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WILDLIFE MARKET AND PREDISPOSITION TO ZOONOTIC DISEASES IN IBADAN, SOUTH-WESTERN NIGERIA

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ABSTRACT

Background: Recent cases of global epidemics rooted in zoonotic diseases' transmission engendered the exploration of wildlife beliefs and practices toward disease transmission among vendors in wildlife markets.
Objectives: The study explored the wildlife market practices in order to understand how the markets, attitudes and behaviours of traders can potentially influence the transmission of zoonotic diseases in Nigeria.
Methods: The study employed a qualitative research method, involving non-participant observation and interviews of 22 consented vendors from five wildlife markers in Ibadan, Nigeria.
Results: Wildlife vendors were neither grounded about animal-human transmission of diseases, nor hardly suspected their stock as a route or gateway for zoonoses' transmission to humans. They also embraced metaphysical explanation of disease aetiology among them.
Conclusion: Holistic and culturally-designed sensitisation about zoonoses targeting the wildlife vendors could facilitate the adoption of healthy practices when handling wildlife among them.

Keywords:
Animal-Human interaction, Epidemics, Hygiene practices, Wildlife market, Zoonosis

INTRODUCTION

In Nigeria, wildlife, whether dead or alive is traded[1]. The market for wildlife continues to grow as it serves the purposes of a quest for bushmeat, as a source of animal protein, traditional medicine and generation of foreign exchange[2,3,4]. The market involves networks of transfer of animal parts, such as hooves, skins, blood, bones, oil, feathers, and tusks, from suppliers to the buyers. Wildlife markets are loosely integrated in Nigeria[5]. Also, in Nigeria, as well as other African countries, bushmeat is commonly traded along the expressway and open markets[6]. National monetary value of the domestic trade in bushmeat ranged between US$42 million and US$205 million in West and Central African countries[7]. Locally, this constitutes a veritable source of income to many rural households that are engaged in subsistence wildlife hunting[8].

Wildlife hunting activities were primarily engaged in to meet basic nutritional, material, social

and spiritual needs[9]. For example, among the indigenous people of Ogbomoso, who practised traditional medicine in Nigeria, it was reported that 55 animal species were being used as part of the ingredients[10]. An increase in the demand for wild animals especially mammals for utilization by traditional medicine practitioners were also reported[11]. For the zoo-therapeutic purpose, many parts of animals are used for the treatment of different ailments in traditional medicine[4]. The use of pangolin scales in the cure of convulsions and infertility[2], and zootherapy with mythological potentials could treat diarrhoea, stomach ache; cure wounds and burns; prevent nose bleeding, breast and chest pain and increase appetite[4,12]. Globally, a larger proportion of the world's population still relies on zootherapy largely on the effectiveness of the medicine[13]. In Nigeria, zootherapy has gained wide acceptance[14] while ethnozoological practices have been observed[12] in Southwestern Nigeria.

In spite of these, wildlife markets may remain a vital source of zoonoses. Historically, wildlife has been an important source of infectious diseases transmissible to humans. Diseases of wildlife origin can impact the conservation of biodiversity, including domestic animals and public health, thereby affecting a nation's economy[15]. In 2001, the epidemiological list indicates that 62% of the 1,415 identified human pathogens were of zoonotic source[16]. For instance, it was reported that the fruit bats of the Pteropodidae family were believed to be the primary host of the Ebola virus[17]. Thus, through close contact with the organs or other bodily fluids, secretions, and the blood of infected animals, such as chimpanzees, gorillas, fruit bats, monkeys and forest antelopes, Ebola virus gained interface into the human population in Africa[18]. In developed countries, wildlife given their nature as a reservoir of zoonoses has gained concentrated surveillance[1]. In 2018, pangolins were suspected to be one of the vectors for diseases[2]. Hence, this heralded the need for major restriction of the wildlife market with an effort vital to initiate the curtailment of other related activities that have to do with the wildlife zoonotic exchange.

In 2014, the outbreak of the dreaded Ebola virus disease (EVD) experienced in Nigeria was traced to the movement of an infected person, a Liberian-American[20] to the country. The primary source of EVD was reported to be zoonotic[2], which pressurized bushmeat consumption and wildlife handling. Specifically, wildlife agents are required to refrain from hunting, killing, handling, rearing and processing of these animals to avoid further spread of the pandemic disease being fought[20,21]. From the foregoing, it is clear that many deadly diseases had crossed from animals to humans; while specifically, Rabies, Monkeypox, HIV, Lassa fever, EVD and most recently, Covid-19, that are highly infectious and life-threatening, have all been traced to cross from animals to humans[22,23,24]. The direct exposure that wildlife traders have with these animals and wildlife products, along with the ignorance of its consequences, puts the traders in danger of contracting and spreading zoonotic diseases. It therefore, becomes important to explore the wildlife market practices in order to understand how the markets, attitudes and behaviours of traders can potentially influence the transmission of zoonotic diseases in Nigeria.

