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Knowledge and Practices toward COVID-19 Preventive Measures and Symptoms: A Case-Control Study in Benin

Connaissances et pratiques concernant les mesures préventives et les symptômes de la COVID-19 : une étude cas-témoins au Bénin

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ABSTRACT

Introduction. Following communication and awareness actions related to COVID-19, we assessed the knowledge and practices about COVID-19 in Benin. **Methods.** A case-control survey was conducted from 14 September to 20 October 2020 in Benin. Questions relating to knowledge and practices on COVID-19 were collected through a questionnaire survey. A total of 312 respondents (104 cases and 208 controls) were included in the study. Logistic regression and Spearman correlation tests were used to examine the relation between participants knowledge and practice at a 5% significance level. **Results.** From the survey, 65.4% of cases and 68.3% of controls knew about COVID-19 transmission via air droplets. Most of the cases (67.31%) and control (79.81%) participants reported cough as a symptom of COVID-19. Handwashing with soap and water was the most protective measure known by 87.5% of cases and 90.87% of controls. Concerning practice, the cloth mask was the type mostly worn by cases (54.81%) and controls (58.65%). Wearing a face mask in public areas was significantly associated with the COVID-19 health status of respondents (OR = 2.98, CI95% [1.16-7.67]; p = 0.022). Furthermore, a significantly positive correlation exists between knowledge of the COVID-19 protective measures and hand hygiene practices when leaving a public place (r = 0.184, p=0.001). **Conclusion.** Through this study, we observed some discrepancies between the knowledge and practices related to COVID-19 among cases and controls surveyed. Therefore, efforts should be directed toward raising awareness about the disease to improve their knowledge and practices.

RÉSUMÉ

Introduction. Suite aux actions de communication et de sensibilisation liées à la COVID-19, nous avons évalué les connaissances et les pratiques sur la COVID-19 au Bénin. **Méthodes.** Une enquête cas-témoins a été menée du 14 septembre au 20 octobre 2020 au Bénin. Les questions relatives aux connaissances et aux pratiques sur la COVID-19 ont été recueillies par le biais d'une enquête par questionnaire. Un total de 312 répondants (104 cas et 208 témoins) ont été inclus dans l'étude. La régression logistique et le test de corrélation de Spearman ont été utilisés pour examiner la relation entre les connaissances et les pratiques des participants à un niveau de signification de 5%. **Résultats.** D'après l'enquête, 65,4% des cas et 68,3% des témoins connaissaient la transmission du COVID-19 par les gouttelettes d'air. La plupart des cas (67,31%) et des témoins (79,81%) ont déclaré que la toux était un symptôme de la COVID-19. Le lavage des mains à l'eau et au savon était la mesure de protection la plus connue par 87,5% des cas et 90,87% des témoins. Concernant les pratiques, le masque en tissu était le type le plus porté par les cas (54,81%) et les témoins (58,65%). Le port d'un masque facial dans les lieux publics était significativement associé à l'état de santé COVID-19 des répondants (OR = 2,98, IC95% [1,16-7,67] ; p = 0,022). De plus, une corrélation significativement positive existe entre la connaissance des mesures de protection contre la COVID-19 et les pratiques d'hygiène des mains à la sortie d'un lieu public (r = 0,184, p=0,001). **Conclusion.** A travers cette étude, nous avons observé certaines divergences entre les connaissances et les pratiques liées à la COVID-19 chez les cas et les témoins interrogés. Par conséquent, les efforts devraient être orientés vers la sensibilisation à la maladie afin d'améliorer leurs connaissances et leurs pratiques.

HIGHLIGHTS

What is already known on this topic

Knowledge, attitudes, and practices (KAPs) studies on COVID-19 are important in controlling its spread and play a vital role in determining people's readiness to accept behavioural change measures.

What question this study addressed

Knowledge and practices about COVID-19 in Benin following communication and awareness actions.

What this study adds to our knowledge

After intervention there is a better knowledge of the incubation period, protective measures and better practice about wearing masks in a public place.

How this is relevant to practice, policy or further research.

Efforts should be directed toward raising awareness about the disease to improve knowledge and practices.

