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Socio-cultural Determinants of Human–Bat Interactions in Rural Ghana

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ABSTRACT Bats are known to be a natural reservoir for a lot of disease pathogens and can spread several diseases. All 11 genera of fruit bat found in West Africa are found in Ghana, and human–bat interactions are common. However, there is a dearth of knowledge about the socio-cultural factors that shape these interactions. This paper explores the socio-cultural factors that bring humans into contact with bats. Data were obtained through focus group discussions and in-depth interviews. The findings indicate that gender, religious affiliation, and belief systems influence the interaction between humans and bats. We conclude that the hunting and consumption patterns of bats have far-reaching consequences for the transmission of bat-borne zoonotic diseases. Educational campaigns, therefore, should be intensified and, in particular, target groups that are most at risk of contracting bat-borne zoonotic diseases.

Keywords: bats, Ghana, sacred forest, socio-cultural beliefs

Over the past four decades there has been an increase in the rate at which zoonotic diseases occur in humans (Daszak, Cummingham, & Hyatt, 2000). The consequences of such outbreaks have often been devastating, threatening the already fragile economic and healthcare systems of affected countries (Pigot et al., 2014). Bats are known to be a natural reservoir for several disease pathogens, such as filoviruses (Marburg and Ebola viruses), paramyxoviruses (*henipavirus*—

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hendra and *nipah* virus), and lyssaviruses (Daszak et al., 2000; Dobson, 2005; Brook & Dobson, 2015).

All 11 genera of fruit bat that are found in West Africa are found in Ghana. The straw-colored fruit bat, *Eidolon helvum*, is especially common (Hayman et al., 2011). Large bat colonies have been found in most parts of the country, such as Accra, Kumasi, Kyebi, Afram Plains, and parts of the Volta and Western regions (Decher, 1997; Decher & Fahr, 2007; Kamins et al., 2011; Hayman et al., 2011). Human–bat interactions are common as bats are widely hunted for food and provide a source of income for many people (Decher, 1997; Hayman et al., 2011; Kamins et al., 2014; Anti et al., 2015). It is estimated that over 128,000 bats are sold each year as bushmeat in southern Ghana (Kamins et al., 2011). More importantly, several disease pathogens have been isolated in bats. For instance, the henipavirus is found in bat colonies in Accra, Kumasi, Tanoboase, and in the Volta Region. It is also present in domestic pigs (Drexler et al., 2009; Hayman et al., 2011).

The henipavirus (hendra and nipah) is especially pathological (Drexler et al., 2009). The nipah virus causes encephalitis in humans and respiratory illness and encephalitis in pigs (Looi & Chua, 2007; Luby, Gurly, & Hossain, 2009). Though there is no evidence yet for the presence of henipavirus in the general human population in Ghana, it is important that we understand the factors that contribute to human–bat interactions. Understanding the factors that put people in contact with bats is useful for mapping out how zoonotic diseases are likely to occur and who is most at risk. There is evidence to show that the 2013 Ebola disease outbreak in West Africa (Baize et al., 2014) was due to the interaction between humans and bats. Saez et al., (2015) provide evidence that the "index case" of the Upper Guinean Ebola outbreak (a 2-year-old boy) may have been playing in a hollow tree with insectivorous free-tailed bats (*Mops condylurus*) in Melinadou, SE Guinea. Similar evidence is found in the nipah virus outbreak that occurred between September, 1998 and June, 1999 in Malaysia and Singapore. In that outbreak, 265 human cases were recorded, while the pig industry was decimated (Looi & Chua, 2007; Luby et al., 2009).

Transmission of the nipah virus occurs when people come into direct contact with the saliva and droppings of the bats. In Malaysia, the existence of large commercial pig farms creates the setting for the transmission. The bats roost on fruit trees planted on pig farms. The half-eaten fruits coated with saliva and bat droppings fall into the pig stalls. The pigs eat the contaminated fruits and developed respiratory illness and encephalitis. Subsequently, farm workers at the pig farms get infected (Luby et al., 2009). The transmission is aided further when sick pigs are clandestinely sold in other parts of Malaysia (Looi & Chua, 2007). The virus spread further among abattoir workers in Singapore, who had come into contact with pigs imported from Malaysia (Looi & Chua, 2007).

In Bangladesh, the transmission from bats to humans occurs in three ways: first, through the ingestion of fresh date sap. The sap is harvested by cutting into the tree trunk where it flows slowly into a clay pot left overnight. In the night, the bats come to lick on the sap of the date palm and hence contaminate it. Transmission occurs when the fresh sap is drunk raw by people. The second route of transmission occurs when domestic animals eat half-eaten fruits dropped by bats. The domestic animals become infected and transfer the virus to other animals and then on to humans. The third pathway is when people come into direct contact with bat secretions by climbing trees which have been visited by bats (Luby et al., 2009).

In terms of hunting, recent literature suggests that men are more likely to hunt bats for food than women (Anti et al., 2015; Kamins et al., 2014; Lawson, Ayivor, Ohemeng, and

Ntiamoa-Baidu, 2016), but the factors that influence interactions between humans and bats have not been well studied. This study sought an in-depth understanding of the broad range of socio-cultural factors which underlie human–bat interactions. Specifically, we asked: What are the historical/cultural understandings of the origins of bats? What factors determine the hunting and consumption of bats?