MATERIALS AND METHODS

The study city is Ibadan, Oyo State, Nigeria. Ibadan, a city in south-west Nigeria, is the third-most populous city in Nigeria with current population estimates as over 3,565,000[25]. Ibadan started as a refugee camp for warriors, it is a forest site and its location at the fringe of the forest facilitated its emergence as a trading hub for traders and goods from the forest and savannah areas[26].

As traders came together, they forged links and activities which went beyond just trading, to include socio-cultural, religious and political activities; these activities helped solidify the links and made the market space a community. With increasing urbanization, the Ibadan market system became a closed space with only two means of entry, first of which is by birth, being born to a family of traders (till date this stands as the major route of entry). And secondly, by apprenticeship, this is when a person pays to learn for a specific period of years, during this time, the individual would have paid the

price that would enable him/her stay in the market, during this stay, the person builds social capital which is the main currency needed to access the resources within the market[27].

Ibadan markets are classified based on seven criteria[28]:

1. The scale of transaction: this implies if goods are sold in retail or wholesales
2. Type of commodities sold: Is it food grains, clothing materials, jewellery, daily needs, and household goods
3. Periodicity: what time interval, is it daily or at regular intervals decided by the market leadership
4. Time of operation: is it a day or night market
5. Nature of growth: is it planned or just left to grow on its own
6. Land ownership: is it owned by the town council, community, a chief or family
7. Function: is it local or spans beyond the region.

All the wildlife markets that were explored were located in Ibadan namely Bode, Molete-NITEL, Moniya, Oje and Alesinloye markets, the coordinate of the selected markets was also taken and recorded.

The location of the wildlife markets

The selected wildlife markets are shown with representative coordinates in Figure 1.

Bode market was popularly known for the wildlife business with a long history that pre-dates the Nigerian independence. It is located in-between *Molete* and *Idi Arere* markets. While passing through the service road next to the market, one might be tempted to conclude that the Bode market is small. But transect walk through the market by the researchers exposed the diverse sections and large trunk of business and transactions in the market. Also, Molete-NITEL wildlife market, believed to be a fall-out from the Bode market is highly reputable for international economic activities. Diverse wildlife vendors were also located in the market. Some of the vendors concentrated on the herbs, some on wildlife, while others sell the combination of herbs and wildlife products. Moniya wildlife market is not as large as the other wildlife markets, in terms of population; however, it has vast landmass. Oje wildlife market is located in the urban slum with a large volume of wildlife vendors. The market has a long history that pre-dated Nigerian independence. The market is popular for wildlife marketing. Alesinloye wildlife market is relatively small compared with Molete-NITEL market. More dried wildlife parts were being sold at Alesinloye and there is a social connection in all the markets.

This study adopted a qualitative research method, using the interviewing approach, to gain an in-depth comprehension of the zoonotic transmission tendency especially among the wildlife vendors in Ibadan metropolis. Through snowballing technique and purposive selection, In-depth interviews were conducted for the vendor who met the selection criteria. Those that participated had a stall in the wildlife market and were actively involved in the handling of the wildlife stock. This was to gain insight into conscious and unconscious handling practices by the vendors. Apart from respondents' willingness to participate in the study, preference was given to those who had large scale wildlife business and to those with at least 10 years of experience. Also, the selection was gender-sensitive; although wildlife business is considered to be feminine in nature, adult male wildlife vendors were also recruited in the study.

Most of the male vendors were engaged in interstate or cross border wildlife entrepreneurial businesses. Twenty-two participants were duly informed about the essence of the study and they provided verbal and written informed consent to participate in the study. All ethical concerns were carefully observed in the course of the study. A semi-structured interview guide was developed, standardised through pretesting and utilised to elicit in-depth information about the participants' experiences and practices in the wildlife markets. The interview covered issues such as stock preparation, handling practices, use of personal protective equipment, as well as knowledge, attitude and beliefs about zoonoses. Each session of the interviews lasted at least 47 minutes. The interview sessions were simultaneously recorded with an electronic recorder and a smartphone. At the close