INTRODUCTION

Knowledge, attitudes, and practices (KAPs) studies on COVID-19 are important in controlling its spread and play a vital role in determining people's readiness to accept behavioural change measures recommended by health authorities[1,2]. To guarantee a successful COVID-19 control, people's adherence to preventive and control measures is essential. This adherence is highly dependent on the population's KAPs toward the disease[3]. Previous studies indicated that knowledge correlated with more optimistic attitudes toward COVID-19 preventive practices[4]. Another study reported a positive relationship between individuals knowledge and practices toward COVID-19[5]. Without effective treatment, the world is left with no option other than to adhere to public health preventive measures such as regular washing of hands using soap and water or alcohol-based solution, physical distancing (maintaining a distance of at least one meter), wearing of face masks, etc. These measures have been welcomed and promoted by the World Health Organization (WHO), governments, and health ministries of countries around the world[6]. The effectiveness of these mitigation measures is strongly dependent on the collaboration and compliance of everyone[2].

In Benin, on March 16, 2020, the Ministry of Health announced the first confirmed case of COVID-19. Since then, 101 deaths out of 8,025 confirmed cases were reported as of June 09, 2021[7]. After the confirmation of this first case, to mitigate the spread and to safeguard the population, the Benin's government declared a state of emergency. In addition to the several restrictions quoted above, one of the actions taken by the government was the stop of face-to-face education for students and the isolation of the first districts with confirmed cases. Moreover, the government, alongside the media, conducted several public sensitization programs on COVID-19 to raise the public's awareness. We, therefore, conducted a national study to assess the influence of contextual factors (environmental, socio-cultural, demographic, economic, and political) on the dynamics of COVID-19 spread in Benin. The current article, based on a part of the data from this survey, assesses the knowledge and practices about COVID-19 among the Beninese. Another objective was to compare the knowledge and practices between case and control participants. Our insights are important to inform future efforts focusing on effective public health preventive measures to better control the spread of COVID-19 and future epidemics.

MATERIALS AND METHODS

Study area

This study was conducted in Benin, a country located in West Africa. Benin is bordered to the west by Togo, in the north by Niger and Burkina-Faso, and in the east by Nigeria, which is one of the most affected countries in Africa by COVID-19. The survey was carried out in health facilities transformed into COVID-19 screening and treatment sites.

Study design

A case-control and cross-sectional survey was conducted from 14 September to 20 October 2020. We considered cases as individuals with a positive RT-PCR test for SARS-CoV-2 and who were undergoing treatment, while controls were those with a negative result and who had no symptoms of COVID-19 before enrolment in the study. Cases enrolled in the study were those who were healthy enough to be interviewed (not hospitalised for serious complications). The selection method was non-probabilistic. Cases and controls were selected for convenience in two stages. The first stage consisted of a purposive selection of nine (9) screening and treatment sites. These sites were identified by the health authorities and selected because they are located in different regions of Benin (North, Center, and South) and are the ones with the highest attendance in terms of tests performed and people being treated and followed up. In Benin, there was a total of 84 screening and treatment sites, distributed at a rate of one (1) per commune (77), with three (3) more in Cotonou, one more in Porto-Novo, one more in Sèmè-Kpodji, one more in Parakou and one more in Natitingou. Thus, in southern Benin, six sites were selected, one in the center and two in the north.

The second stage consisted of convenience recruitment of cases and controls screened at the sites. A total of 312 participants were surveyed (104 cases for 208 controls). For each case, two controls from the same site were surveyed.

Study variables

The study variables related to COVID-19 knowledge were about the mode of transmission, persons at risk, protectives measures, the incubation period, and the existence of asymptomatic people. For practice, they were about the type of mask used, wearing mask habits, hand washing with soap and water habits, cleaning and disinfection of objects/surface habits, social distancing, risk behaviours (handshake, mask below the chin, touching the face with hands, eyes or mouth) and teleworking.

Statistical analysis

All statistics were performed using Stata software version 11.0. To identify statistically significant variables, logistic

regression analysis was conducted at 95% confidence interval (CI). Spearman correlation coefficient was used to examine the correlation between participants knowledge and practice. A significance level of 5% was defined and used.

Ethical consideration

An agreement for the selection of screening and treatment sites of COVID-19 was obtained from the National Direction of Benin Hospitals as well as an ethical approval (N°086/MS/DRFMT/CNERS/SA of August 04, 2020) from the National Ethics Committee for Health Research in Benin. The health area coordinators where the selected sites were located, were all informed about the study. The participants (cases and controls) gave their free and informed written consent and the interviews were conducted in strict respect of the privacy and confidentiality of participants.

