INFLUENCE OF HUMAN-ANIMAL INTERACTIONS AND CLIMATE CHANGE ON THE SPREAD OF COVID-19 IN NIGERIA

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Abstract

This study evaluated the knowledge and perceptions of respondents regarding the impact of human-animal interactions and climate change on the Coronavirus pandemic. Data were collected through a nationwide analytic cross-sectional survey with the aid of a structured questionnaire made available online. The questionnaire consisted of 26 items divided into four sections (socio-demographic characteristics; knowledge and attitudes towards COVID-19; COVID-19 and human-animal interactions; COVID-19 and climate change) while participants' responses were scored using the 'Likert-type' scale. The percentages of responses obtained were calculated, while data collected were analysed, descriptively. More males participated in the survey with most respondents being between the ages of 41-50 years. Most participants had postgraduate education, lived in urban areas, practiced Christianity, and were from the southwestern geopolitical zone of Nigeria. All respondents were aware of the existence of COVID-19, as a transmissible disease while about 93.95% reported touching of face, nose, and mouth with contaminated hands as the route of COVID-19 transmission. About 45.1% of respondents affirmed that they always took precautions when interacting with animals while 44.19% believed that the increasing spread of disease-carrying pests is a consequence of climate change. Though a high level of awareness of COVID-19 was noted, there was a need for more aggressive sensitization of people especially in the rural areas on the impact of COVID-19 disease on human and environmental health.

Keywords: One Health; wildlife trade; emerging zoonotic diseases; climate change; biodiversity

INTRODUCTION

Human evolution is fundamentally a story of human interactions with plant and animal species (Hendry *et al*., 2017). The positive and negative interactions between humans and animals (including wildlife) have prompted a defining experience for human existence and survival (Nyhus, 2016). Over time, humans have competed with wildlife for food and resources, and have applied a wide range of social, behavioural, and technical approaches to reducing their negative interactions with wildlife, especially those associated with health and diseases (Soulsbury and White, 2015; Nyhus, 2016). The points of human-animal interactions or interfaces represent a critical point for cross-species disease transmission and emergence of pathogens (Hassell *et al*., 2017). For instance, wild animal trading in markets brings species that would not interact in their natural habitats, together, thereby exposing the captive wild species, merchants, shoppers, and general public is zoonotic diseases. Hence, anthropogenic factors, such as wildlife trade, migration, deforestation, habitat destruction, intensified agriculture, consumptive utilisation and climate change have amplified animal-human interactions, thereby increasing the risk of disease outbreaks and pathogens (Nasi *et al*., 2011;

Horby *et al*., 2014; Deem and Brenn-White, 2020; Ji *et al.*, 2020; Magouras *et al*., 2020). Also, increased human - animal interface events, have created ever-expanding routes for transmission of novel emerging diseases via pathogen sharing and development (Swift, 2007; Pulliam *et al.*, 2012). The event that triggered the corona virus disease (COVID-19) pandemic, which was an initial transmission of SARS-CoV-2 from an animal to a human host, is a prime example of how pathogens move into human populations (Deem and Brenn-White, 2020). The emergence and subsequent spread of infectious diseases such as Ebola, Influenza, ZIKA, SARS and corona virus (all of zoonotic origin) has resulted in public health crises, globally (UNEP/ILRI, 2020).

Many salient questions continue to remain unanswered about the origin of the COVID-19, which is caused by a novel Betacoronavirus [2019-nCoV] (Chen *et al*., 2020; Huang *et al*., 2020). Although an animal source is most highly plausible, the paucity of relevant data ensures that there is a wide room for accommodation of a variety of assumptions. According to McNeely (2021), the coronavirus may have emerged from wildlife reservoirs linked to environmental disruption, and was probably transmitted to humans via the wildlife trade, while its spread was facilitated by economic globalization. In fact, the COVID-19 pandemic is thought to have originated from the wholesale market in Wuhan, China, where wild animals such as birds, reptiles, and small mammals are sold (Ji *et al*., 2020). Unnatural interactions between humans and animals in such markets, provide opportunities for human exposure to millions of microbes (Deem and Brenn-White, 2020). Furthermore, alterations in trends of disease outbreaks in relation to human-animal interface have been fuelled by factors like climate change (Lindahl and Grace, 2015).