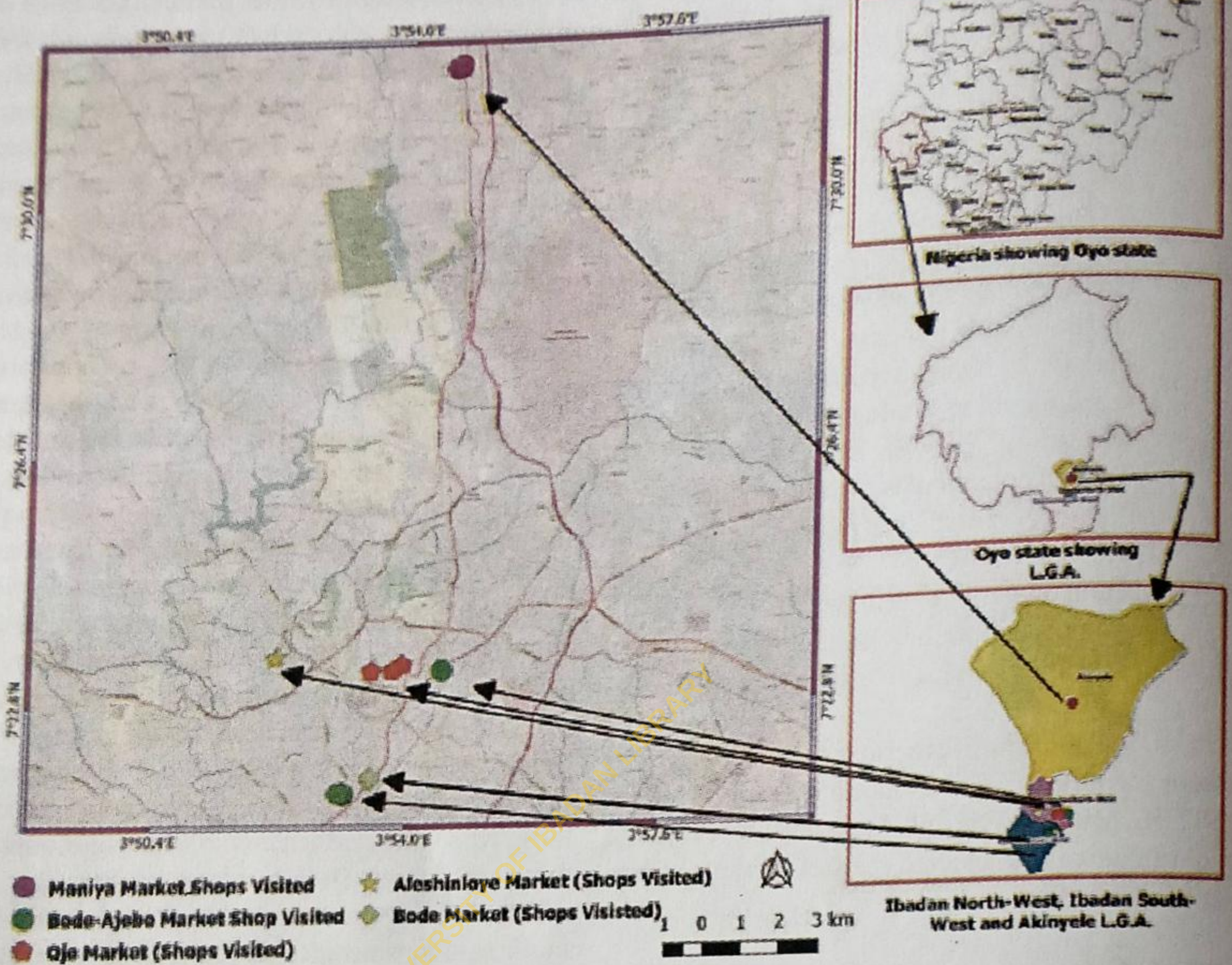

Figure 1: Map showing the locations of the sampled markets

of each fieldwork day, the audio files from the two devices were cropped and saved into a folder on a personal computer which was password protected and accessible only to members of the research team. Each of the audio files was labelled according to selected de-identified demographic characteristics of the participants. The audio files were transcribed verbatim and translated to the English language since the interviews were conducted in Yoruba, the local language. Activities were also observed and recorded in a checklist, including the list of wildlife products available during the interview sessions. Data analysis commenced with a critical reading of the imported edited version of the interview scripts on Atlas.ti version 8. This helped understand the natural generation of codes and nodes connected by networks to form themes. The discussion was done using the emic and etic discursive technique to explore their realities. The narratives from the study were subjected to content analysis. This generated useful data and quotes were used to substantiate finding. Also, grey literature was used in various discussions.

RESULTS AND DISCUSSION

Belief System and Zoonotic Diseases: Vendors' Perspective

The study exposed that the belief system of individuals would influence the perception of health conditions and how such individuals would interact with the situation. In animals, the severity of the impact of zoonotic diseases outbreak via animal-human interaction has been documented[31]. Largely, the wildlife vendors in the current study did not believe the information they had ever received about zoonoses. For instance, the vendors asserted their awareness of the history of EVD; hence the claim that EVD was alien to Nigeria, especially in wildlife market terrain, therefore they do not believe it exists nor associated with wildlife. This further supports their argument that there was no disease in the wildlife products which they deal with. The vendors maintained that the act of God has been protective and has never made any trader come down with any zoonotic disease emergent from that epidemic period. Besides the availability of local medicines which would cure illnesses, participants were aware of people who visited hospitals repeatedly in order to ascertain their health status during EVD episode. The wildlife vendors demonstrated with correctness to the related question, that they are aware of the routes through which EVD can be transmitted to individuals. Another participant cited an example of sexually transmitted infection (STI) and emphasised the possibility of contracting STIs from unprotected sexual intercourse. However, the vendor found it unbelievable to accept that touching carcasses of infected animals could infect the handler:

> I have never heard of such disease, and God forbid that one of us contracts it. From the little knowledge I have, a promiscuous woman can contract STIs like gonorrhoea and I don't know more than that. God forbid any of us to contract AIDS, when it comes to AIDS I don't know anything about it. But if it comes to STIs like gonorrhoea, I am quite knowledgeable about it. So, if it's a disease contracted by just touching something, I am not knowledgeable about it at all (IDI_Alesinloye Mkt_Adult Female).