Methods

The Study Area

The study was conducted at Tanoboase in the Techiman North District of the Brong Ahafo Region of Ghana. The Bonos are part of the Akan ethnic group which constitutes about 45% of Ghana's population. Other Akan groups include the Asante, Fante, Kwahu, Akyem, Akwapim, Ahanta, and Sehwi. They speak a mutually intelligible language called Twi. Tanoboase is a small farming community with a population of about 2,470; they are predominantly peasant farmers. The major cash crops grown are cashew nuts and mangoes (Ghana Statistical Service, 2014).

This area was chosen as the study site because the Tanoboase Sacred Grove, which covers an area of ca. 300 acres, supports a large roost of bats. The Tano Sacred Grove has great spiritual significance for the citizens of Tanoboase. The terrain of the grove comprises a thick semi-deciduous forest, large rocks, and caves which give a panoramic view of the forest. In the past, the grove served as a safe haven against enemy attacks, particularly the Asante. The grove is believed to be the earliest settlement of the Bonos and also home to Taakora, the great god of the Akan people who is believed to be the first son of the supreme god (Rattray, 1923). The Tano River takes its source from the sacred grove and runs for 400 km through five districts in the Brong Ahafo region and also in the Western region, before it enters the Gulf of Guinea at Aby lagoon in La Cote d'Ivoire (Adiyiah, Aboagye-Larbi, & Acheampong, 2013).

All activities such as farming, logging, and hunting are forbidden in the Tano Sacred Grove; people are allowed only to pick herbs there. Sacred groves are small patches of land or forests protected by religious and/or cultural agents (Nganso, Kyerematen, & Obeng-Ofori, 2012). They are believed to contain the spirits (*sunsum*) of ancestors, local gods, and other spiritual beings. They are often the sites for rituals (*mmusuyi*), prayers (*apayɛ*) to ancestors, the gods and other deities, and for other religious purposes (Sarfo-Mensah, Oduro, Antoh, & Amisah, 2010). Due to the fact that sacred groves have spiritual significance, they often are forbidden places; farming, hunting, logging, and trapping are not allowed. The picking of herbs for medicinal purposes, however, is allowed (Sarfo-Mensah et al., 2010).

Data Collection and Analysis

The data were collected through focus group discussions (FGDs) and in-depth interviews with key informants. Two FGDs based on sex were organized. The FGDs consisted of 98 females and 38 males and were facilitated by one of the researchers assisted by a research assistant. Participants were chosen through convenience sampling. The criteria for the selection of participants were that the participant should be at least 18 years old and willing to take part in the study. The discussions centered on beliefs about the origins of bats, the hunting, processing, and consumption practices, and the perceived threat of disease spillover from bats to humans. We also conducted in-depth interviews with key informants including the chief and some of his elders, one of whom was also the assemblyman[1], some members of the royal family, hunters, the sole butcher in the community, a *mallam*[2], and some fruit farmers. In all, 15 people were interviewed. The interviews lasted between 45 minutes and

one hour and took place in the homes of the participants. They were conducted with the aid of a semi-structured interview guide.

Both the in-depth interviews and the FGDS were conducted in Twi, the language the participants understand perfectly. The FGDs and the in-depth interviews were tape-recorded and then later transcribed and translated into English. The transcribed data were analyzed through thematic analysis, as described by Braun and Clarke (2006). We started the analysis by familiarizing ourselves with the data and identifying patterns. These patterns were then coded, and themes developed and were analyzed.

Ethical approval for the study was obtained from the Institutional Review Board of the Nogouchi Memorial Institute for Medical Research of the University of Ghana. Participants were informed about the study and their consent sought before the interviews began.

Results

Local Classifications of Bats

In Tanoboase a bat is known as *ampane* (singular) or *mmpane* (plural). In other Twi dialects it is known as *apan* (singular) or *mmpan* (plural) (Cansdale, 1970a). The residents identified four types of bats by the following local names: *ahwenekron* (*Hypsignathus-monstrous*, Hammer headed bat) *ampane ankasa* (literally the original or normal bat, *Eidolon helvum*, straw-colored fruit bats), *sreso ampane* (*Epomophorus gambianus*, epaulette fruit bat), *afrifraa/fredɛ fredɛ* (free-tailed bats; family—*Molossidae*). The *ahwenekron* are said to have nine noses (*Ehwene* in Twi is nose and nkron is the number nine). The participants indicated that the *ahwenekron* are uncommon, bigger in size, have a distinctive cry from other bat species and feed only in the sacred grove. Some participants indicated that they preferred this type of bat for consumption because they are more delicious. At the time of the visit, the straw-colored fruit bat was the most common species in the area, with large numbers roosting in the grove and were the ones most often consumed. The *sreso ampane*, are believed to originate from the Northern part of Ghana where the vegetation is savannah grassland. Another name given to the *sreso ampane* is *ampane kronfoɔ* (thief/criminal bat) because they are perceived to be very destructive on farms. These were not too common in the area. The *afrifraa/fredɛ fredɛ* derive their name from the fact that they are very swift and go in and out of their roost. They were found mostly in ceilings. Unlike the other species they are insectivorous, and were not consumed because they are small in size and very smelly. At the time of the study, there was a roost of these in the community day-care center.

McCaskie (1992) indicates that the Ashanti classify animals in two ways—phenomenologically and ontologically. Phenomenologically, the Ashanti translate "their sensory observations of habitat, physicality and primary behavior in animals into a set of basic discretionary categories" (McCaskie 1992, p. 223). Animals are classified according to their habitat, primary behavior, and physical appearance. We see a similar mode in the classification of bats at Tanoboase; the bats were classified based on their physical appearance, their habitat, and primary behavior. Thus, *ahwenekron* is a bat with nine noses, *ampane ankasa*, the real bats, *sreso ampane* grassland bats, also described as criminals because of their destructive nature, and *afrifraa/fredɛ fredɛ* because they move swiftly in and out of the ceilings of buildings.