RESULTS

Sociodemographic characteristics of the respondents

A total of 312 (50.96% male and 49.04% female) respondents were interviewed. The mean age of the participants was 34±11.85 years (females: 34.27±12.3 and males: 33.78±11.44). Regarding their educational status, about 43.59% had attended university, 38.14% stopped at secondary school, 13.46% at primary school, and 4.81% had no formal education. Most participants are married (62.7%) and Christians (81.29%) in religion. Concerning their monthly income, about 33.22% earned between 75-185 USD (United States Dollars), less than 75 USD (28.27%), 185-560 USD (25.44%) and more than 560 USD (13.07%).

Knowledge and practices related to COVID-19

The results obtained showed that the respondents had moderate knowledge of COVID-19 infection. The modes of transmission of COVID-19 through direct contact with the virus were known by 53.9% of the cases and 48.6% of controls. Additionally, transmissions via air droplets when an infected person coughs were known by 65.4% of the cases and 68.3% controls. Handwashing with soap and water was the most reported protective measure by 87.5% of cases and 90.87% of controls. Most of the controls (61.54%) knew the incubation period of COVID-19 while fewer cases (35.38%) did. Only 2.88% of cases and 1.92% of controls recognised obese individuals as a risk group. Both cases (87.5%) and controls (90.87%) mentioned handwashing with soap and water as the most known protective measures against COVID-19. Regarding practice, cloth mask was the most worn as reported by 54.81% of cases and 58.65% of controls. The majority of participants often wear a mask in public places with people as reported by 89.32% of cases and 96.15% of controls. Hand washing after returning home was often executed by 75% of controls and 79.81% of cases. Few cases (7.69%) and controls (13.95%) often shook hands with other people. The social distancing of at least 1 meter was observed by 70.19% of cases and 83.65% of controls. We also noticed that at home, cleaning and disinfection of surfaces and objects were rarely conducted daily by 13.46% cases and 12.02% of controls. Respondents who did not know the incubation period of COVID-19 were 2.89-times more in cases compared to controls (OR = 2.89, CI95% [1.77-4.72]; p = 0.029). Those who did not wear a face mask regularly (never or rarely) in public places were 2.98-times more in cases compared to controls (OR = 2.98, CI95% [1.16-7.67]; p = 0.022). Tables 1, 2, and 3 show details of knowledge and practices related to COVID-19 among case and control respondents.

Correlation between knowledge and practice toward COVID-19

Our statistical analysis through the Spearman correlation coefficient revealed that there exists some significant correlation between respondents' knowledge and their practices. The frequency of wearing face masks at home in the presence of other people was positively correlated with better knowledge of the mode of transmission of COVID-19 (rs = 0.117, p = 0.040); also positively with symptoms of COVID-19 (rs = 0.142, p = 0.012). Lowering the mask at the level of the chin or neck was more likely among respondents with less knowledge of the modes of transmission of COVID-19 (rs = -0.136, p = 0.016) and of COVID-19 symptoms (rs = -0.115, p = 0.043). The frequency of hand hygiene when leaving a public place was positively and significantly correlated with a better knowledge of: the mode of transmission of COVID-19 (rs = 0.157, p = 0.005) ; COVID-19 symptoms (rs = 0, 198, p = 0.000) ; persons at risk (rs = 0.119, p = 0.036) ; protective measures (rs = 0.184, p = 0.001) and existence of asymptomatic people (rs = 0.158, p = 0.005). All details obtained for the correlation between knowledge and practice among participants are presented in tables 4 and 5.

DISCUSSION

This cross-sectional study was conducted to assess and compare the knowledge and practices on COVID-19 between case and control participants. In our study, the mean age of the participants was 34.02 (± 11.85 SD) and 42.63% of them are under 29 years old. This mean age in our context would probably be related to the youth of the African population notably in Benin. Alemu et al[8] reported a similar result in Ethiopia. Overall, our findings demonstrated that the respondents had a moderate level of knowledge and practice about the COVID-19 pandemic. Roy et al[9] had a similar observation in their study carried out in India.