Climate change is one of the major drivers of infectious disease emergence (Sasikumar *et al*., 2020). It influences the survival, reproduction, abundance and distribution of pathogens and vectors (Plowright *et al*., 2017). Climate change has led to widespread habitat loss (Mantyka-Pringle *et al.*, 2012), coupled with an increase in demand for bush meat (Hussani and Khan, 2020). It has been implicated in the increasing spread of deadly zoonotic viruses (Carlson *et al*., 2022). Therefore, the growing threat of emerging infectious disease outbreaks with increasing wildlife contacts in a changing climate, necessitate the need for evaluation of the knowledge and perceptions of people to this occurrence. In this study, we analysed the influence of interactions between humans and animals as well as climate change on the SARS-CoV2 (COVID-19) pandemic.

MATERIALS AND METHODS

An online survey was conducted between June 2020 and September 2020, using a structured questionnaire. Participants, who were 18 years and above, were invited to participate in the anonymous survey. The Joint Information System Committee approach was used to deploy and distribute the questionnaire (JISC, 2020). The questionnaire was presented in English Language; pretested for comprehensibility, acceptability, and accuracy prior to the commencement of the study. Invitations to participate in the study were sent through private messages and on several social

networking platforms (emails, WhatsApp, and Facebook). By clicking on a web link, the participants were directed to the entry page which contained information on the objectives of the survey, terms of participation and data privacy. Participants were able to access the survey and complete it on a computer or mobile device. The structured questionnaire consisted of 26 items divided into four sections (socio-demographic characteristics; knowledge and attitudes about COVID-19; COVID-19 and human-animal interactions; COVID-19 and climate change). Participants' responses were scored using the Likert type scale. Data were analysed using descriptive statistics in the IBM SPSS Statistics for Windows, version 21 environment.

RESULTS

Socio-Demographic Characteristics of Respondents

A total of 215 respondents (males, *n*=112, 52.1%; females, *n*=103, 47.9%) aged 18 – 68 (mean age ± SD, 42.51 ± 11.87 years) were surveyed. Most of them had postgraduate degrees as their highest educational status 64.2% (*n*=138), while 78.6%, (*n*=169) lived in urban areas. Most of the respondents were from the south west Nigeria (70.7%) (Table 1).

Knowledge and Perceptions towards COVID-19

All respondents were aware of the existence of COVID-19 as a transmissible disease and 64.2% (*n*=138) were aware that it was a zoonotic disease. Only 33.5% (*n*=60) were unaware of animals getting infected with the COVID-19, through human contact. Also, 93.95% reported that touching of face, nose and mouth with contaminated hands were routes for COVID-19 transmission (Table 2 and Figure 1).

COVID-19, Human-Animal Interactions and Climate Change

Some respondents (31.5%, *n*=67) attested to never or rarely interacting with animals while 36.3% (*n*=78) agreed that COVID-19 infected humans should limit contact with animals to reduce transmission (Table 3). About 45.1% (*n*=97) agreed that activities in the markets where animals and animal products were sold, could provide opportunities for diseases to spread between animals and humans. Also, 41.5% (*n*=88) affirmed that they always took precaution when interacting with animals.

Most respondents (98.6%, *n*=210) had heard about climate change, while 38.8% (*n*=83) affirmed that the consequence of climate change was implicated in the emergence and spread of new diseases such as COVID-19. Majority (96.28%) felt that climate change was increasing temperature (Figure 2).

DISCUSSION

Humans and wildlife can interact and co-exist within human-dominated landscapes with appropriate management, relevant public policies and societal support (Nyhus, 2016; McNeely, 2021). The online survey provided essential data on COVID-19 and insights on human responses (Zhou *et al*., 2020; Nwagbara *et al*., 2021). However, the sample size was low and this study is noted as a limitation.

