the disease by producing neutralising antibodies to SARS-CoV-2. Several studies have reported on seroprevalence in the West African sub-region. However, there is little information on the seroprevalence of SARSCoV-2 in Guinea, particularly in Conakry. The aim of this study was therefore to determine seroprevalence in people vaccinated or not against COVID-19 in the city of Conakry.

2 Material and method

This was a descriptive cross-sectional study lasting 6 months from 7 April to 7 October 2021. Carried out on the population of the five communes of the administrative region of Conakry being vaccinated or not.

2.1 Sampling

Sampling was based on simple random selection of all patients attending consultations and those receiving vaccination against COVID-19 at the Nongo Epidemiological Treatment Centre (CTePI-Nongo). Those who gave a favourable opinion for participation in the study. All those whose free and informed consent had not been obtained were excluded. And those whose medical record were not complete.

The sample size was calculated with the Schwartz formula using the estimated prevalence of confirmed cases of COVID-19 and those vaccinated in the city of Conakry.

$$\boldsymbol{N = \frac{t^2 x\, P(1-P)}{(Pr * P)^2}}$$

N: Required sample size
t: Parameters related to the 95% risk of error (1.96)
Pnv: Estimated prevalence of COVID-19 positive persons in the city of Conakry (10%)
Pv: Estimated prevalence of people vaccinated against COVID-19 in the city of Conakry (53, 7%)
m 1: Relative accuracy (60%)
m 2: Relative accuracy (10%)
Nnv = (1, 96)2 x 0, 10 (1-0, 10)/ (0,60*0,10)2 =96,04≈96.
Nv = (1, 96)2 x 0.54 (1-0.54)/ (0.10*0.54)2 =327.24≈327.
Hence Nnv = 104 for unvaccinated individuals.
Hence Nv= 339 for vaccinated individuals.

2.2 Variables

- The variables studied were divided into biological and epidemiological variables.
- Biological variables: Vaccine and type, Dose and number of doses, Optical Density
- Epidemiological variables: Age, Sex, Occupation, Residence, Vaccination.
- All patients were asked to fill in a survey form. This form consisted of a section on socio-demographic characteristics (age, sex, residence, socio-professional category) and another on parameters relating to vaccination and results (1st dose, 2nd dose, Optical Density (OD).
- All patients underwent blood sampling in a dry tube (red cap). The samples were sent to the INPS-Nongo Respiratory Virus Laboratory for anti-SARSCoV-2 antibody testing.

2.3 Collecting and performing manipulations

When the samples are received, they are counted and checked for compliance before being handled. They are then left to stand until the serum and other blood elements have been separated, or they are centrifuged at 12,000rpm for 5 minutes.

The serum is aliquoted into 1.5 ml Eppendorf tubes and stored at 4°C for 48 hours or at -20°C for several days.

Anti-SARSCoV-2 antibodies were determined by enzyme-linked immunosorbent assay (ELISA) using the Rumei kit, which targets antibodies to the Spike (S) protein. The optical density was read on a plate reader at a wavelength of 620nm.

The results are positive when the optical density is greater than 0.30, suspect when the OD is between 0.16 and 0.29 and negative when the OD is less than 0.16.

2.4 Ethical considerations

As part of the response to COVID-19, approval has already been obtained from the Ministry of Health and Public Hygiene.

The data collected was entered into Excel version 2016 and then exported to Epi Info version 7 for descriptive analysis. The proportions of positive, suspect and negative cases were calculated in relation to the total number of cases received. The 95% confidence interval was calculated for each proportion. The proportion of positive individuals was taken as the overall seroprevalence of SARSCoV-2.

The proportions related to socio-demographic characteristics were determined as a function of the total number of positive cases. We determined the Chi-square test to see if there was a difference between the proportions of vaccinated and unvaccinated people. The proportions of vaccinated people were determined not only according to the total number tested but also the total number of positive people. We determined the proportion of optical density as a function of the number of positive cases. The proportion of the number of doses received was determined as a function of the total number of people tested and those who tested positive.