Beliefs About the Origin of the Bats

There were two schools of thought about the origins of the bats in the sacred grove. One school was that the bats were brought to the sacred grove by Taakora (the deity associated

with the Tano Sacred Grove). Those who were of this view indicated that the bats were with Taakora when he moved into the forest. Others were of the view that Tano brought the bats from elsewhere to the forest, but did not know exactly where they came from and when they populated the sacred grove. Furthermore, others also believed that Tano continually adds to the bat population. One participant from the FGDs said, "Tano brings the bats from different parts of Ghana. However, as to exactly where he brings them from, nobody can tell because there are bats in northern Ghana, bats in Accra, in Kumasi and Buoyem." Others also said the bats were brought by Tano, to be used as food when the town experienced famine as a result of bushfires. However, there was no written record of famine or bushfires in the community at the time of the study. An elderly man from the royal family in the community emphasized that the bats were connected to Taakora:

> Originally, the bats were here but not in large numbers. My father, my own biological father, [he] was the person who first started to manage the forest. The forest did not only have bats but also monkeys, baboons and other wild animals. I used to go to the Tano Shrine with my father at that time.

He further explained that he and his late father, who was the previous chief of the town, used go to the forest to offer sacrifices to Tano and to take care of the place before the relocation of the shrine. The sacred grove was declared an ecotourism site in 1996 (Yeboah, 2013) and this occasioned the relocation of the shrine to its present abode within the vicinity of the chief's palace, after some rituals were performed to pacify Tano.

The second school of thought, which was also the view held by the current chief of the town, was that the occurrence of the bats is a recent event and has nothing to do with the Tano. According to this school of thought, the bats have been there for just about the last three decades, arriving around 1985. They explained that, indeed, there were a few bats in the town which previously roosted on coconut trees and around the forest. The chief of the town had this to say:

> On one occasion, I was here when somebody came and said: "Nana, I was passing by the forest and I heard noise from bats"; and then they [community] began hunting them. We don't know where the bats came from. Remember, that that place [forest] is a forbidden place. So what we saw was that the bats were there.

There are no written records on the occurrence of the bats in the sacred forest. It is possible that the bats moved into the forest when they lost their habitat elsewhere due to ravaging bushfires, which is characteristic of the area. Looi and Chua (2007) suggest that the bats that caused the nipah virus outbreak in Malaysia migrated from the forests and neighboring countries due to the severe 1997–1998 El Niño Southern Oscillation (ENSO) event. The drought destroyed the natural forest habitat of the bats and forced them to move from the forest to fruit orchards around pig farms. Ghana witnessed a long drought between 1983 and 1984. The prolonged drought caused bushfires across the country and destroyed much of the crops and vegetation (Dei, 1988; Awuah-Nyamekye, 2009). Bushfires are still common in Ghana, especially during the dry harmattan season which occurs between December and March. Since bats are known to be very mobile, and taking into consideration the fact that the sacred forest is protected, they might have migrated there when they lost their original roosting and feeding habitats, and finding a safe haven in the forest, they settled there. It must be noted, however, that although the bats roost in the sacred forest, they are not regarded as sacred animals. Also, the fact that they were believed to have been brought to the forest by the gods did not influence bat consumption by the people.

Feeding Habits of Bats

Bats normally do not feed where they roost. They are known to behave like migratory birds. They normally roost at one place and travel to areas where there are fruit trees to feed on. This is what an FGD participant said:

In the evening, around 4.00 or 5.00pm, you see the bats leaving the forest and flying over the town to go and feed. The sky becomes dark with them. At dawn, around 4.00am, they start to return. When you hear them cry and make noise, it means they are returning. By 6.00am, almost all of them have returned to the forest.

On where the bats feed, there were varied responses from participants. While a few indicated that they did not know where the bats fed, others suggested that the bats traveled to Sunyani (76 km away), Northern Ghana, and Buoyem (a village close to Tanoboase where there are bat roosts in caves). The majority of the participants, however, claimed that the bats fed on cashew farms surrounding the village. It was reported that they generally fed on fruits such as cashew nuts, pawpaw, mangoes, black plum, figs, and soursop. With regards to the eating habits of the bats, while some were of the view that the bats eat fruits, particularly cashew, on the farms where they pick them, others believed that the bats pick cashews from one farm and take them to a different place to feed. It was reported that it is common to find a huge pile of cashew nuts left by the bats on one's farm or under trees in the bushes. The participants indicated that they did not normally see bats on their farms; they only knew that the bats had been there from the left-over or partially eaten fruits and nuts left behind.

The cashew-nut farmers could not indicate exactly how much revenue is lost due to the feeding habits of the bats. Some were not even sure whether they lost any revenue at all. They explained that what they needed were the nuts and not the fruits, and since the bats drop the nuts after they have eaten the fruits, they could always collect the nuts and sell them. They believed they only lost revenue when the bats carried the fruits to another farm to eat. This was succinctly expressed by a participant in the in-depth interviews when he said: "If the bats make your cashew farm the dining hall, then you are lucky; but if they make it [the] take-away, then you are in trouble." We found only one mango farmer who indicated that the bats destroyed his fruits. He, however, could not indicate how much revenue he lost. Furthermore, some of the traditional leaders expressed concern that the bats could decimate the forest. They explained that when the bats hang on the branches, the branches do not grow again and cause the tree to die. They indicated that they had noticed that some of the trees were dying, and were worried that with time, most of the trees in the forest could die.