More than half of the cases (65.4%) and controls (68.3%) respondents knew about COVID-19 transmission mode through air droplets when an infected person coughs. For 53.9% of cases and 48.6% of controls, the virus could be transmitted through direct contact with the virus. According to Reuben et al[10], 93.0% and 88.5% of the respondents in their study knew that the COVID-19 virus could be transmitted through air droplets (from patients' sneezing/coughing) and close contact with infected persons.

Table 1: Logistic regression between knowledge and health status of respondents.

Knowledge	Cases. n (%)/ m (SD)	Controls. n (%)/ m (SD)	Total n (%)/ m (SD)	OR[$CI_{95\%}$]	p
Mode of Transmission				-	-
Through direct contact with the virus	56 (53.9%)	101 (48.6%)	157 (50.3%)		
Indirect contact to contaminated objects or surfaces	40 (38.5%)	95 (45.7%)	135 (43.3%)		
Through air droplets when an infected person coughs	68 (65.4%)	142 (68.3%)	210 (67.3%)		
Through hand contact with eyes. nose and mouth after touching contaminated surfaces	25 (24.03%)	47 (22.60%)	72 (23.07%)		
Mode of Transmission (quantitative)	02.21 (01.40)	02.37 (01.31)	02.32 (01.34)	0.91 [0.76-1.09]	0.309
Symptoms of COVID-19				-	-
Cough	70 (67.31%)	166 (79.81%)	236 (75.64%)		
Fever	62 (59.62%)	155 (74.52%)	217 (69.55%)		
Headache	49 (47.12%)	91 (43.75%)	140 (44.87%)		
Shortness of breath	26 (25%)	59 (28.37%)	85 (27.24%)		
Sore throat	16 (15.38%)	59 (28.37%)	75 (24.04%)		
Muscle pain	31 (29.81%)	40 (19.23%)	71 (22.76%)		
Diarrhoea	23 (22.12%)	38 (18.27%)	61 (19.55%)		
Conjunctivitis	13 (12.50%)	28 (13.46%)	41 (13.14%)		
Loss of smell or taste	11 (10.58%)	05 (02.40%)	16 (05.13%)		
Skin rash or discoloration of fingers/toes	03 (02.88%)	06 (02.88%)	09 (02.88%)		
Loss of speech	0 (0.00%)	06 (02.88%)	06 (01.92%)		
Symptoms of COVID-19 (quantitative)	02.86 (01.56)	03.17 (01.47)	03.07 (01.51)	0.87 [0.74-1.02]	0.086
People at Risk				-	-
Pregnant women	02 (01.92%)	08 (03.84%)	10 (03.21%)		
Overweight or Obese people	03 (02.88%)	04 (01.92%)	07 (02.24%)		
People with cancer	03 (02.88%)	09 (04.33%)	12 (03.84%)		
People with diabetes	26 (25.00%)	77 (37.02%)	103 (33.01%)		
People with high blood pressure	24 (23.08%)	74 (35.58%)	98 (31.41%)		
People with respiratory problems	27 (25.96%)	53 (25.48%)	80 (25.64%)		
Elderly people	68 (65.38%)	158 (75.96%)	226 (72.43%)		
People at Risk (quantitative)	01.63 (01.36)	02 (01.41)	01.88 (01.40)	0.82 [0.69-0.98]	**0.029**
Protective measures against COVID-19				-	-
Go out only when neccessary	08 (07.69%)	20 (09.62%)	28 (08.97%)		
Maintaining social distance of at least 1 meter	73 (70.19%)	174 (83.65%)	247 (79.17%)		
Avoids contact with infected people	25 (24.04%)	50 (24.04%)	75 (24.04%)		
Teleworking	03 (02.88%)	05 (02.40%)	08 (02.56%)		
Hand washing with soap and water	91 (87.50%)	189 (90.87%)	280 (89.74%)		
Cover mouth with a tissue or elbow when sneezing or coughing	13 (12.50%)	47 (22.60%)	60 (19.23%)		
Wearing a cloth-mask when physical distancing is not possible	82 (78.85%)	166 (79.81%)	248 (79.49%)		
Protective measures against COVID-19 (quantitative)	02.83 (01.10)	03.12 (0.92)	03.02 (01)	0.73 [0.57-0.94]	**0.015**
Incubation period of COVID-19					**<0.001**
No	67 (64.42%)	80 (38.46%)	147(47.12%)	2.89 [1.77-4.72]	
Yes	37 (35.38%)	128 (61.54%)	165 (52.88%)	1	
Existence of asymptomatic carriers					0.826
No	16 (15.38%)	34 (16.35%)	50 (16.03%)	0.93 [0.48-1.77]	
Yes	88 (84.62%)	174 (83.65%)	262 (83.97%)	1	
COVID-19 transmission through asymptomatic carriers					0.138
No	22 (21.15%)	30 (14.42%)	52 (16.67%)	1.59 [0.87-2.93]	
Yes	82 (78.85%)	178(85.58%)	260 (83.33%)	1	