Participants expressed concerns on the animal-human means of transmission of diseases. Some vendors resorted to a metaphysical explanation of scientific conclusion about zoonotic diseases. It is believed that those who were 'born into the business' possessed a level of mystical power to detect any mysterious animal that could infect such vendor. A vendor believed that only the novice in the business could be victims and suffer the consequences. Further explanation showed that such mystical animal-human transmission of zoonotic disease could be averted through sacrifice[1]. For the vendor, they believe *that is the reason why if you are to be closer to elders, you will see signs and if you see signs you must not do it* (IDI_Moniya Mkt_Young Female). Different diseases and their antidotes exist as noted by a participant:

> There are different diseases, but the individual needs to take care of self. One would need to apply antidote that can suppress poisonous things. There is also *Eyin aro* (treatment of opportunistic disease), it is used for bacteria. We use it for different purposes; we use it to mix soap and anything caused by bacteria like pimples, eczema in order to rub it. It can be mixed with *imi ojo*[2] together with kerosene and apply on it. It is used in various ways and not in just one way (IDI_Oje Mkt_Young Female).

Based on the explanation, wildlife market vendors might not necessarily suspect that their stock might have been infected with viruses or bacteria

which are transmittable to humans. The possibility of such animal-human transmission is hinged on a higher tendency for living wildlife stock to be asymptomatic. Similarly, it may be difficult for vendors to notice the presence of diseases in dried stock. The situation becomes difficult when vendors rely on unverified information about zoonotic diseases. One of the vendors believed that the aetiology of EVD should be traced to Hausa land in northern Nigeria. Similarly, in the social construction of the disease and its emergence, a wildlife vendor opined that the belief system usually played a large role. Besides, the explanation, vendors thought that the tendency to contract a disease from the wildlife product would depend largely on the end-user patronage and eventual use of infected animals. In contrast, some asserted that the preservation styles adopted by some vendors may predispose them to infectious diseases. Hence, when wildlife stocks are not preserved adequately, there would be a generation of stench causing diseases. In the same vein, some vendors believed that odour emanating from wildlife stock could be a source of major diseases. Other possibilities of contracting non-zoonotic diseases are due to personal lifestyles, such as having 'sexual intercourse in hot weather' and 'urinating on the urine of an infected person'.

The accounts of the vendors implied that they do not accept the tendency of the animal-human interface of zoonotic diseases. The acceptance of zoonotic disease transmission tendencies is not grounded in the narratives from the vendors, hence the vendors' belief that as humans have their own diseases likewise do animals. Participants also credibly defended the impossibility of animal-human disease transmission arguing that some of the wildlife stock are killed and processed into dried type prior to access by wildlife market vendor to the final products. Thus, it was not possible for diseases to be transmitted from the wildlife to man. One of the vendors believed that germs could remain active until the stock is preserved at a particular level of temperature. She, however, noted that the timeframe of processing and drying the stock should be sufficient to prevent the growth of any opportunistic infection in the wildlife stock.

Wildlife vendors and their own diseases

No disease, as concluded by participants, is peculiar and or attributed to wildlife vendors owing to their business activities. However, an exceptional condition which is a metaphysical dimension of illness was considered possible. In their own explanation, metaphysically, a disease may present similar symptoms in the same way the natural illnesses do, whereas, the actual condition may not be the same. This situation further explains the reasons why wildlife vendors would delay in presenting medical conditions in the hospital. The narrative from one of the vendors indicates all activities performed on their products are protective to their health:

> There is no disease common among wildlife vendors. And the smell that oozes from herbs in our shop is good for our health. For the clothes, I am wearing, if I don't wash it after now the smell of herbs will still ooze and it's also good for our health. The same way when we mix our products the smell that oozes is good for our health and wellbeing (IDI_Alesinloye Mkt_Adult Female).

Violation of cultural beliefs and taboo was considered a predisposing factor a vendor can have a disease. Such violation of a taboo was narrated to include having sexual intercourse in the afternoon especially when the temperature is at the peak, and 'urinating on the surface where an infected person had urinated earlier'. To the vendors, the prevention of such diseases may not necessarily represent healthier behaviour, while the adoption of such behaviour would not translate into staying healthy. Apart from that, wildlife natural reactions to their predator could predispose the vendors to sickness. The vendors identified some of the reactions, namely: poisonous bodily secretion of frog, and lizard or scorpion's bites among others. The aftermath of human exposure to wildlife natural reactions serve as a gateway to infections ranging from epilepsy to eventual death. To this end, participants emphasised

the practice of personal hygiene and exercising caution when handling wildlife product, as the main requirement for the prevention of contracting diseases. The following excerpt captures some of the vendors' perspectives:

> ..... one can't contract any disease, it's only when one is not neat when you handle them, it is only proper to wash both hands when you want to eat, no disease at all (IDI_Oje Mkt_ Adult Female)

Wildlife handling preparation for Sales and hand-washing practice

Vendors may not attach any serious meaning to a hygienic way of handling their products, yet the possibility of getting their hands stained while selling their products was acknowledged. Again, the tendency that a vendor would engage in hygiene practice depends on his/her ability to identify the depth of dirt through physical or stench evaluation. As some vendors expressed a belief that would inform hand washing after handling wildlife products, it was based on individual perception of dirt cum their belief. To an adult female vendor, *all animals in the world are used for healings, hence they produce no harm* (IDI_Moniya Mkt_Adult Female). Superficially, the belief represented the harmlessness of the positive purpose of the wildlife products in curing ailments. However, such belief seemingly prevented the vendors from suspecting possible hand-contamination through the handling of wildlife products. Consequently, the vendors may not wash their hands before eating; *If I like, I wash my hands, if I like I don't, what I sell is consumable, so it can't poison me (*IDI _NITEL _Adult Female*)*.