The farm-raiding activities of bats have been reported in Mauritania (Price, 2013). Price found that fruit bats of the genus *Pteropus* raid farms and eat fruits in people's gardens and farms. The fruits commonly destroyed by the bats were mangoes and lychees. Participants in Price's study thought that bats were a big problem to which a solution must be found.

Hunting of Bats

The bats were hunted in the sacred forest by means of a spray gun or catapult. When a shot is fired, several pellets are released which can hit several bats at a time. Bats hang together in groups, normally up to a hundred at a time. About 20 to 50 bats could be killed by a single gunshot. The bats fall to the ground and are collected and put into sacks. Those that do not die immediately are hit with sticks until dead. According to the participants, bats do not die easily; they can hold on to a branch for a long time before dying. Sometimes, even when they are dead they can remain hanging on the branch for several hours before falling to the ground. Bats

may scratch or even bite the hunters when they fall and are not dead. Sometimes, the one who kills the bat may not get the carcass immediately, but another person, who happens to be passing by at the time the bat falls could get it.

In Tanoboase, the processing of bats is done in the bushes, using fire to singe the skin and the membrane; the head also is removed. The processing is done in the bush because bat hunting is illegal and hunters are afraid that if they processed at home, the strong smell emitted from the burning fur could expose them. It was obvious that hunters were exposed to scratches and bites from the bats during hunting, and routinely to bat blood and other body fluids during processing. Similar observations have been reported elsewhere in Ghana (Anti et al., 2015).

The legality or otherwise of hunting bats in the sacred forest has not been consistent. At one point, it seemed to be legal and then was made illegal. Some participants indicated that a long time ago the hunting of bats was legal. This was when the village was devastated by wildfire. The god then gave permission for the bats to be hunted for food. However, people started killing the bats indiscriminately, forcing them to retreat into the sacred grove where there is a total prohibition on hunting and farming. At the time of the study, the hunting of bats in the forest was illegal. Those apprehended for hunting were sent to the chief's palace where they were either fined or sent to the police station at Tuobodom, about 6km away, for prosecution. They alleged that sometimes people from other villages and towns came to hunt in the forest under the cover of darkness. We were told of a man serving a two-year prison sentence for illegal hunting. To enforce the ban on hunting, the traditional authority had appointed special guards to patrol the forest. However, the guards were accused of hunting the bats themselves and extorting monies from the illegal hunters they apprehended. Nevertheless, some participants justified the actions of the guards, saying that they were not paid and were at risk of being harmed or even killed by the illegal hunters in the forest, knowing the severity of the punishment they could receive if arrested.

Though hunting is illegal, the traditional leaders could allow hunting when the bat population is deemed to have increased. In such instances, some rituals were performed. When the leaders consider that the bat population has become too high, the chief would sound the *gong gong*[3] and announce a day when any individual, who desired, could go into the sacred grove and hunt; or the chief would select a few men to go and hunt. That was the only period when hunting, selling, and processing bats were lawful.

There was, however, disquiet in the community regarding the hunting of the bats. It was alleged that the chief had given permission to one individual to hunt bats. The economic undertones arose out of the fact that the community members thought the chief and that individual were making themselves rich at the expense of the whole community. This person, they alleged, hunted bats regularly and sold them at the Techiman market and not at Tanoboase. The Techiman market is known as a hub for bushmeat, especially bat meat, in that part of the country (Anti et al., 2015). The proceeds were then shared between the two. They claimed that the individual had become rich as a result and was putting up a new house. They further alleged that this action by the chief was denying the rest of the people access to bat meat. This allegation was evident when in the men's FGDs they claimed they did not know the price of a bat because they were not sold in the town. The women, on the other hand, readily provided information on the price of bats: between one and two Ghana cedis (about US$0.30). In the FGDs, none of the male participants admitted to have ever hunted bats in the sacred forest. However, in the in-depth interviews with individual males, hunters readily admitted to have hunted bats and even directed us to other hunters.

Our findings indicate that the hunting and processing of bats were gendered—men generally hunted bats, but not women. None of the women in the study indicated that they had ever hunted bats. A few said they had picked bats from the ground before, when the bats were electrocuted on high tension cables or found in the bushes. Women did not hunt because hunting is socially defined as a masculine task. More so, it occurred in the sacred forest, and as noted by Sarfo-Mensah et al., (2010), sacred groves have the reputation of being quiet, serene, and frightening areas that possess supernatural powers and should not be profaned. It was believed that those without supernatural powers or unauthorized people, therefore, go there at their own peril, so it was unlikely for women to go there to hunt or engage in any other activity. Men were more likely to attempt to go into the forest, even when it was forbidden to do so, than women.

The gendered nature of hunting bats reported in this study is consistent with other studies (Anti et al., 2015; Kamins et al., 2014). In the study by Anti et al. (2015), the bats roosted in caves, several of which were believed to be spiritual sanctuaries. In one of the communities they studied, hunting of bats was part of the yam festival, where only women collected the night's catch. Similarly, Kamins et al. (2014) report that only two of the hunters they interacted with were women, but even these scavenged for fallen bats or helped to beat them with sticks after they fell.