3 Results and Discussion

A total of 104 unvaccinated and 339 vaccinated individuals gave free and informed consent to participate in this study. Thirty-four (34) percent (95% CI 24 - 46) of individuals (OD ≥ 0.30) were positive with 30% (95% CI 22 - 40) suspected and 36% (95% CI 26 - 46) negative cases of unvaccinated individuals and 93% (95% CI 90 - 96) of vaccinated individuals were positive with 2% (95% CI 0 - 3) suspected and 5% (95% CI 3 - 8) negative cases.

Suspect cases are those in which the optical density has exceeded the negativity threshold but the positivity threshold has not been reached. They range from 0.16 to 0.29 (0.16 ≤ OD ≤ 0.29).

People who test positive for the presence of IgG in their serum have either developed the disease and recovered without the health authorities being informed, or they have been in contact with the virus without developing the disease (asymptomatic subjects).

Table 1 Overall seroprevalence of vaccinated and unvaccinated individuals

SARSCoV-2 serology	**Non-vaccinated**		**Vaccinated**	
	Workforce	Percentage	Workforce	Percentage
Positive	35	34	317	93
Negative	37	36	17	5
Suspect	32	30	5	2
Total	104	100	339	100

We found an overall seroprevalence of 34% (95% CI 24 - 46) for unvaccinated people and 93% (95% CI 90 - 96) for vaccinated people. This observation is similar to that described by Gianpaolo Zarletti et al in an Italian population of 45 people, 16 of whom were IgG positive (35%) [12].

Table 2 Breakdown of positive people vaccinated or not, by socio-demographic characteristics

Age groups (year)	**Non-vaccinated**		**Vaccinated**	
	Workforce	Percentage	Workforce	Percentage
≤18	1	3	2	1

19-39	23	66	229	72
40-59	9	26	72	23
≥ 60	2	5	14	4
Gender				
Female	15	43	206	57
Male	20	57	111	43
Residence				
Matoto	5	14	113	36
Matam	1	3	29	9
Dixinn	3	9	18	6
Ratoma	22	63	147	46
Kaloum	4	11	10	3
Profession				
Health Officer	11	31	205	65
Student	8	23	1	1
Other	16	46	111	34
Total	35	100	317	100

A total of 352 people tested positive, vaccinated or not, by detecting the presence of Immunoglobulin G (IgG) in their serum. The 19-39 age group was the most represented, with 66% (95% CI 48-81) of unvaccinated individuals and 72% (95% CI 67-77) of vaccinated individuals. In contrast, the age group ≤18 years had the lowest seroprevalence, with a rate of 3% (95% CI 0 - 15) in unvaccinated individuals and 1% (95% CI 0 - 2) in vaccinated individuals. The median age of the series was 33 years (29 - 40), with a mean age of 37 years (11) in vaccinated patients and 35 years (26; 45) in unvaccinated patients. The mean age was 36 years (13). A study by Naaber et al in India showed that the median age was 29 years compared with 35 years in our study. This is slightly different [15].
This difference can be explained by the fact that we conducted the study on people who were older than them.

Seroprevalence was 57% (95% CI 39-74) for men compared with 43% (95% CI 26-61) for women in unvaccinated people and 65% (95% CI 60-70) for men compared with 35% (95% CI 30-40) for women in vaccinated people. Our results are comparable to those found in the United States by Naaber et al who reported that 42.3% were female and 57.7% were male [15].

We found a significantly higher proportion in the commune of Ratoma 63% (95% CI 47 - 81) among unvaccinated people and 46% (95% CI 33 - 70) among vaccinated people. The commune with the lowest proportion was Matam, with 3% (95% CI 0 - 16) among unvaccinated people, and Kaloum, with 3% (95% CI 0 - 16) among vaccinated people. Naaber et al showed in their study that regions such as New York (33.6%), Louisiana (17.6%) and Illinois (17.5%) recorded significantly higher seroprevalence than their respective neighbouring states of Pennsylvania (6.4%), Arkansas (1.9%) and Missouri (1.9%) [15]. The results of our study are similar to those found by Shuchi Anand et al, who reported in their study that seroprevalence was highest in the Southern region at 38.4%, followed by the Western region at 32.5%. The regions with the lowest seroprevalence were the North-East with 15.9% and the South with 13.2% [14].

The highest proportion of unvaccinated people was observed in the other professions class, at 46% (95% CI 33 - 69). On the other hand, among vaccinated people, the highest proportion was observed in the health worker class, i.e. 65% (95% CI 60 - 71).