More males responded in the survey and were middle aged adults (41-50 years). Adults in the >60 years category may have limited access to social media (Reuben *et al.,* 2021).

Table 1. Demography of respondents on the influence of human-animal interactions and climate change on COVID-19 spread in Nigeria

Characteristics	Frequency	Percentage
Age Category (n = 208)		
< 20	6	2.9
21 – 30	43	20.7
31 – 40	43	20.7
41 – 50	56	26.9
51 – 60	53	25.5
61 and above	7	3.4
Gender		
Male	112	52.1
Female	103	47.9
Educational Status		
Secondary Education	1	0.5
Undergraduate degree (e.g., BSc, HND, OND, NCE)	76	35.3
Postgraduate degree (Masters, PhD and higher)	138	64.2
Religion practiced (n = 214)		
Christianity	189	88.3
Islam	20	9.3
Traditional Religion	1	.5
Not religion	4	1.9
Residential Area		
Rural	4	1.9
Semi-urban	42	19.5
Urban	169	78.6
Geopolitical Zone of residence (n = 208)		
South-West	147	70.7
South-East	9	4.3
South-South	18	8.7
North-Central	31	14.9
North-West	3	1.4
North-East	0	0

Table 2. Knowledge, attitude and awareness of COVID-19 in Nigeria

Variable	Category	Frequency	Percentage
Are you aware COVID-19 is a transmissible disease	Yes	215	100
	No	0	0
	I don't know	0	0
COVID-19 can be transmitted from animals to humans and the other way round (that is, a zoonotic disease)	Yes	138	64.2
	No	30	14.0
	I don't know	47	21.9
Wild animals such as bats and pangolins have been reported as the source of COVID-19 virus	Yes	175	81.4
	No	25	11.6
	I don't know	15	7.0
Animals can become infected with COVID-19 through close contact with infected humans	Yes	112	52.1
	No	19	8.8
	I don't know	84	39.1
Are you aware of any news report of animals becoming infected with COVID-19 through human contact	Yes	86	48.0
	No	60	33.5
	I don't know	33	18.4
Involvement of different professionals would be important in the control of the COVID-19 pandemic	Yes	198	92.1
	No	4	1.9
	I don't know	13	6.0