Wildlife handling experiences of vendors exposed them to potential transmission of zoonotic pathogens. Similarly, the practice of hand-washing after each sale, among the wildlife vendors, depends on many factors, such as the definition of contamination of their hands, whether this requires proper cleaning or not; kind of wildlife product sold to clients; and availability of other materials required to accomplish hand-washing practices. In fact, a female vendor maintained "*when we want to eat, there is no washing our hands when we are still attending to customers during the market hours*". To her, hand washing would disrupt her from active wildlife marketing or distract her attention from clients. However, the tendency of transmitting zoonosis is tied to contact with the wildlife[30]. The narratives from interviews also show that selective washing of hands or use of other materials such as pieces of clothes are also practised by the vendors when they handle the wildlife stock:

> ....we sometimes wash our hands after selling because it might stain our hands. When we sell things like black soap we wash our hands but when we sell any of our other products, it's not necessary... Also, there are some times that we clean our hands with a piece of cloth after selling our products (IDI_Alesinloye Mkt_Adult Female).

Narratives from participants clearly indicate a need for vendors to engage hand-washing and sustain the practice. To some vendors, processing dead wildlife to become dried necessitates handwashing with soap. One major reason for considering handwashing was, "*for prevention of unknown illnesses*" said a young female vendor, in Moniya market, and "*the vendors might want to sell herbal medicine to someone who would drink it instantly*" was another reason given by an adult male vendor at NITEL market. Generally, vendors maintained that it was expedient for them to wash their hands thoroughly. Vendors also acknowledge the possibility for wildlife to possess infections before getting to them for trade, hence, the need for adoption of hand-washing practice among some of the vendors:

> Some animals may have infections inside their body. When the animal is slaughtered to be preserved;

> the disease will be removed from its body. If not removed and we use it for herbal food concoction (*aseje*[3]), eating such herbal concoction prepared from an infected animal can affect such a person that eats the concoction (IDI_Moniya Mkt_Young Female)

Wildlife vendors claimed special knowledge and power to remove infections from the animal part in the process of preserving the dead animals. The 'wildlife quarantine' practices might be difficult since the public hardly understand its purpose[31]. They acknowledged that if their client should consume the animal parts or concoctions from infected animal parts, it could predispose them to zoonotic diseases. According to them, it is an expectation that the vendors should be able to remove the 'diseases' from the animal parts. Again, the use of chemicals in the preservation of wildlife stock usually requires the vendors to wash their hands thoroughly since they were aware of the danger of consuming preservatives. The vendors use these chemicals without adequate knowledge about their dosage and administration. No vendor perceived the danger in the consumption of wildlife products which were preserved with insecticides and other chemicals.

In terms of preparation of wildlife products for sales, it was clear that some vendors organised and tagged their products with names in different packages. The labelling practice was common among the young and literate vendors, who were learning the business from the cradle. Largely, the elderly vendors without formal education displayed a higher level of dexterity in identifying and locating their packed stock within their stalls. In their own instance, sacks and iron containers used to keep the wildlife products were not labelled; but just at a call, the elderly vendors were able to describe where their stocks were located; …*The heads of birds are not kept in the same place with the heads of rats* (IDI_Alesinloye Mkt_Adult Female). Generally, vendors were adept in stocking the products. As observed, vendors carefully arranged their stocks in different spaces with stall size in mind. The dried animal parts were kept in a safe space separately. Different species of snakes were sighted in a stall. For example, snakes were kept in fabricated circularly-closed metal-nets to protect them from one another and or to reduce the tendency of bite to human; the net limited the snakes' interaction with the public spaces.

The vendors identified five skills they used in offering wildlife for sale. The individual must possess skills in exercising patience applicable to handling different wildlife, carefully observing animal movement sequence, handling container-opening, systematic way of handling selected part of the live wildlife, and releasing the animal for sale. The knowledge and acquisition of these skills are not easy to come by but required for successful handling of wildlife stocks. A vendor stated *if we put it inside a cage, and we want to bring it out, we, first of all, open the cage partially and strategically in order not to allow it to escape. We target its tail and bring it out* (IDI_Bode_Adult Female). Vendors also developed their skills in this aspect differently; hence, some vendors offered the service of handling-wildlife-for-sale to other members for a fee depending on the kind of wildlife stock they want to handle. Similarly, the acquisition of the skill helps prevent and reduce the tendency of animal bites or animal-related injuries common in the wildlife profession. Vendors maintained that handling wildlife stock hinges on how careful an individual is rather than the use of diabolical means. Vendors were very careful in handling the live stocks to avoid bodily injury and/ or economic loss.