Our results are slightly different from those found by Matho et al who reported that health workers had a seroprevalence of 25.8% compared with 31.43% in our study [16]. This slight difference may be explained by the fact that our studies were not conducted on the same population.

Subbarao et al reported in their study that healthcare workers developed more antibodies because they were more exposed than other occupational groups, which corroborates the results found in this study [17].

Table 3 Breakdown of antiCOVID-19 vaccines according to the number of tests performed

Vaccines	Workforce	Percentage	Positive	Percentage
Sinopharm	205	60	186	59
Sinovac	22	7	22	7
Sputnik v	86	26	83	25
Moderna	8	2	8	3
Pfiezer	8	2	8	3
Astrazénica	10	3	10	3
Total	339	100	317	100

A total of 339 people received the vaccines (one or two doses). Of these, 205 received the Sinopharm vaccine (60%). One hundred and eighty-six people (59%) tested positive for the presence of immunoglobulin G in their serum. This was followed by the Sputnik V vaccine with 25% positive results.

Table 4 Comparison of vaccinated and unvaccinated positive individuals

Statut	Workforce	Positive	Total	Percentage
Unvaccinated	22	69	91	20,54
Vaccinated	317	35	352	79,45
Total	339	104	443	100

The results presented in Table 16 clearly show that people who have received one or two doses of vaccine have a much higher seroprevalence than people who have not been vaccinated. With a Chi-square $X^2 = 20{,}49$ $Z_c > Z_t$ $<=>$ $20{,}49 > 3{,}84$ which means that there is a statistically significant difference between the seroprevalence of vaccinated and unvaccinated individuals p < 0,001. Bruna et al showed that anti-SARCoV-2 IgG levels were significantly lower in previously infected subjects than in vaccinated subjects. This is consistent with the results found in our study [18]

4 Conclusion

This study enabled us to understand the effect of vaccination on the population of Conakry during our study period. In addition, our study enabled us to make a comparison between vaccinated and non-vaccinated individuals in the production of antibodies. This shows that the vaccinated population has the highest seroprevalence and the highest level (DO≥2) of anti-SARSCoV-2 IgG antibodies. However, to determine the efficacy of the vaccines, it would be very important to have an equivalent sample size for all the vaccines.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest will be mentioned.

Statement of ethical approval

This study was not part of a clinical trial but rather part of the response to Covid-19 in the Republic of Guinea. Approval for acceptance of these vaccines and their use was obtained from the Ministry of Health and Public Hygiene

Statement of informed consent.

Informed consent was obtained from all individual participants included in the study.

References

[1] T. T. Wang, H. S. Moon, A. Le, and N. Panchal, "Proceedings of the OMS COVID-19 Response Conference," J. Oral Maxillofac. Surg., vol. 78, no. 8, pp. 1268–1274, 2020, doi: 10.1016/j.joms.2020.05.003.

[2] K.-Y. Y. Jasper Fuk-Woo Chan, Shuofeng Yuan, Anna Jinxia Zhang, Vincent Kwok-Man Poon, Chris Chung-Sing Chan, Andrew Chak-Yiu Lee, Zhimeng Fan, Can Li, Ronghui Liang, Jianli Cao, Kaiming Tang, Cuiting Luo, Vincent Chi-Chung Cheng, Jian-Piao Cai, Hin Chu, Kwok-Hung, "Surgical mask partition reduces the risk of non-contact transmission in a golden Syrian hamster model for Coronavirus Disease 2019 (COVID-19)," vol. 2019, pp. 1–18, 2020, doi: 10.1093/cid/ciaa644.

[3] R. Patel, A. Society, E. Babady, E. S. Theel, and G. A. Storch, "Rapport du sommet international COVID-19 de l'American Society for Microbiology, 23 mars 2020 : Valeur des tests de diagnostic pour le SARS-CoV-2/COVID-19," crossm Rep. from Am. Soc. Microbiol. COVID-19, vol. 11, no. 2, pp. 1–5, 2020, doi: 10.1128/mBio.00722-20.