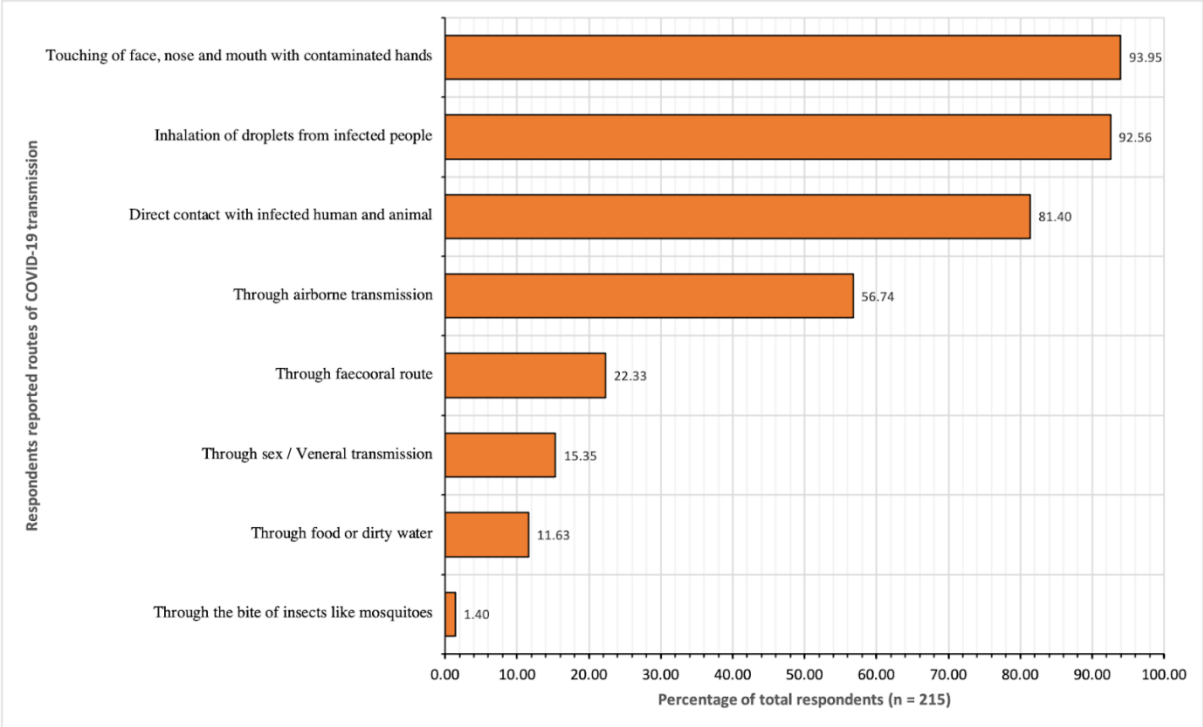

Figure 1. Perceived routes for COVID-19 transmission among people in Nigeria

Table 3. Perception on the influence of human-animal interactions on the spread of COVID-19

Variable	Category	Frequency	Percentage
Frequency of interaction with animals (n = 213)	Everyday	56	26.3
	At least once a week	16	7.5
	At least twice a month	28	13.1
	At least once a year	46	21.6
	Never/Rarely	67	31.5
COVID-19 infected humans should limit contact with animals so as to reduce possible transmission. (n = 215)	Strongly disagree	30	14.0
	Disagree	10	4.7
	Neutral	35	16.3
	Agree	78	36.3
	Strongly agree	62	28.8
Frequency of taking precaution whilst interacting with animals (n = 212)	Never/Not at all	49	23.1
	Rarely	14	6.6
	Sometimes	34	16.0
	Often	27	12.7
	Always	88	41.5
Activities in the markets where animals and animal products are sold can provide opportunities for diseases to spread between animals and potentially to humans (n = 215)	Strongly disagree	20	9.3
	Disagree	8	3.7
	Neutral	19	8.8
	Agree	97	45.1
	Strongly agree	71	33.0
There should be a law to ban the sale and consumption of wild animals. (n = 213)	Strongly disagree	23	10.8
	Disagree	51	23.9
	Neutral	53	24.9
	Agree	52	24.4
	Strongly agree	34	16.0
Banning the sale of wildlife and their products can reduce the risk of spreading new diseases like COVID-19 (n = 214)	Strongly disagree	24	11.2
	Disagree	55	25.7
	Neutral	45	21.0
	Agree	62	29.0
	Strongly agree	28	13.1
Constant interaction with animals and the environment may pose higher risk of contracting diseases like COVID-19. (n = 215)	Strongly disagree	19	8.8
	Disagree	12	5.6
	Neutral	28	13.0
	Agree	107	49.8
	Strongly agree	49	22.8