Wildlife vendors and use of personal protective equipment

Wildlife vendors' use of protective gears such as the nose mask, aprons and hand gloves meant to prevent physical contact with live/dead animals and their dried parts was assessed. Potentially, the use of the gears would prevent any opportunistic zoonotic disease. Most vendors never considered aprons as necessary in their daily activities, other than changing clothes to an *overall-wear* (kind of apron) in their stalls before daily sales

start. Coincidentally, the vendors identified a non-hygienic and social concern that would necessitate the use of apron in wildlife market. The vendors acknowledged the kind of smell on their clothes, which may be irritable to other people they encountered in public spaces like the bank, eatery and public transport, among others. A young female wildlife vendor retorted: *That is why; we change our clothes during the market hours. We change our clothes after the market hours when we are about to go home. This points out that appropriate hygiene practices are necessary for the wildlife market.* The adoption of personal protective gears was noticeable especially among young vendors with formal education.

No vendor-approved of the use of gloves while handling the stock or selling of wildlife products. The use of gloves was not incorporated in their apprenticeship. To all the participants, use of hand gloves was not in consonance with their conventional market practice. In Oje market, one of the vendors reacted to hand glove usage that, '*at what time, it's late and those who use gloves still contract the disease but as an educated person, I believe it doesn't stop anything. One can contract any disease'* (IDI_Oje Mkt_Adult Female). The comment exposed the orientation of the wildlife vendors. Clearly, the participants believed that probably literacy would have played an enlightening role. The non-participant observation in the study exposed that all the vendors did not use a glove, and the glove is not commonly seen or mentioned in the market. However, the vendors asserted that use of glove would depend on the circumstance at hand. For instance, "improvised gloves" is used only if clients request for it to pick the product to ascertain that the products are not decaying. Again, gloves are used in the market when a product that could injure hands or causes damage is handled. A participant shared her experience emphasising the need for the protective gears especially nose mask and hand glove:

> There was a product called "moru" in the Hausa language. If I open its paper at a coincidental time when the wind blows, and if you are eating in a short distance away, the wind blows it easily, and you'll just notice that your food suddenly becomes bitter. You'll now be wandering! (IDI_NITEL Mkt_Adult Male).

The vendors felt that issues related to the use of hand gloves are not significant until they handle poisonous substances; whereas participants believed that their products were not poisonous, hence, consistent use of hand glove is not necessary. Sensitisation on adoption of personal protective gears could be a helpful approach[32]. A participant observed that civilisation had exposed them to a lot of health-related issues surrounding their business. The Ebola and Lassa fever outbreaks were a major eye-opener in their profession and heralded emergency handwashing practices[33]. Many vendors would not allow new products into their stock immediately and in fact, many would arrange new stocks outside their stalls a bit far from their stock. However, most elderly vendors did not practise this during the EVD outbreak. According to a participant, Ebola was an imported virus as there was no local evidence to prove that the EVD outbreak emanated from their immediate environment:

> ...we don't really use hand gloves. Firstly, this is because we don't really use it, but for present civilization, there's meant to be sensitisation on it. Secondly, our products are not poisonous, and then traders (vendors and customers) won't use gloves when transacting business. So I think this belief was responsible for some reaction during Ebola episode. During that time, you too would want to run out; when you get to a vendor and they are

> offloading fresh wildlife products and you are perceiving odours. .... However, all those times hunters killed monkeys to eat in the bush, they would roast it on fire. Then we would eat alongside with our soaked *garri*[4]. Do we look like Ebola patients? (IDI_Oje Mkt_Young Female)

Wildlife vendor and stock-handling skills

With regards to handling wildlife products, wildlife vendors use their hands to handle all products. The vendors have gained some level of control over the living wildlife stock. The control involves the tying of the live-stock with a rope. The rope is used to restrain the animal. For the dead but fresh stock, vendors were observed while they exposed them to dry under the sunlight, while stocks become dried and the products tied together. Contrary to this, another participant asserted that there was no special device to handle the stock, thus warned that individual vendors should be careful. The participant noted that living stocks were usually unpredictable. Vendors are expected to be skilful especially when handling animals such as a snake. Few male vendors had developed the skills to handpick a live snake. These skilled vendors are engaged by other wildlife vendors whenever such expertise was required, at a fee. However, an injury may occur as noted by the participants. Narratives indicate that in case of physical injury as a result of handling animals, herbal remedies are believed to be amply available. The vendors would apply 'pure honey' as one of the remedies for an open wound. Some of the vendors have reportedly decided not to sell such physically harmful animal.

