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Seroprevalence of anti-SARS-CoV-2 Antibodies among Slaughterhouse workers in Burkina Faso

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ABSTRACT

The first cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) were recorded in the Wuhan seafood market, where a variety of mammalian animals are sold live and for direct consumption and the resulting pandemic has once again highlighted the role of human-animal interaction in the spread of pathogens. The objective of this study was to evaluate the seroprevalence of SARS-CoV-2 among slaughterhouse workers in Burkina Faso. We carried out a cross-sectional study among slaughterhouses workers of Ouagadougou and Bobo Dioulasso between March and April 2021. We collected sociodemographic data and we performed ELISA tests to determine the presence of anti-SARS-CoV-2 antibodies. Anti-SARS-CoV-2 antibodies in slaughterhouse workers serum samples. We included 183 participants. Among these, 79 resided in Ouagadougou and 104 in Bobo Dioulasso. The majority of participants were men (179/183, or 97.81%) and the average age was 33.87 years. Of the 183 samples analyzed, 140 (76.50%) were found to be positive for anti-SARS-CoV-2 antibodies, including 76/104 (73.07%) in Bobo Dioulasso and 64/79 (81.01%) in Ouagadougou. Univariate analysis showed no significant association between SARS-CoV-2 seropositivity, sociodemographic data, professional profile and personal hygiene. The seroprevalence of COVID-19 among slaughterhouse workers was high in 2021. These results highlighted the circulation of SARS-CoV-2 within this population and demonstrate a high exposure of these professionals to virus.

Keywords

Burkina Faso,
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Introduction

Since the first identified cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in December 2019, millions of cases of infections and deaths have been reported worldwide. In March

2020, the coronavirus disease (COVID-19) was declared a pandemic by the World Health Organization (WHO) (Ceniti *et al.*, 2021). Although controversial results are available in the literature regarding the origin of the pandemic, all genomic studies agree on the zoonotic origin of SARS-CoV-

2. Indeed, the epicenter of the pandemic was recorded in the Wuhan seafood market, where a variety of mammalian animals are sold live and for direct consumption (Maxmen *et al.*, 2022).

This underlines once again the role of the human-animal interrelationship, the importance of food safety in public health, and the control of the spread of pathogens according to the One Health approach. In addition, previous epidemics of SARS-CoV and Middle East Respiratory Syndrome (MERS) dating back to 2002 (in China) and 2012 (in Saudi Arabia) respectively had their epicenter in wet markets characterized by the massive presence of wild and tropical animals (Lam *et al.*, 2020).

More recently in 2021, numerous episodes of human cases of COVID-19 have been reported in slaughterhouses in the United States and Europe (Ijaz *et al.*, 2021). Thus, animals can act as vectors or reservoirs of the virus and the consumption of meat would be a potential means of spreading pathogens. It is now clearer that the slaughterhouse environment is characterized by high aerosol production combined with the intense use of water which widely transports germs across surfaces (Middleton *et al.*, 2020). Viral transmission is difficult to control due to a combination of factors, including unavoidable environmental conditions, high occupancy, physical demands, the nature of the work, shared work areas, and difficulties in implementation of physical distancing in slaughterhouses (Walshe *et al.*, 2021).

SARS-CoV-2 is primarily transmitted through human interaction through aerosolized respiratory droplets, which are typically released when an infected person speaks, coughs, or sneezes (Leung *et al.*, 2011). However, SARS-CoV-2 has been shown to persist on surfaces for several hours or days at room temperature and appears to be stable at low and freezing temperatures, indicating the possibility of transmission through contact with contaminated surfaces (Ceniti *et al.*, 2021). Currently, there is little data on COVID-19 in slaughterhouses in Africa (Obese *et al.*, 2021; Olawuyi *et al.*, 2020).

Indeed, these published data relate to the state of slaughterhouses during the COVID-19 pandemic and the impact of COVID-19 on the meat industry (Obese *et al.*, 2021; Olawuyi *et al.*, 2020). It is in this context that we set out to evaluate the presence of anti-SARS-CoV-2 antibodies in slaughterhouse workers in Burkina Faso.