OR: Odds Ratio ; CI95% : 95% Confidence Interval; m: mean; SD: Standard Deviation.

Table 2: Logistic regression between wearing mask practices and health status of respondents

Practices	Cases. n (%)	Control. n (%)	Total. n (%)	OR[$CI_{95\%}$]	p
Type of mask					0.517
Cloth masks	57 (54.81%)	122 (58.65%)	179 (57.37%)	0.85 [0.53-1.37]	
Surgical masks/ FFP2	47 (45.19%)	86 (41.35%)	133 (42.63%)	1	
Wearing a mask at home in the presence of others					**0.030**
Never/Rarely	75 (72.12%)	172 (82.69%)	247 (79.17%)	1.84 [1.05-3.23]	
Often/Always	29 (27.88%)	36 (17.61%)	65 (20.83%)	1	
Wearing a mask on the street					0.106
Never/ Rarely	16 (15.39%)	19 (09.18%)	35 (11.22%)	1.80 [0.88-3.66]	
Often/ Always	88 (84.61%)	188 (90.82%)	276 (88.78%)	1	
Wearing a mask in individual transport					**0.009**
Never/Rarely	05 (4.81%)	01 (0.48%)	06 (1.92%)	1.51 [0.92-2.49]	
Often/ Always	40 (38.46%)	64 (30.77%)	104 (33.33%)	1	
Wearing a mask in public transportation					0.273
Never/Rarely	03 (2.91%)	6 (2.90%)	09 (2.90%)	1.19 [0.29-4.93]	
Often/Always	53 (51.46%)	126 (60.87%)	179 (57.74%)	1	
Wearing a mask in the main workplace					0.272
Never/ Rarely	18 (17.31%)	28 (13.53%)	46 (14.79%)	1.41[0.73-2.71]	
Often/Always	76 (73.08%)	167 (80.68%)	243 (78.14%)	1	
Wearing a mask in a public place					**0.022**
Never/Rarely	11 (10.68%)	08 (3.85%)	19 (6.11%)	2.98[1.16-7.67]	
Often/Always	92 (89.32%)	200 (96.15%)	292 (93.89%)	1	
Lowering the mask below the chin or neck					0.562
No	13 (12.50%)	31 (14.90%)	44 (14.10%)	1.22 [0.61-2.45]	
Yes	91 (87.50%)	177 (85.10%)	268 (85.90%)	1	

OR: Odds Ratio ; $CI_{95\%}$: 95% Confidence Interval.

Table 3: Logistic regression between hygiene and preventive measures, practices and health status of respondents