The vendors and stall hygiene practices in the wildlife market

From the observation of the physical environment and arrangement of the stalls in the market, it is fair to conclude that the stalls in the wildlife market are unkempt, especially in locations where space is limited. The market physical setting does not allow spaced stalls since the majority of the market is expanding through the proliferation of new vendors who want to remain on the initially limited market space. Again, the arrangement of products in medium or large-scale stalls could paint a picture of negative presumptive conclusion, that the ability to maintain adequate hygiene will be difficult and or impossible. For example, the vendors acknowledged that *selling wildlife animals that look dirty doesn't mean you should be dirty too.* Based on the statement, the responsibility to maintain adequate and proper hygiene would largely depend on individual vendors in the wildlife market. Accordingly, the observation and evaluation of hygiene levels should be on micro-level which allows individual stall to be engaged.

The vendors maintained that the issues relating to hygiene practice are visible. The vendors consensually maintained that they adopted adequate hygiene in all the markets. This is usually done through some techniques and conventional practices, alluding to the Yoruba cultural lifestyle that required individuals to sweep their environment or stall upon arrival and when closing the stalls. Also, the vendors reportedly arranged their stock properly. There is no fixed style of arranging their stocks, but rather depends on space and season. Another technique is the use of chemicals to preserve stocks. Apart from that, applying chemicals on the stocks reduces the emission of stench in their immediate environment. Through these techniques, the market surroundings would be clean until the next market day. Also, the government played a significant role in sustaining the hygiene practices in the wildlife markets: *This owes to the fact that the government has consistently preached about the importance of cleanliness in the market and sometimes monitors that* (IDI_Moniya Mkt_Young Female). However, the presence of environmental officers was not felt in the wildlife market unlike before when the officers were available on a weekly basis. There was no explanation about why environmental officers ceased from coming to oversee the vendors' hygiene practices. In one of the markets, the vendors asserted

that the officers stopped coming from the time the wildlife market was relocated. The following excerpt captured the daily activities on hygiene for most of the vendors:

> When I finish my sales for the day, I sweep my shop. For every used container, once I am done for the day, I'll wash them. You can hardly meet anything dirty in my shop when I am around. As you said, you'll go to another seller's shops and meet it unkempt. I adopted cleanliness in my day-to-day activities since when we were in the Dugbe market; it did not just start here in our present location. This is because most of our customers are educated and we have to present ourselves well not only to our educated customers but to others that patronise us. Asides from sweeping, if it's still dirty we sometimes wash the floor. During the rainy season, we sweep and wash the floor and during harmattan, we also sweep and wash (IDI_Alesinloye Mkt_Adult Female).

CONCLUSION

In spite of the awareness that several deadly diseases in the world had crossed from animals to humans, most of the wildlife traders in this study seem to be ignorant of the grave danger posed by their exposure to wildlife products (both live and dead). This is evidenced by their attitudes and behaviour towards the use of protective gears. This puts the wildlife traders in a position of threat to their health, hence exposing the public to grave outbreak consequences. Also, in spite of the current media sensitisation about the higher tendencies of zoonoses transmission to human, wildlife vendors still upheld cultural beliefs about the animal disease. Vendors generally believed that diseases in animals could not be transmitted to humans. The vendors' social construction of the belief explains their attitude to wildlife activities and its accompanying practices which include bare-hand practices, after handling practices and stall hygiene. Both attitudinal and behavioural changes among wildlife vendors remain plausible to reduce the tendency of animal-human transmission of zoonotic diseases. There is, therefore, a dire need for an aggressive public awareness drive, targeted at the wildlife traders and those that patronize them. Further studies on comprehensive periodic pathogenic and genetic screenings of the wildlife products and their vendors in the markets should be conducted. Finally, the pathogenic screening and holistic culturally sensitive awareness programme should be designed for the vendors through the combined efforts of the ministry of health, art and culture, and trade and commerce.

CONFLICT OF INTEREST

The authors have not declared any conflict of interests and no external funding was provided for this research.

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APPENDIX 1

The list and frequency of wildlife products observed in the markets are presented in Table 1.

Wildlife categories	Scientific Names	Common Names	Local Names	Availability at the markets (X)
Birds	*Streptopelia senegalensis*	Laughing Dove	Oderekoko	XXXXX
	Ploceus cucullatus	Village weaver	Eye Ega	XXXXX
	Bubulcus ibis	Cattle egret	Lekeleke	XXXXX
	Peliperdix lathami	Frankolin	Aparo	XXXXX
	Psittacus erithacus	Parrot	O rofo/Odidere/Ayekoto	XXXXX
	Turdus pelios	African thrush	Opere	XX
	Centropus senegalensis	Senegal coucal	Elulu	XX
	Serinus canaria domestica	Canary	Ibaka	X
	Necrosyrtes monachus	Hooded Vulture	Igun	XXXXX
	Milvus migrans	Kite	Asa	XXXXX
	Struthio camelus	Ostrich	Ogongo	XXXXX
	Corvus albus	Pied Crow	Kanakana/Akalamagbo	XXXXX
	Stephanoaetus coronatus	Crowned Eagle	Awodi/Idi	XXXXX
	Tyto alba	Barn Owl	Owiwi	XXXXX
	Columba livia domestica	Pigeon	Eyele	XXXXX
	Dendrocopos major	Great spotted Woodpecker	Akoko	XXX
	Cuculus clamosus	Black Cuckoo	Koowe	XXX
	Apus apus	Swift	Alapandede	XX
	Pavo cristatus	Peacock	Okin	XXX
	Corythaeola cristata	Blue turaco	Agbe	X
Rodents	*Thryonomys swinderianus*	Grasscutter	Oya	XXXXX
	Cricetomys gambianus	Giant rat	Okete	XXXXX
	Rhabdomys species	Striped bush rat	Olofe	XX
	Funisciurus pyrropus	Fire-footed Squirrel	Okere	XXXX
	Cavia porcellus	Guinea pig	Eku emo	XXXX
	Atherurus africanus	African brush-tailed porcupine	Oore	XXXX
	Rattus fuscipes	Bush rat	Emo igbo	XXXX
	Rattus rattus	Rat	Ekute	XXXXX
	Atelerix albiventris	Four-toed Hedgehog	Lili	X
	Rattus fuscipes	Bush rat	Afe	XX