Materials and Methods

Patient recruitment and data collection

This was a descriptive cross-sectional study which took place from April to May 2021 in the two main refrigerated slaughterhouses in the city of Ouagadougou and Bobo Dioulasso. The study population consisted of slaughterhouse workers present at their workplace on the days of collection and having given their informed consent.

This study used a database acquired during a study on leptospirosis conducted among slaughterhouse workers (Zida *et al.*, 2023) during which participants completed a questionnaire and provided venous blood samples.

The sera from this study were stored with the consent of the participants for subsequent studies of public health interest. In this study extracted sociodemographic data including age, sex, residence and education, data on the professional group within the slaughterhouse, data on personal hygiene, and data on knowledge of zoonoses. Also, Enzyme-linked immunosorbent assay (ELISA) was performed to determine the presence of anti-SARS-CoV-2 antibodies in serum samples from slaughterhouse workers. Serum samples were stored at -20°C.

Laboratory method

The “WANTAI SARS-CoV-2 Ab ELISA” reagent was used for the detection of anti-SARS-CoV-2 antibodies, following the manufacturer's recommendations as described previously (Ouedraogo *et al.*, 2023; SARS-CoV).

Statistical analyzes

Data were analyzed with Stata 14. Proportions of categorical variables were calculated. Bivariate logistic regression analyzes were carried out to identify factors associated with the presence of anti-SARS-CoV-2 antibodies. Associations were expressed as unadjusted odds ratios (OR) with 95% confidence intervals (CI). The results were considered statistically significant at the $p < 0.05$ threshold.

Ethical considerations

The study was conducted in compliance with ethical rules. It received approval from the health research ethics committee (CERS) of Burkina Faso, following deliberation No.: 2020-11-251. Written, free and informed consent was obtained from each participant with agreement for subsequent use of their samples for other health research needs. All data recordings were completely anonymous with no possibility of participant identification.

Results and Discussion

Sociodemographic characteristics and professional status of participants

In the present study, 183 participants was included. Among these participants, 79 resided in Ouagadougou and 104 in Bobo Dioulasso. The majority of participants were men (179/183, or 97.81%) and the average age was 33.87 years (range 16 to 68 years).

The jobs position in slaughterhouses included slaughterers (36.61%), foremen (2.73%), offal cleaners (9.28%), slaughterhouse cleaners (3.27%), meat sellers (15.30%), livestock sellers (3.27%), livestock transporters (2.73%), inspectors/veterinarians (7.10%), administrators (3.82%) and other positions (24.59%) (Table 1).

Seroprevalence

Of the 183 samples analyzed, 140 (76.50%) were found to be positive for anti-SARS-CoV-2

antibodies, including 76/104 (73.07%) in Bobo Dioulasso and 64/79 (81.01%) in Ouagadougou.

Univariate analysis of anti-SARS-CoV-2 antibody seropositivity and potential risk factors

Univariate analysis showed no significant association between SARS-CoV-2 seropositivity, sociodemographic data (Table 2), jobs position (Table 3) and personal hygiene (Table 4).

The objective of the present study was to assess the seropositivity of anti-SARS-CoV-2 antibodies among slaughterhouse workers in Ouagadougou and Bobo-Dioulasso. It reports that the overall seroprevalence of SARS-CoV-2 was high (76.5%).

This shows that slaughterhouse workers were widely exposed to the disease and also suggests a high rate of asymptomatic infections (Alene *et al.*, 2021). In Africa in general and Burkina Faso in particular, there's no data on SARS-CoV-2 seroprevalence specific to slaughterhouse workers but a few seroprevalence studies are available.

In Burkina Faso, a study that took place between February and June 2021 at the general population in the same cities, reported seroprevalences of 55.7% in Bobo Dioulasso and 37.4% in Ouagadougou (Struck *et al.*, 2022). This result suggests that slaughterhouse workers are more exposed than the general population. Another study carried out during the same period between February and May 2021 among healthcare professionals reported a SARS-CoV-2 seroprevalence of 45.7% in Burkina Faso (Kribi *et al.*, 2023).