[4] G. Dilaura, "Persistent Symptoms in Patients After Acute COVID-19," Am. Med. Assoc. All rights Reserv., vol. 324, no. 6, pp. 2020–2022, 2020, doi: 10.1001/jama.2020.12603.

[5] B. Lowe and B. Bopp, "COVID-19 vaginal delivery – A case report," R. Aust. New Zeal. Coll. Obstet. Gynaecol., pp. 465–466, 2020, doi: 10.1111/ajo.13173.

[6] L. Porte, P. Legarraga, V. Vollrath, and X. Aguilera, "Evaluation of a novel antigen-based rapid detection test for the diagnosis of SARS-CoV-2 in respiratory samples," Int. J. Infect. Dis., no. January, 2020, doi: 10.1016/j.ijid.2020.05.098.

[7] M. R. Tfi, M. R. Hamblin, and N. Rezaei, "COVID-19 : transmission, prevention and potential therapeutic options," Clin. Chim. Acta, vol. 508, no. January, pp. 254–266, 2020, doi: 10.1016/j.cca.2020.05.044.

[8] R. Patel, A. Society, E. Babady, E. S. Theel, and G. A. Storch, " Report of the American Society for Microbiology's COVID-19 international summit, 23 March 2020 : Valeur des tests de diagnostic pour le SRAS-CoV-2/COVID-19," Am. Soc. Microbiol., vol. 11, no. 2, pp. 1–5, 2020, doi: 10.1128/mBio.00722-20.

[9] Z. Abdelrahman, M. Li, and X. Wang, "Comparative Review of SARS-CoV-2, SARS-CoV, MERS-CoV, and Influenza A Respiratory Viruses," Front. Immunol., vol. 11, no. July 2003, 2020, doi: 10.3389/fimmu.2020.552909.

[10] S. C. Sakoba Keita, "COVID-19 situation in Guinea" National Agency for Health Security consulted on October 15, 2020 https://anss-guinee.org

[11] K. H. Hong et al., "Guidelines for laboratory diagnosis of coronavirus disease 2019 (COVID-19) in Korea," Ann. Lab. Med., vol. 40, no. 5, pp. 351–360, 2020, doi: 10.3343/alm.2020.40.5.351.

[12] G. Zarletti et al., "A Cell-Based ELISA to Improve the Serological Analysis of Anti-SARS-CoV-2 IgG," pp. 1–11, 2020, doi: 10.3390/v12111274.

[13] W. Liu et al., "crossm Evaluation of Nucleocapsid and Spike Protein-Based Enzyme- Linked Immunosorbent Assays for Detecting Antibodies," no. March, pp. 1–7, 2020, doi: 10.1128/JCM.00461-20.

[14] S. Anand et al., "Prevalence of SARS-CoV-2 antibodies in a large nationwide sample of patients on dialysis in the USA : a cross-sectional study," Since January 2020 Elsevier has Creat. a COVID-19 Resour. Cent. with Free Inf. English Mandarin Nov. coronavirus COVID- Res. that is available COVID-19 Resour. Cent. - Incl. this unrestricted Res. re-use a, no. January, 2020, doi: 10.1016/S0140-6736(20)32009-2.

[15] P. Naaber, A. Ottas, K. Toompere, and I. Lutsar, "Seroprevalence and levels of IgG antibodies after COVID-19 infection or vaccination," vol. 0, no. 0, pp. 1–9, 2021, doi: 10.1080/23744235.2021.1974540.

[16] M. Mahto, A. Banerjee, B. Biswas, S. Kumar, N. Agarwal, and P. K. Singh, "Seroprevalence of IgG against SARS-CoV-2 and its determinants among healthcare workers of a COVID-19 dedicated hospital of India," vol. 11, no. 1, pp. 44–52, 2021.

[17] S. Subbarao et al., "Robust antibody responses in 70 – 80-year-olds 3 weeks after the first or second doses of Pfizer / BioNTech COVID-19 vaccine , United Kingdom , January to February 2021," no. February, pp. 1–6, 2021, doi: 10.2807/1560-7917.ES.2021.26.12.2100329.

[18] Bruna Lo Sasso et al., "Evaluation of Anti-SARS-Cov-2 S-RBD IgG Antibodies after," pp. 1–9, 2021, doi: 10.3390/diagnostics11071135.