Consumption Patterns

As pertains to other parts of the country (Hayman et al., 2011), bat meat is widely consumed by residents in Tanoboase. It was a delicacy in the town and this was reflected in the many nicknames given to it, for example, *dankwansre* (literally smiling in soup) or *mea ne bo*, (literally, press its chest). The participants recounted that all one has to do when bat meat is served in soup is to press its chest and the soup that has soaked in comes out, so one does not need additional soup. The most popular ways bat meat is consumed is either in soup, barbecued, roasted, or fried. It can be cooked whole or cut into two or four pieces. The participants indicated that with the exception of the head and nails, no other body part of a bat is thrown away.

Those who consumed bat meat indicated that it is more delicious than other types of meat. They attributed the delicious nature of meat to the fact that bats feed only on fruits—on "foods which are above and not foods which are on the ground." While bat meat was widely consumed, not everyone ate it. Consumption was influenced by religious beliefs, food taboos and some myths about bats. Opinions differed when it came to whether or not people from the royal family ate bat meat. While some were of the view that it was a taboo for members of the royal family to eat bat meat, others thought otherwise. An elder, whose deceased father was a chief of Tanoboase, indicated that he did not consume bat meat because it was a taboo to consume food items that belong to Tano. He intimated that it was a sign of disrespect to Tano to eat bats because the bats and other animals in the sacred grove were given to the people by the god. According to him, he had "never eaten bat meat because I am a direct son of the shrine." Another view was that bat meat was a taboo only to the *Nifahene* and not to the entire royal family or the shrine (such as the priest/priestess and those around the shrine). The *Nifahene* is the head of one of the four military wings in the Akan army. The four military wings are the *nifa* (right wing), the *benkum* (left wing), the *adonten* (front wing) and the *kyidom* (back wing), and the *Nifahene* has the responsibility of sending extra troops to the field when necessary.

Another factor that influenced the consumption of bats was religious affiliation. Muslims and Seventh Day Adventists (SDAs) did not consume bat meat. Muslims interviewed indicated that their religion did not allow them to eat bats. Islamic laws stipulate that animals to be slaughtered must be alive and healthy at the time of slaughter and that all blood should be drained from the carcass. In addition, the animal should be killed by cutting through the jugular vein, carotid artery, and the windpipe. The Muslims pointed out that, normally, the bats would already be dead when captured, thus making it difficult for them to adhere to their religious practice. Nevertheless, some young Muslim men indicated that they ate bat meat. Similarly, the SDAs indicated that they did not eat bat meat. They follow strictly the Old Testament regulations on clean and unclean animals. As indicated by Cansdale (1970b), bats are among the animals considered unclean in the Bible and which Hebrews were commanded not to consume. All other Christian denominations do not have restrictions on the consumption of bat meat, though they are considered unclean in the Old Testament.

The consumption of bat meat was influenced also by the features and characteristics of the bats. Such views were mostly expressed by female participants in the FGDs. Indeed, the findings show that men tend to consume bat meat more than women. Only a few of the women interviewed said they ate bats. A lot of participants in the female FGDs observed that bats have very strange features. They said the bats looked like dogs and human beings and believed that if a pregnant woman ate bat meat, her baby, when born, would look like a bat. One female participant in the FGDs remarked:

> If you are a pregnant woman and you like eating bats, you would give birth to a child whose face is small and who looks like a bat. The child would also not be able to cry like a normal child. When you go for postnatal visits, everybody would know you have eaten bat meat and the other women would laugh and poke fun at you. They would say your husband steals bats from the forest.

Apart from the reasons given above, other women indicated they did not like bat meat because of their pungent smell. They attributed the strong smell to the perception that bats defecate on themselves. Bats normally hang upside down on trees with their feet clutching the branch and their heads down. The odor deters some people, especially, women, from consuming them.

Others also claimed that they would experience a slow and painful death if they ate bat meat. The participants explained that bats are very strong, difficult to kill, and die slowly. Hence, the belief that anyone who ate bat meat would experience a similar death. Ironically, it is for this same reason (that they are very strong) that some men enjoy eating it. One male participant, beating his chest, described himself as very strong because he always ate bat meat. Another made a similar assertion by saying that: “if you consume bat meat every day, you will become strong; because the skin (of the bat) is very strong.”

There was no evidence that social class influenced the consumption of bats. Both people of high status and low status considered bat meat to be delicious. People of high status were more likely to consume bat meat because they could afford it. In other studies, where the sample was relatively more diverse than Tanoboase, bat meat was consumed by people of a certain class because of the “high taste ratings” and also because they could afford it (Kamins et al., 2011). Nevertheless, the hunting and consumption of bats is found to decrease with education (Lawson et al., 2016; Kamins et al., 2014).

Risk Perception of Bat-borne Disease

On whether bats harbor viruses and could transmit diseases, the participants did not believe that bats could cause diseases. This was the case for both those who consumed bat meat and those who did not. The participants were of the view that since the bats ate only fruits, their meat is very safe and healthy and does not harbor any viruses. Indeed, almost all participants in both the FGDs and the in-depth interviews indicated that they were not aware that bats harbor any viruses, nor had they experienced or witnessed someone who got sick from eating bat meat. This is what one participant said:

I have not seen or heard anyone being sick because they ate bat meat. If someone became sick after eating bat, then it means that person was already sick or about to get sick. I have not heard anything like that. No, not at all.