A study conducted before the period of the present study, in November 2020 in HIV-positive patients reported a seroprevalence of 18% of SARS-CoV-2 (Sagna *et al.*, 2022). This could be explained by the fact that the spread of the virus was still limited. Although the studies published in Burkina Faso are fragmentary, it should be noted an increase in seroprevalence over time due to the probable spread of the infection: 18% in 2020 (Sagna *et al.*, 2022) to 76.5% in 2021 for this study.

Regarding Africa, in Mali, seroprevalence increased from 12% in September 2020 to 69.8% in May 2021 (Alber *et al.*, 2022). In October-November 2021, seroprevalences of 42.5% and 53.5% were noted in urban and rural areas of Nigeria, respectively (Chechet *et al.*, 2022).

approximately 41.2% and 41.5% respectively in 2021 (Struck *et al.*, 2022). In the United States, seroprevalence studies among slaughterhouse workers and agricultural workers in 2020 reported that around 50% of them carried anti-SARS-CoV-2 antibodies in North Carolina (Klein *et al.*, 2022; Sciaudone *et al.*, 2023).

In Ghana and Madagascar, seroprevalences reached

Table.1 Distribution of slaughterhouse workers according to job position (N=183)

Job position	Eff. (N)	Percentage (%)
Slaughterers	67	36.61
Foremen	5	2.73
Offal cleaners	17	9.28
Slaughterhouse cleaners	6	3.27
Meat sellers	28	15.30
Livestock sellers	6	3.27
Livestock transporters	5	2.73
Inspectors/veterinarians	13	9.90
Administrators	7	7.10
Other positions	29	15.84

Table.2 Association of sociodemographic characteristics and SARS-CoV-2 seropositivity among slaughterhouse workers

Variables	SARS-CoV-2 seropositivity		Odds Ratio	95% Confidence Interval		p-value ^a
	Eff. (N)	POS		Inf.	Sup.	
Sex						
Female	4	2	1			
Male	179	138	3,37	0,46	24,67	0,20
Age (years)						
> 30	105	78	1			
≤ 30	78	62	1,34	0,66	2,71	0,50
Residence						
Bobo Dioulasso	105	76	1			
Ouagadougou	79	64	1,63	0,8	3,3	0,20
Formal education						
Yes	131	99	1			
No	52	41	1,2	0,55	2,61	0,90

OR, odds ratio; CI, confidence interval. ^aUnivariate logistic regression was applied.

Table.3 Association of job position, and SARS-CoV-2 seropositivity among slaughterhouse workers

Variables	SARS-CoV-2 seropositivity		Odds Ratio	95% Confidence Interval		p-value ^a
	Eff. (N)	POS		Inf.	Sup.	
Slaughterers						
Yes	67	54	1			
No	116	86	1,45	0,7	3,02	0,50
Foremen						
Yes	5	4	1			
No	178	136	1,24	0,13	11,4	0,90
Offal cleaners						
Yes	17	14	1			
No	166	126	1,48	0,4	5,41	0,90
Slaughterhouse cleaners						
Yes	6	4	1			
No	177	136	0,6	0,11	3,39	0,90
Meat sellers						
Yes	28	22	1			
No	155	118	1,15	0,43	3,05	0,90
Livestock sellers						
Yes	6	6	1			
No	177	134	-	-	-	0,20
Livestock transporters						
Yes	5	3	1			
No	178	137	0,45	0,07	2,79	0,50
Inspectors/veterinarians						
Yes	13	11	1			
No	170	129	1,75	0,37	8,22	0,50
Administrators						
Yes	7	4	1			
No	176	136	0,39	0,08	1,82	0,30
Other positions						
Yes	29	18	1			
No	154	122	-	-	-	-

OR, odds ratio; CI, confidence interval. aUnivariate logistic regression was applied.