The list and frequency of wildlife products observed in the markets are presented in Table 1.

Wildlife categories	Scientific Names	Common Names	Local Names	Availability at the markets (X)
	Mus minutoides	Mouse	Eliri	X
	Crocidura nigeriae	Shrew	Asin	X
Reptiles	*Crocodylus niloticus*	Crocodile	Ooni	X
	Python sebae	Rock Python	Ejola / Ere	XXXXX
	Centrochelys sulcate	African-spurred Tortoise	Ijapa	XXXX
	Pelusios niger	Turtle	Kungu	XXXX
	Varanus niloticus	Monitor Lizard	Anta/Awonriwon	XXXX
	Trioceros cristatus	Chameleon	Oga	XXXXX
	Naja nigricollis	Spitting Cobra	Sebe	XXXXX
	Atheris chlorechis	Bush Viper	Paramole	XXXX
	Naja melanoleuca	Black Cobra	Oka	XXXXX
	Bitis gabonica	Gaboon viper	Monamona	XX
	Dendroaspis angusticeps	Green mamba	Soro	X
	Psammophis species	Sand snake	Asan	X
	Bitis arietans	Puff adder	Igba/Gbagbafufu	X
	Mecistops cataphractus	Short-snouted crocodile	Agiliti	X
	Agama agama	Lizard	Alangba	X
Primates	*Cercopithecus mona*	Mona monkey	Edun	XXXXX
	Papio anubis	Baboon	Akiti	XXXXX
	Erythrocebus patas	Patas monkey	Ijimere	XXXX
	Chlorocebus tantalus	Tantalus monkey	Aaya	XXXXX
	Gorilla gorilla diehli	Gorilla	Inaki	XXXXX
	Pan troglodytes	Chimpanzee	Elegbede	XXXXX
Amphibians	*Xenopus tropicalis*	Frog	Konko/Pontan	XXXXX
	Amietophrynus superciliaris	African Giant Toad	Opolo	XXXXX
Other Mammals	*Sylvicapra grimmia*	Common Duiker	Etu	XXXXX
	Phataginus tricuspis	Pangolin	Akika	XXXXX
	Eudorcas thomsonii	Thomson's Gazelle	Esoro	XXXXX
	Eidolon helvum	Fruit Bat	Adan	XXXXX

The list and frequency of wildlife products observed in the markets are presented in Table 1.

Wildlife categories	Scientific Names	Common Names	Local Names	Availability at the markets (X)
	Loxodonta africana	Elephant	Erin	XXXX
	Hippopotamus amphibius	Hippopotamus	Erinmilokun	XXXX
	Hippotragus equinus	Roan Antelope	Igala	XXXX
	Diceros bicornis	Rhinoceros	Agbanrere	XXXX
	Syncerus caffer	Buffalo	Efon	XXXXX
	Giraffa camelopardalis	Giraffe	Agunfon	XXXXX
	Canis aureus	Jackal	Akata	XXXXX
	Kobus kob	Kob	Egbin	XXXX
	Equus quagga	Zebra	Ketekete Abila	XXXX
	Lycaon pictus	Hunting dog	Aja igbo	XXXX
	Crocuta crocuta	Spotted Hyena	Ikoko	XXXXX
	Phacochoerus africanus	Warthog	Imado/ Elede Igbo	XXXXX
	Vulpes vulpes	Fox	Kolokolo	XXX
	Civettictis civetta	Civet	Eta	XXXXX
	Panthera leo	Lion	Kiniun	XXXXX
	Panthera pardus	Leopard	Amotekun	XXXX
	Acinonyx jubatus	Cheetah	Owawa	XXXX
	Felis catus	Cat	Ologbo/Ologini	XXXX
Invertebrates	*Achatina achatina*	Snail	Igbin	XXXX
	Papilio dardanus	Butterfly	Labalaba	XXXX
	Macrotermes bellicosus	Termites	Ikan	XXXXX
	Periplaneta americana	Cockroach	Ayan	XXXXX
	Acheta domesticus	Cricket	Ire	XXXXX
	Cardisoma armatum	Crab	Alakan	XXXXX

** wildlife products are found in dried part, fresh part, processed, specific part, and whole animal*

X = found in one market, therefore the frequency of X represents the number of markets where the products was found.