Discussion

In this paper, we explored the factors that shape human–bat interaction in a rural community in Ghana. The findings show that human–bat interaction in Tanoboase is influenced by gender, religious beliefs and affiliation, myths, and food taboos. There were two schools of thought about the origins of the bats at Tanoboase. The prevalent view was that the bats were brought to the sacred grove by Taakora, the highest god of the Akans who is also the deity of the community. The majority of the participants who held this view intimated that the bats have always been in the forest since their ancestors migrated to the town. The minority view held by the chief and the assemblyman was that the bats are of recent origin. There were no written records on when the bats started populating the forest. The differing views broadly indicate the deficiency inherent in oral tradition. It is possible that some aspects of the story may change through generations. That is not to say that oral history is not credible. In the absence of written records, one has no choice but to rely on oral history. We are inclined to believe that the bats were present in the community but not in large numbers; that they might have migrated to the sacred grove in large numbers when their habitats in other parts of the region or even country were destroyed by the bushfires of the 1980s. As has been noted above, Ghana experienced her worst bushfires and drought between 1983 and 1984 (Awuah-Nyamekye, 2009; Dei, 1988). Bats are known to migrate when their habitat is destroyed.

Our finding that the hunting and consumption of bats in Ghana are mediated by gender confirm those reported by Kamins et al. (2011, 2014) and Anti et al. (2015). A similar finding was made by Mickleburgh, Waylen, & Racey (2009). In a study, they conducted on the hunting and consumption of bats in several countries such as Cambodia, Malaysia, Nigeria, New Guinea, Philippines, Madagascar, Benin, and Cameroun, they found out that men tend to hunt and consume bats more than women. Mickleburgh et al. (2009) and Kamins et al. (2014) however, do not explain the gender differences that exist in the hunting and consumption of bats. On the other hand, Anti et al. (2015) indicate that women were specifically barred from hunting bats because it was a religious activity. In one of the communities they studied—Buoyem—the hunting of bats was part of the celebration of the yam festival. Also, menstruating women were barred from collecting the dead bats hunted by men because women in that state were perceived to be unclean. In our study, however, the hunting of bats was not associated with any religious ceremony. Women did not hunt bats primarily due to the hunting practices—shooting and hitting of bats with sticks. Besides, hunting occurred in the sacred grove where hunting, farming, logging, and all other activities were forbidden. The hunting practices confirm already existing gender roles in many parts of Ghana.

This paper further elucidates why women tend not to consume bat meat. The women in this study tended not to consume bat meat because of fears of having strange or deformed children, fear of dying a slow and painful death, and the strong scent emitted by bats. Observing taboos, especially those during pregnancy, is not uncommon in Ghana. Sarpong (1974, p. 86) states that: "it is believed that if a pregnant woman sees a monster or an ugly thing or person, her child will be like what she has experienced." Likewise, pregnant women are restricted from eating certain foods or drinking certain liquids for fear of affecting their babies (Sarpong, 1974; Senah, 2003). For instance, in some Ghanaian societies, pregnant women are not expected to eat snails lest the baby will drool; or eat eggs lest the child grows to become a thief (Senah, 2003). Among the Yilo Krobos of southern Ghana, a pregnant woman is forbidden to eat snails, rats, hot food, and animal lungs, although the eating of snails and rats is also forbidden outside pregnancy (Arzoaquoi, 2014). Similarly, among the Kasena Nankana of the Upper West region, pregnant women are forbidden to eat meat and groundnut, lest they give birth to spirit children (Senah, 2003). Although women in our study were not forbidden to consume bat meat, they reckoned that if they did, their children would look like the bats. Prokop, Fančovičová, & Kubiatko (2009) have observed that females normally have negative attitudes to, and tend to believe myths about, bats. In their study on students' attitudes toward bats in Slovakia, Prokop et al. (2009, p. 28) explain that women's negative attitude toward bats are "consistent with women's enhanced evolutionary role in protecting the next generation." So, women are afraid, not only for themselves, but for their offspring as well.

Currently, the hunting of bats in Tanoboase is illegal due to the fact that hunting and other economic activities are forbidden in the sacred forest. Another reason is the fact that the forest was designated by the government as an eco-tourism site (Yeboah, 2013), though this was not given as a reason for the harvesting or otherwise of bats. Officials from the Wildlife Division of the Forestry Commission visit the site periodically and interact with the traditional authorities. This might further encourage the traditional authorities to restrict the hunting of bats in the forest. There is no documentation on when the hunting of bats was legal and when it became illegal. The legalization of hunting seems to tie in with the history of the town. It seems that hunting was legal when the bats were not in the forest and became illegal when they moved into the forest. As has been alluded to, the nature of oral history makes it a bit challenging to know the exact timelines of these events.

The general view in the community was that bats could be killed for consumption but not for sale. Bats could be sold only when the bat population increases and the traditional authority allowed hunting. Otherwise, the bats are not commoditized. They are not commoditized due to the view that one should not make money off the shrine. Though the women claimed to know the price for bats, it was not sold on the open market in the town. However, bat meat was widely available at the Techiman market and at Tuobodom.

Although bats are widely consumed, they are not associated with any diseases in the community. The common diseases reported were fevers, bodily pains, and malaria. The people in the community were convinced that bat meat was safe to be consumed and healthy because bats eat only fruits. Generally, diseases in Ghana are either believed to be of natural or spiritual causes. Normally, diseases thought to be strange are believed to be spiritually caused because they cannot be explained (Abotchie, 2014). For instance, when HIV/AIDS emerged in Ghana in the early 1980s, it was thought to be spiritually caused because it was poorly understood. However, some diseases such as cancer, mental illness, and epilepsy also are given

spiritual interpretation (Atobrah, 2012). The implication of this is that should there be an outbreak of a bat-borne disease, the initial interpretation would be spiritual. This could pose a major challenge to the prevention and treatment interventions.