Practices	Cases. n (%)	Control. n (%)	Total. n (%)	OR[$CI_{95\%}$]	p
Hand washing before entering in public place					> 0.99
Never/Rarely	12 (11.54%)	24 (11.54%)	36 (11.54%)	1 [0.47-2.08]	
Often/Always	92 (88.46%)	184 (88.46%)	276 (88.46%)	1	
Hand washing when leaving a public place					0.320
Never/Rarely	62 (59.62%)	136 (65.38%)	198 (63.46%)	1.27 [0.78-2.07]	
Often/Always	42 (40.38%)	72 (34.62%)	114 (36.54%)	1	
Hand washing before leaving the home					**0.003**
Never/ Rarely	58 (55.77%)	151 (72.60%)	209 (66.09%)	0.47 [0.30-0.77]	
Often/Always	46 (44.23%)	57 (27.40%)	103 (33.01%)	1	
Hand washing after returning home					0.340
Never/Rarely	21 (20.19%)	52 (25%)	73 (23.40%)	0.76 [0.42-1.34]	
Often/ Always	83 (79.81%)	156 (75%)	239 (76.60%)	1	
Hand washing after touching non-disinfected objects or surfaces					0.275
Never/ Rarely	64 (61.54%)	141 (67.79%)	205 (65.71%)	0.76 [0.46-1.24]	
Often/ Always	40 (38.46%)	67 (32.21%)	107 (34.29%)	1	
Hand contact with the face, eyes or mouth					0.800
Never/ Rarely	35 (33.65%)	73 (35.10%)	108 (34.61%)	1.06 [0.65-1.76]	
Often/ Always	69 (66.35%)	135 (64.90%)	204 (65.39%)	1	
Handshake to other persons					0.11
Never/Rarely	96 (92.31%)	179 (86.05%)	275 (88.14%)	0.51 [0.21-1.12]	
Often/Always	08 (07.69%)	29 (13.95%)	37 (11.86%)	1	
Cleaning/disinfection of objects or surfaces at home					0.122
Never	38 (36.54%)	101 (48.56%)	139 (44.55%)	0.67 [0.31-1.42]	
One to six times a week	52 (50%)	82 (39.42%)	134 (42.95%)	1.13 [0.54-2.37]	
Every day	14 (13.46%)	25 (12.02%)	39 (12.50%)	1	
Cleaning and disinfection of objects or surfaces at the workplace					0.250
Never	35 (37.23%)	80 (40.03%)	115 (39.89%)	0.68 [0.38-1.21]	
One to three times a week	23 (24.47%)	59 (30.25%)	82 (28.37%)	0.60 [0.32-1.15]	
Every day	36 (38.30%)	56 (28.72%)	92 (31.83%)	1	

OR: Odds Ratio ; $CI_{95\%}$: 95% Confidence Interval.

Table 4: Correlation between knowledge and wearing mask practices toward COVID-19 among participants

Practices	Knowledge r_s* (p-value)						
	Mode of transmission	Symptoms	Persons at risk	Incubation Period	Existence of asymptomatic carriers	COVID-19 transmission through asymptomatic people	Protectives Measures
Wearing of face mask at home in the presence of others	0,117 (0,040)	0,142 (0,012)	0,011 (0,848)	-0,147 (0,009)	0,049 (0,386)	-0,001 (0,979)	0,152 (0,007)
Wearing a mask on the street	0,118 (0,037)	0,111 (0,051)	0,009 (0,880)	-0,046 (0,421)	0,142 (0,012)	-0,016 (0,779)	0,060 (0,720)
Wearing a mask in individual transport	0,248 (0,009)	0,256 (0,007)	0,277 (0,017)	0,145 (0,132)	0,143 (0,135)	0,064 (0,506)	0,122 (0,204)
Wearing a mask in the public transportation	-0,013 (0,858)	-0,029 (0,697)	-0,119 (0,103)	0,009 (0,907)	0,138 (0,058)	0,010 (0,895)	-0,105 (0,153)
Wearing a masks in the main workplace in the presence of others	0,137 (0,020)	0,192 (0,001)	0,137 (0,020)	0,102 (0,083)	0,282 (0,000)	0,098 (0,095)	0,113 (0,055)
Wearing a mask in a public place in the presence of others	0,133 (0,019)	0,158 (0,005)	0,040 (0,487)	0,062 (0,280)	0,124 (0,028)	-0,083 (0,147)	0,019 (0,735)
Lowering the mask at chin or neck level	-0,136 (0,016)	-0,115 (0,043)	-0,019 (0,739)	-0,032 (0,574)	-0,026 (0,642)	0,041 (0,469)	-0,011 (0,845)

Table 5: Correlation between knowledge and hygiene practices toward COVID-19 among participants