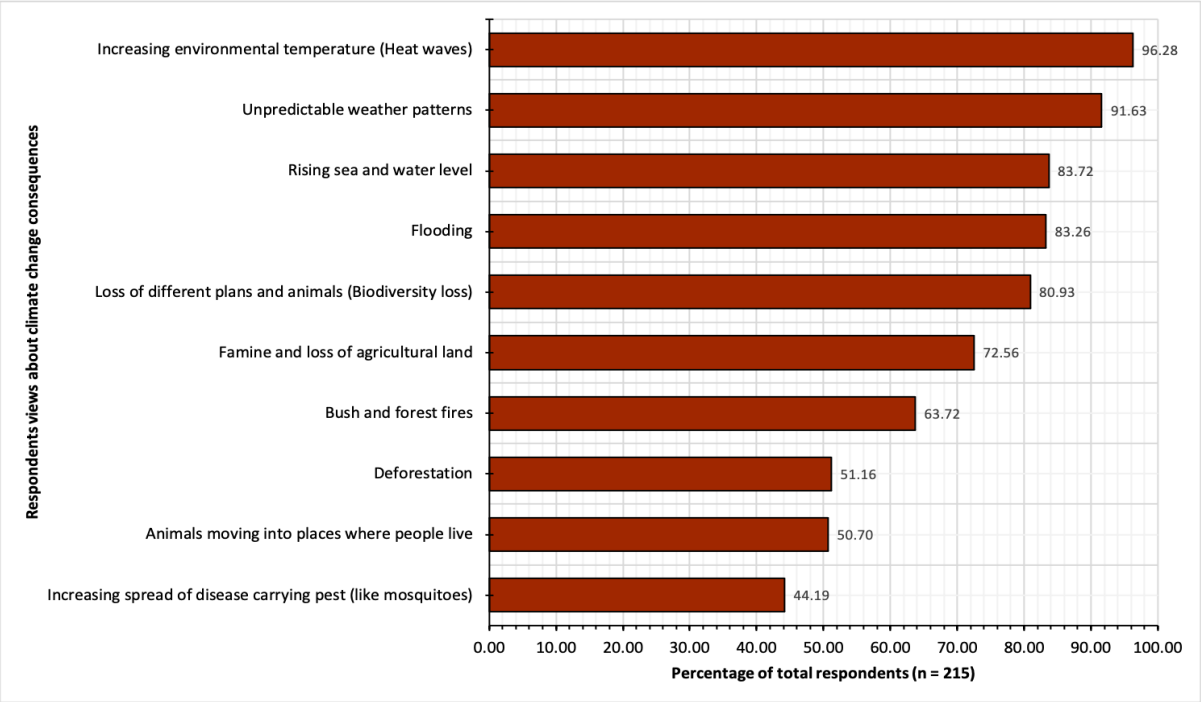

Figure 2. Consequences of climate change on the social, economic and environmental conditions in Nigeria

Most of the participants had postgraduate education, lived in south-west Nigeria, which has the highest adult literacy rate (NBS, 2010; Habib *et al*., 2021).All participants were aware of COVID-19 as a transmissible zoonotic disease, probably because of their educational backgrounds (Adesegun *et al*., 2020; Gollakner and Capua, 2020). There were speculations that domestic animals could become infected with the deadly virus via close contact with infected humans (Shi *et al.*, 2022). Transmission of the disease through touching of face, nose and mouth with contaminated hands as well as inhalation of droplets from infected people were highlighted as major routes of COVID-19 transmission (Abdelhafiz *et al*., 2020; Reuben *et al*., 2021).

A high proportion mentioned that they always took precautions, while interacting with animals. This affirmation might have stemmed from earlier reports about the origin of the disease (Pappas, 2011; Zhu *et al*., 2020).

A law banning the sale and consumption of wild animals could help reduce the risk of spread of COVID-19 (Bonwitt *et al*., 2018; Huong *et al*., 2020; Roe *et al*., 2020). The involvement of professionals such as veterinarians, medical doctors, environmental and wildlife scientists was imperative in the control of the COVID-19 pandemic. These professionals may be at a higher risk of contracting COVID-19 via constant interaction with animals or infected persons. These expertise could help with

surveillance of wildlife, management of animal epidemics, laboratory services, diagnoses and characterisation of pathogens (Ferri and Lloyd-Evans, 2021).

Climate change is an important factor in the emergence and spread of novel diseases and it is associated the spillover of pest carrying diseases (Gortazar *et al.,* (2014). Variation in climatic conditions facilitate pathogen survival and dissemination of zoonotic conditions (Morens and Fauci, 2020).

CONCLUSION

The findings suggest an increased level of awareness among people on the COVID-19 pandemic. Human-animal interaction, especially through wildlife trade, could accelerate the emergence and distribution of COVID-19. Importantly, there is need to take climate action to forestall the emergence and spread of pandemics.

Ethical Considerations

The study was conducted in line with the Nigerian Code of Health Research Ethics.

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