The implications of the hunting and consumption patterns indicate that men may be more at risk of bat-borne diseases since they tend to hunt and consume bats more than women. Typically, the transmission of bat-borne diseases occurs when one comes into contact with the saliva, feces, or blood of bats (Looi & Chua, 2007; Luby et al., 2009). For instance, the 2013 Ebola outbreak in West Africa (Baize et al., 2014) occurred when the index case came into contact with bat droppings (Saez et al., 2015). In the same vein, the nipah virus outbreak in Malaysia occurred when pig farmers came into contact with bat droppings (Looi & Chua, 2007; Luby et al., 2009). In this study, however, the men were exposed through the bites and scratches they receive from bats during hunting. In addition, they may be exposed to the blood of the bats during processing. Similar findings were reported by Anti et al., (2015) in their study of bats and human interaction in three communities in Ghana. They report that bat hunters are exposed by bat bites, scratches, and urine. Also, when not cooked properly, bat meat may pose health issues for consumers as they harbor unusually high amounts of viruses (Luis et al., 2013).

Conclusion

The hunting and consumption patterns of bats in Ghana has far-reaching consequences for the transmission of zoonotic diseases. Educational campaigns should therefore target men since they tend to be more at risk of contracting bat-borne zoonotic diseases than women. The situation is more challenging as people have a lower risk perception of disease spillover from bats. In fact, both those who consume bat meat and those who do not did not think bats could be the cause of zoonotic disease in their community. Indeed, this study was conducted before the 2013 Ebola outbreak in parts of West Africa. Further studies should be conducted to examine whether the attitudes of the people have changed since the 2013 Ebola outbreak.

This study adds to the body of knowledge on the importance of sacred forests to the conservation of the environment and wildlife. The designation of patches of forests as sacred is not uncommon in Ghana (Nganso et al., 2012; Ntiamoa-Baidu, 2008). Almost all the forest reserves in Ghana have close links with sacred groves (Nganso et al., 2012). While some of the designated sacred forests tend to be small and individually may not be significant for biodiversity conservation, they are often found in places where all the surrounding forests have been destroyed; and are therefore important for biodiversity. In the case of the Tano Sacred Grove, it is a wildlife refuge for bats and other animals. As discussed above, bushfires are common in Ghana and environmental degradation is widespread. Thus, sacred forests become useful ways of preserving the environment and protecting wildlife. The declaration of the Tano forest as an eco-tourist site deserves to be applauded and encouraged as this can improve the economy of the town, while at the same time enhancing conservation of flora and fauna for the benefit of the people.

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Conflict of interest

The authors declare there are no conflicts of interest.

Notes

1. Assemblymen are part of the local government system in Ghana. The assemblymen/women are elected by the electoral areas and who represent them at the District Assemblies. For more, see Ayee (2011).
2. A *mallam* is an Islamic spiritual healer who also consults for a wide range of conditions such as infertility, successful visa applications, and successful business deals.
3. A *gong gong* is a double cow bell (a big and small) made of brass, which is hit with a stick to make announcements in the village. The one who beats the *gong gong* is known as the gong gong beater or town crier.

References

Abotchie, C. (2014). *Ghanaian traditional social institutions.* Accra: Olive Tree Printing and Publishing.

Adiyiah, J., Aboagye-Larbi, H., & Acheampong, M. A. (2013). Comparative assessment of the upstream and downstream water qualities of River Tano in Ghana. *Journal of Environmental Science and Engineering A*, *2*(5A), 283–292.

Anti, P., Owusu, M., Agbenyega, O., Annan, A., Badu, E. K., Nkrumah, E. E., Tschapka, M., … Drosten, C. (2015). Human–bat interaction in rural west Africa. *Emerging Infectious Diseases, 21*(8), 1,418–1,421.

Arzoaquoi, S. K. (2014). Common food taboos and beliefs during pregnancy in Yilo Krobo district, Ghana (Unpublished master's thesis). University of Ghana, Accra, Ghana.

Atobrah, D. (2012). When darkness falls at mid-day: Young patients' perceptions and meanings of chronic illness and their implications for medical care. *Ghana Medical Journal, 46*(2), 46–53.

Awuah-Nyamekye, S. (2009). Salvaging nature: The Akan religio-cultural perspective. *Worldviews, 13*, 251–282.

Ayee, J. R. (2011). Provincial governance in Africa: The Ghanaian experience. *Verfassung und Recht in Übersee/Law and Politics in Africa, Asia and Latin America, 44*(3), 409–421.

Baize, S., Pannetier, D., Oestereich, L., Rieger, T., Koivogui, L., Magassouba, N. F., ... Tiffany, A. (2014). Emergence of Zaire Ebola virus disease in Guinea. *New England Journal of Medicine, 371*(15), 1,418–1,425.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77–101.

Brook, C. E., & Dobson, A. P. (2015). Bats as "special" reservoirs for emerging zoonotic pathogens. *Trends in Microbiology, 23*(3), 172–180.

Cansdale, G. S. (1970a). *A list of scientific and vernacular names of the fauna of Ghana.* Accra: Ghana University Press.

Cansdale, G. S. (1970b). *All the animals of the bible lands.* Grand Rapids, MI: Zondervan Publishing House.

Daszak, P., Cunningham, A. A., & Hyatt, A. D. (2000). Emerging infectious diseases of wildlife-threats to biodiversity and human health. *Science's Compass, 287*, 443–449.

Decher, J. D. (1997). Conservation, small mammals, and the future of sacred groves in West Africa. *Biodiversity and Conservation, 6*, 1,007–1,026.