	Knowledge r_s*(p-value)						
Practices	Mode of transmission	Symptoms	Persons at risk	Incubation Period	Existence of asymptomatic carriers	COVID-19 transmission through asymptomatic carriers	Protectives Measures
Hand hygiene before entering public places	-0,084 (0,136)	0,003 (0,954)	0,017 (0,762)	0,214 (0,000)	0,075 (0,189)	0,118 (0,038)	0,045 (0,424)
Hand hygiene when leaving a public place	0,118 (0,037)	0,198 (0,000)	0,119 (0,036)	-0,015 (0,793)	0,158 (0,005)	0,004 (0,942)	0,184 (0,001)
Hand hygiene after returning at home	0,161 (0,004)	0,150 (0,008)	0,089 (0,118)	0,072 (0,204)	0,209 (0,000)	0,056 (0,323)	0,127 (0,024)
Hand hygiene after touching non-disinfected objects or surfaces	0,240 (0,000)	0,262 (0,000)	0,201 (0,000)	0,070 (0,215)	0,207 (0,000)	0,100 (0,078)	0,106 (0,061)
Cleaning/disinfection of objects or surfaces at home	0,041 (0,467)	0,029 (0,614)	0,008 (0,885)	-0,041 (0,476)	0,042 (0,460)	-0,129 (0,023)	0,015 (0,788)
Cleaning and disinfection of objects or surfaces at the workplace	0,123 (0,036)	-0,011 (0,847)	0,094 (0,111)	0,131 (0,025)	0,088 (0,136)	-0,004 (0,941)	-0,030 (0,614)
Give a handshake to others	0,151 (0,008)	0,021 (0,714)	0,019 (0,740)	0,008 (0,891)	-0,038 (0,500)	0,036 (0,530)	0,043 (0,446)

Some authors reported in their studies that the most commonly listed modes of transmission were direct contacts such as handshaking (94.3%), respiratory droplets (52.1%), and indirect contact with contaminated inanimate objects (33.3%)[8]. This study showed that overall, both controls and cases had low levels of knowledge about COVID-19 symptoms. The most known symptoms were cough (67.31% of cases and 79.81% of controls) and fever (59.62% of cases and 74.52% of controls). In contrast, few respondents (22.12% of cases and 18.27% of controls) reported diarrhea as symptoms of COVID-19. According to Gheorghe et al[11], the poor knowledge about diarrhea as a manifestation of COVID-19 is potentially dangerous, as it was shown that these people shed the virus for about 6 weeks, i.e. longer than those with airway symptoms. The study of Adesegun et al[12] showed that the most common symptoms that the population knew were difficulties in breathing (96.9%), dry cough (96%), and fever (93%), with much fewer respondents being aware of gastrointestinal symptoms like vomiting (17.8%) and diarrhea (19.2%). Similar results were also seen in another study where the more listed symptoms were cough (93.6%), breathing difficulties (75.4%) and fever (74.4%)[13]. In the current study, the incubation period was more known by controls (61.54%) than cases (35.38%) interviewees. This difference may indicate limited access to credible and timely information about the virus[2]. Other cross-sectional surveys conducted in India and China reported 72% and 66.40% correct responses about the incubation period, respectively[4,14].

Most of the cases (65.38%) and controls (75.96%) reported elderly people as people at risk. This could be explained by the higher mortality observed in these groups, which has been reported in the media. About half of the respondents felt that only elderly individuals with comorbidities go on to develop severe disease[12]. It's interesting to note that only 1.92% of cases and 3.84% of controls knew about the fact that the pregnant women were people at risk. This variation in the level of knowledge may be reflective of the current COVID-19 information landscape in the country[2]. Our study also revealed that most respondents were aware of the major preventive strategies for COVID-19, particularly handwashing with soap and water (87.5% among cases and 90.87% among controls) and wearing a mask when social distancing is not possible (78.85% among cases and 79.81% among controls). Moreover, 78.85% of cases and 85.58% of controls knew about the fact that asymptomatic people can transmit the disease. According to Adesegun et al[12], about 86.4% of the respondents reported that COVID-19 transmission occurred through asymptomatic carriers. Several studies carried out in Asian countries have indicated high levels of COVID-19 knowledge among the general population and healthcare workers[4,15]. The higher proportion of knowledge among Asian populations would probably attributable to the fact that they are the first populations affected by the epidemic and have been exposed to health information for longer.