Table.4 Association between individual factors and SARS-CoV-2 seropositivity among slaughterhouse workers

Variables	SARS-CoV-2 seropositivity		Odds Ratio	95% Confidence Interval		p-value ^a
	Eff. (N)	POS		Inf.	Sup.	
Regular use of soap						
Yes	99	78	1			
No	84	62	1,32	0,67	2,62	0,50
Wearing protective clothing						
Yes	133	102	1			
No	50	38	1,04	0,48	2,23	0,90
Eating while working						
Yes	34	26	1			
No	149	114	1	0,42	2,41	0,90
Smoking while working						
Yes	25	19	1			
No	158	121	0,97	0,36	2,61	0,90
Consuming alcohol in the slaughterhouse						
Yes	6	5	1			
No	177	135	1,56	0,18	13,73	0,90
Knowledge of zoonoses						
Yes	92	74	1			
No	91	66	1,56	0,78	3,11	0,30

OR, odds ratio; CI, confidence interval. aUnivariate logistic regression was applied.

Our study did not show a significant association between cities of residence, sociodemographic data, jobs position, personal hygiene, and SARS-CoV-2 seropositivity. This could be explained by the fact that all workers were exposed to the same risk at work as outside of work. Risk factors external to the workplace include social determinants of health such as living conditions, social behaviors, and shared transportation. Workplace-specific factors include close physical proximity between workers, extended working hours, and shared spaces and equipment (Klein *et al.*, 2022).

This study has some limitation. The sociodemographic, socio-professional, and behavioral data come from an initial study aimed at assessing the seroprevalence of leptospirosis (Zida *et al.*, 2023) among slaughterhouse workers. They

are therefore not specific to COVID-19. Variables such as wearing masks, respecting social distancing, and the working environment (cold temperatures, humidity, poor ventilation, etc.) (Neisi *et al.*, 2022), which would have made it possible to identify specific risk factors are not available. Despite these limitations, this study is the first to report the situation of carriage of SARS-CoV-2 antibodies among slaughterhouse workers in Burkina Faso and one of the few in West Africa.

This work shows that the seroprevalence of COVID-19 among slaughterhouse workers was high in 2021. These results highlight the circulation of SARS-CoV-2 within this population and demonstrate a high exposure of these professionals to the virus. Further research could identify risk factors to reduce SARS-CoV-2 transmission among slaughterhouse

workers. These slaughterhouse workers could play a role in community spread of the disease.

Conflict of interest

The authors declare that there is no conflict of interest.

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Authors' Contributions

SZ, HGO, OO: Study design and implementation. STS, AAZ, TRC, TS: Data collection and supervision. SZ, CD: Biological laboratory tests. DK, AD: Data analysis and interpretation. SZ: Manuscript drafting. SZ, HGO, OO, SK: Correction of manuscript. All authors: Final review and approval of the manuscript.

References

- Alber D, Haidara F C, Luoma J *et al.*, SARS-CoV-2 infection and antibody seroprevalence in routine surveillance patients, healthcare workers and general population in Kita region, Mali: an observational study 2020-2021. *BMJ Open* 2022;12:e060367. <https://doi.org/10.1136/bmjopen-2021-060367>
- Alene M, Yismaw L, Assemie M A *et al.*, Magnitude of asymptomatic COVID-19 cases throughout the course of infection: A systematic review and meta-analysis. *PLoS One* 2021;16:e0249090. <https://doi.org/10.1371/journal.pone.0249090>
- Ceniti C, Tilocca B, Britti D *et al.*, Food Safety Concerns in “COVID-19 Era.” *Microbiology Research* 2021;12:53–68. <https://doi.org/10.3390/microbiolres12010006>
- Chechet G D, Kwaga J K P, Yahaya J *et al.*, SARS-

CoV-2 seroprevalence at urban and rural sites in Kaduna State, Nigeria, during October/November 2021, immediately prior to detection of the Omicron variant. *Int J Epidemiol* 2022;51:1361–70. <https://doi.org/10.1093/ije/dyac141>