Decher, J., & Fahr, J. (2007). A conservation assessment of bats (Chiroptera) of Draw River, Boi-Tano, and Krokosua Hills Forest Reserves in the western region of Ghana. *Myotis, 43*, 5–30.

Dei, G. J. (1988). Coping with the effects of the 1982–83 drought in Ghana. The view from the village. *Africa Development/Afrique et Développement, 13*(1), 107–122.

Dobson, A. P. (2005). What links bats to emerging infectious diseases? *Science, 310*, 628–629.

Drexler, J. F., Corman, V. M., Gloza-Rausch, F., Seebens, A., Annan, A., Ipsen, A., ... Oppong, S. (2009). Henipavirus RNA in African bats. *PloS ONE, 4*(7), e6367.

Ghana Statistical Service. (2014). 2010 Population and Housing Census, District Analytical Report-Techiman North District.

Hayman, D. T. S., Wang, L-F., Barr, J., Baker, K. S., Suu-Ire, R., Broder, C. C., Cunningham, A. A., & Wood, J. L. N. (2011). Antibodies to henipavirus or henipa-like viruses in domestic pigs in Ghana, West Africa. *PloS ONE, 6*, 1–4.

Kamins, A., O., Restif, O., Suu-Ire, R., Hayman, D. T. S., Cunningham, A. A., Wood, J. L. N., & Rowcliffe, M. J. (2011). Uncovering the fruit bat bushmeat commodity chain and the true extent of fruit bat hunting in Ghana, West Africa. *Biological Conservation, 144*, 3,000–3,008.

Kamins, A. O., Rowcliffe, J. M., Ntiamoa-Baidu, Y., Cunningham, A. A., Wood, J. L., & Restif, O. (2014). Characteristics and risk perceptions of Ghanaians potentially exposed to bat-borne zoonoses through bushmeat. *EcoHealth, 12*(1), 104–120.

Lawson, E. T., Ayivor, J. S., Ohemeng, F., & Ntiamoa-Baidu, Y. (2016). Social determinants of a potential spillover of bat-borne viruses to humans in Ghana. *International Journal of Biology, 8*(2), 66–76.

Looi, L. M., & Chua, K. B. (2007). Lessons from the nipah virus outbreak in Malaysia. *Malaysia Journal of Pathology, 29*, 63–67.

Luby, S. P., Gurly, E. S., & Hossain, M. J. (2009). Transmission of the human infection with nipah Virus. *Clinical Infectious Diseases, 49*, 1,743–1,748.

Luis, A. D., Hayman, D. T. S., O'Shea, T. J., Cryan, P. M., Gilbert, A. T., Pulliam, J. R. C. ... Webb, C. T. (2013). A comparison of bats and rodents as reservoirs of zoonotic viruses: Are bats special? *Proceedings of the Royal Society B, 280*(1,756). doi:10.1098/rspb.2012.2753.

McCaskie, T. C. (1992). People and animals: Construc (ct) ing the Asante experience. *Africa, 62*(02), 221–247.

Mickleburgh, S., Waylen, K., & Racey, P. (2009). Bats as bushmeat: A global review. *Oryx, 43*(2), 217–234.

Nganso, B. T., Kyerematen, R., & Obeng-Ofori, D. (2012). Review of biodiversity in sacred groves in Ghana and the implications for conservation. *Current Trends in Ecology, 3*, 1–10.

Ntiamoa-Baidu, Y. (2008). Indigenous beliefs and biodiversity conservation: The effectiveness of sacred groves, taboos and totems in Ghana for habitat and species conservation. *Journal for the Study of Religion, Nature & Culture, 2*(3), 309–326.

Pigot, D. M., Golding, N., Mylne, A., Henry, A. J., Weiss, D. J., Brady, O. J., Kraemer, M. U. G., … Hay, S. I. (2014). Mapping the zoonotzic niche of Ebola Virus disease in Africa. *eLife, 3*, e04395.

Price, V. (2013). Trouble in paradise: Mapping human–wildlife conflict in the western Indian Ocean (Unpublished Master's thesis). Imperial College London, UK.

Prokop, P., Fančovičová, J., & Kubiatko, M. (2009). Vampires are still alive: Slovakian students' attitudes toward bats. *Anthrozoös, 22*(1), 19–30.

Rattray, R. S. (1923). *Ashanti*. Oxford: Oxford University Press.

Saéz, A. M., Weiss, S., Nowak, K., Lapeyre, V., Zimmermann, F., Düx, A., ... Sachse, A. (2015). Investigating the zoonotic origin of the West African Ebola epidemic. *EMBO Molecular Medicine, 7*(1), 17–23.

Sarfo-Mensah, P., Oduro, W., Antoh, F. E., & Amisah, S. (2010). Traditional representations of the natural environment and biodiversity conservation: Sacred groves in Ghana. In G. I. P. Ottaviano (Ed.), *Global Challenges Series.* Fondazione Eni Enrico Mattei Working Paper Series. Retrieved from http://ageconsearch.umn.edu/bitstream/92787/2/NDL2010-087.pdf.

Sarpong, P. (1974). *Ghana in retrospect: Some aspects of Ghanaian culture.* Accra: Ghana Publishing Corporation.

Senah, K. A. (2003). Maternal mortality in Ghana: The other side. *Institute of African Studies Research Review, 19*(1), 47–56.

Yeboah, T. (2013). Ecotourism development in Ghana: A case of selected communities in the Brong-Ahafo Region. *Journal of Hospitality Management and Tourism, 4*(3), 69–79.