Regarding practice, more than half both in cases and controls, participants indicated that they wore cloth masks. Chughtai et al[16] claimed that in community settings, cloth masks may be used to prevent the spread of infections by sick or asymptomatically infected persons, and the public should be educated about their correct use. It is important to mention that only 27.88% of cases and 17.61% of controls often or always wear a face mask at home in the presence of others. However, the vast majority of cases (89.32%) and controls (96.15%) often or always wore a mask in a public place in the presence of other persons. Moreover, most of them often or always wear a face mask in the main workplace (78,14%) and on the street (88.78%). Most cases (70.19%) and controls (83.65%) observed the social distancing at least one meter. According to Rahman and Sathi[17], the majority of respondents wore a face mask (91.4%) and kept a safe physical distance when outdoors (87.1%). Considering hand washing as a major preventive measure, up to 85% often or always washed their hands before entering public places in the presence of others. This result is consistent with other reports[12]. Ferdous et al[18], reported that actions such as hand washing after coming from outside can play an important role in COVID-19 prevention. Globally, there was no difference in knowledge and practice rate among the study groups (cases and controls). However, preventive practices have to be reenforced and control strategies should be enhanced.

The sufficient knowledge on protective measures (OR = 2.98, CI 95% [1.16-7.67], p = 0.022) and incubation period (OR = 2.89, CI 95% [1.77-4.72], p = 0.029) of COVID-19 were significantly associated with COVID-19 health status of respondents. Interestingly, the wearing of a face mask in a public place in the presence of others was significantly related to COVID-19 health status. Therefore, it would benefit from being reinforced with other less respected measures such as avoiding hand-hacking with others and crowded places. Although significant efforts are still needed to achieve a very good level of compliance, communication with prevention measures seems to have a positive impact.

This study found that knowledge on COVID-19 transmission mode was positively and significantly correlated with wearing a mask when going outside (in a public place in the presence of others) and at home. A study in Bangladesh reported a similar association between knowledge and the wearing of masks[17]. Although some negative correlations were found, knowledge on the modes of transmission of COVID-19 and its symptoms, the incubation period of COVID-19, protective measures, and the existence of asymptomatic carriers were overall, significantly and positively correlated with protective measures regarding the wearing of masks, hand hygiene and cleaning/disinfection of objects or surfaces at home or work. In addition, lowering the mask to the chin or neck level was positively influenced by less knowledge of the modes of transmission of COVID-19. This confirms the importance of communication concerning COVID-19 to improve compliance with protective measures and limit risk actions. Several studies reported the same findings about the correlation between knowledge and practice of COVID-19[16,19].

This survey had some limitations. Firstly, it followed a cross-sectional study design, therefore, causal inferences may not be established. Secondly, compared with face-to-face interviews, self-reporting has limitations. Thus, participants might have answered knowledge and practice questions positively based on what they perceive to be expected of them[2]. A further limitation of the current study is the possibility of participants giving socially desirable responses. At the design stage of the study, no information was available on the incidence or prevalence of COVID-19 in Benin. The screening was done on a very limited part of the population. Thus a non-probabilistic sampling method was used. Therefore, the participants surveyed may not be representative of Benin. Future studies could overcome this limit.

CONCLUSION

In summary, highlighted that both case and control respondents had moderate knowledge and practice on COVID-19 preventive measures and symptoms. Overall, there was no difference in knowledge and practice between cases and controls. However, controls had better knowledge than the cases in terms of the incubation period and protective measures. Controls had also better practice about wearing masks in a public place. Thus, it is important to implement massive education campaigns. That would increase population knowledge about COVID-19 and promote the adoption of protective measures to stop its spread in Benin.

Conflict of Interest

The authors declare no conflict of interests.

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Authors' Contribution

Nonvignon Marius Kêdoté: Conceptualization; Data curation; Formal analysis; Funding acquisition; Methodology; Project administration; Resources; Supervision; Validation; Review & Editing. **Aymeric Joaquin Darboux:** Conceptualization; Data curation; Methodology; Project administration; Validation; Formal analysis; Software; Supervision; Original draft; Review & Editing. **Sonagnon Claude-Gervais Assogba:** Conceptualization; Methodology; Validation; Supervision & Review. **Roch Houngnihin:** Conceptualization; Methodology; Validation; Supervision & Review. **Ange Dossou:** Conceptualization; Methodology; Validation ; Supervision & Review. **Essé Agossou:** Conceptualization; Methodology; Validation; Supervision & Review. **Luc Salako Djogbénou:** Conceptualization; Funding acquisition; Methodology; Validation & Review. **Fatou Bintou Sarr:** Conceptualization; Funding acquisition; Methodology; Validation & Review. **Jacques François Mavoungou:** Conceptualization; Funding acquisition; Methodology; Validation & Review.

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