- Ijaz M, Yar M K, Badar I H *et al.*, Meat Production and Supply Chain Under COVID-19 Scenario: Current Trends and Future Prospects. *Frontiers in Veterinary Science* 2021;8. <https://doi.org/10.3389/fvets.2021.660736>
- Klein M D, Sciaudone M, Richardson D *et al.*, SARS-CoV-2 seroprevalence and risk factors among meat packing, produce processing, and farm workers. *PLOS Glob Public Health* 2022;2:e0000619. <https://doi.org/10.1371/journal.pgph.0000619>
- Kribi S, Touré F, Mendes A *et al.*, Multicountry study of SARS-CoV-2 and associated risk factors among healthcare workers in Côte d'Ivoire, Burkina Faso and South Africa. *Trans R Soc Trop Med Hyg* 2023;117:179–88. <https://doi.org/10.1093/trstmh/trac089>
- Lam TT-Y, Jia N, Zhang Y-W *et al.*, Identifying SARS-CoV-2-related coronaviruses in Malayan pangolins. *Nature* 2020;583:282–5. <https://doi.org/10.1038/s41586-020-2169-0>
- Leung V, Luong M-L, Libman M. Leptospirosis: pulmonary hemorrhage in a returned traveller. *CMAJ* 2011;183:E423–7. <https://doi.org/10.1503/cmaj.092203>
- Maxmen A. Wuhan market was epicentre of pandemic's start, studies suggest. *Nature* 2022;603(7899):15–16. <https://doi.org/10.1038/d41586-022-00584-8>
- Middleton J, Reintjes R, Lopes H. Meat plants-a new front line in the covid-19 pandemic. *BMJ* 2020;370:m2716. <https://doi.org/10.1136/bmj.m2716>
- Neisi A, Goudarzi G, Babaei A *et al.*, Meta-Analysis of COVID-19 Spread in Meat Processing Plants and Recommended Practical Actions. *Avicenna J Environ Health Eng* 2022;9:109–

16. <https://doi.org/10.34172/ajehe.2022.5270>
Obese F Y, Osei-Amponsah R, Timpong-Jones E *et al.*, Impact of COVID-19 on animal production in Ghana. *Anim Front* 2021;11:43–6.
<https://doi.org/10.1093/af/vfaa056>
- Olawuyi K A, Enitan S S, Akele R Y *et al.*, (2020) A review on the state of abattoirs in Nigeria during COVID-19 pandemic era: Potential threats and public health interventions. <https://doi.org/10.31248/JPHD2020.095>
- Ouedraogo H G, Zoure A A, Compaoré T R *et al.*, Evaluation of ten (10) SARS-CoV-2 rapid serological tests in comparison with WANTAI SARS-CoV-2 ab ELISA in Burkina Faso, West Africa. *Virol J* 2023;20:57. <https://doi.org/10.1186/s12985-023-02011-4>
- Sagna T, Ouedraogo P, Traore L *et al.*, Enigma of the high prevalence of anti-SARS-CoV-2 antibodies in HIV-positive people with no symptoms of COVID-19 in Burkina Faso. *J Public Health Afr* 2022;13:1778. <https://doi.org/10.4081/jphia.2022.1778>
- Sciaudone M, Cutshaw M K, McClean C M *et al.*, Seroepidemiology and risk factors for SARS-CoV-2 infection among household members of food processing and farm workers in North Carolina. *IJID Regions* 2023;7:164–9.
<https://doi.org/10.1016/j.ijregi.2023.03.010>
- Struck N S, Lorenz E, Deschermeier C *et al.*, High seroprevalence of SARS-CoV-2 in Burkina-Faso, Ghana and Madagascar in 2021: a population-based study. *BMC Public Health* 2022;22:1676.
<https://doi.org/10.1186/s12889-022-13918-y>
- Walshe N, Fennelly M, Hellebust S *et al.*, Assessment of Environmental and Occupational Risk Factors for the Mitigation and Containment of a COVID-19 Outbreak in a Meat Processing Plant. *Front Public Health* 2021;9:769238.
<https://doi.org/10.3389/fpubh.2021.769238>
- Zida S, Ouédraogo H G, Compaoré T R *et al.*, Leptospirosis seroprevalence and risk factors among slaughterhouse workers in Burkina Faso. *IJID Regions* 2023;9:125–30.
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