

# Primate Bushmeat Consumption: A Source of Zoonotic Disease Risk in Tombel Area, Southwest Region, Cameroon



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## Abstract

In sub-Saharan Africa, primate bushmeat consumption is considered the primary risk factor for human-wildlife contact and zoonotic disease transmission, particularly for the transmission of simian retroviruses. Despite the frequent zoonotic disease out-breaks from the primate bushmeat consumption in some parts of Africa, many Cameroonians still consider the monkey bushmeat as a delicacy. The main objective of this study was to investigate the consumption behaviour of monkey meat in Tombel area. The survey method constituted the administration of five hundred and fifty questionnaires to a selected population in the study area. The results of this study showed that the Age-class and Awareness of Ebola disease is significantly related,  $X^2 = 13.53$   $df= 3$  at  $P<0.05$ . Also, the Age range with 15-25yrs has the highest knowledge 31.52% on the Ebola disease zoonoses. The survey also recorded a significant correlation between Gender and the Awareness of zoonotic diseases,  $R^2 = 0.728$  at  $P < 0.05$ . In addition, the Female respondents recorded the highest knowledge on the existence of primate zoonoses 53.32%, while the male respondents recorded 46.68%. The study has shown that 75.88% of the respondents consuming primates were aware that their illnesses are transmissible to humans while 24.12% were unaware. This study further discovered that 82.75% of the respondents have heard about Ebola disease while 17.25% had no knowledge on the existence of Ebola disease. About 69.22 % of the respondents accepted that they consume the monkey bush meat while 30.78% unaccepted its consumption. The national government of Cameroon might need to create jobs in order to discourage wildlife hunting and trapping; hence, the wildlife conservation public sensitization campaigns would deepen understanding on the cost of primate zoonotic epidemic from bush meat consumption.

**Keywords:** Primate bush meat; zoonoses; Ebola disease; wildlife conservation; sensitization

## Introduction

Emerging infectious diseases from animals pose significant threats to human health on a global scale. Zoonotic agents cause an estimated 70% of emerging and re-emerging diseases in humans, with RNA viruses being particularly important [1]. As humans and wildlife come into increasing contact, the risks of pathogen transmission increase in concert. In sub-Saharan Africa, bushmeat hunting, butchering and consumption is widely considered to be the primary risk factor for human-wildlife contact and zoonotic viral transmission [2]. Human immunodeficiency virus, the cause of AIDS, evolved from related viruses of nonhuman primates that entered human populations through multiple zoonotic events as a result of bushmeat hunting and butchering in West and Central Africa [2]. In addition, other retroviruses have crossed into persons with primate contact in Africa, including simian foamy virus (SFV) and simian T-cell lymphotropic virus [3]. However, bushmeat hunting and

butchering are part of a broader spectrum of activities in sub-Saharan Africa that bring people and animals into direct and potentially risky contact.

Urbanization and economic crisis in Congo Basin countries contribute to the extension of forest exploitation and, on the basis of cultural values, to the hunting of wild animals and to the development of an informal bushmeat trade [4]. Roads established and maintained by logging concessions have intensified hunting by providing hunters greater access to relatively unexploited populations of forest wildlife and by lowering hunters' costs to transport bushmeat to market [5]. This commercial hunting threatens many animal species such as monkeys and great apes [6], duikers, and the forest elephant, all of which are suffering from a decline in the Congo Basin [4,7].

While our own species continues to expand exponentially wild populations of nonhuman primates are experiencing a

global crisis [8]. Almost half of today's two hundred and fifty primate species are thought to be of conservation concern in all of the ninety-two countries in which they occur [9]. Even more alarmingly, one in five primate species are classified as being endangered or critically endangered by the Primate Specialist Group of the World Conservation Union (IUCN), suggesting their viable extinction within the next two hundred years [10]. The threat facing primate populations is not evenly distributed. Results show a strong positive correlation across the continents, between extinction risk and human population growth [11]. It has been found that those primates most at risk of extinction live in regions where human figures exceed 0.28 humans per hectare [11]. Protein consumption including beef, mutton, chicken, bushmeat, and eggs has been studied in Brazzaville by [12], who described the dietary habits of its inhabitants. However, data on bushmeat consumption, especially the socio-economic ones, are lacking. Many indigenous people rely on primate meat as their main or only source of protein. For example, In the North of Cameroon bushmeat supplies more than fifty percent of the population its principal source of animal protein. [10,13] suggests that the main threat to most primates of tropical rainforests is that imposed by humans hunting them for meat. Evidence to support this has been found for two "edible" lemur species in Madagascar. There is evidence that hunters show a greater preference for larger prey [14]. According to the Optimal Foraging Theory large bodied animals will be hunted in favour of small-bodied species, as the energy gained from the catch will outweigh that utilised during the hunt. Hunting therefore tends to have extremely detrimental effects on the larger species from a given area [13,15] suggests that it would take only a few hunters with shotguns to drive an entire population of relatively large-bodied primates towards the brink of extinction as demonstrated by the recent eradication of red colobus across its entire range.

The fact that large-bodied species tend to have decreased rates of reproductive output and increased inter-birth intervals exacerbates the effects that hunting has on them [16]. As a direct result of discriminative hunting larger bodied species in both Africa and Madagascar are endangered [11]. Small-bodied, discrete primates may be hunted less as they are less profitable and increasingly difficult to find. For example, Campbell's monkey (*Cercopithecus Campbelli*) appears to be more resilient to hunting than the other guenons with which it shares the forest, as it is more cryptic in colour and smaller in body size [17]. It has also been found that secretive species such as the Aye-aye (*Daubentonia madagascaris*) and the dwarf lemur (*Microcebus spp.*) are the only lemur species not affected by local hunting [18]. Some Cercopithecine species will purposely reduce alarm calls and hide in thick bush in response to human encounters in order to be more inconspicuous [19].

Cultural and religious beliefs will influence the susceptibility of primates being hunted for meat. For example, gorilla meat is also highly sought after in many parts of Africa and appears to

be of principal importance for a number of ceremonious events. The Bishop of Bertoua in Cameroon is regularly offered gorilla hands and feet at festivities, as it is believed to bestow strength and power to those who consume it [20]. In contrast, Hanuman langurs (*Semnopithecus entellus*) escape the pressures of hunting in Jodhpur where they are thought to be sacred [9]. In parts of Western Cameroon in the 1960's all primates except chimpanzees (*Pan Troglodytes*) were hunted because they were thought to share too many similarities with people [19]. Such influences may be highly influential in shaping primate communities; Kibale is home to a rich diversity of primate species as a result of the local tribe having never hunted them [19]. Hunting of non-human primates also poses a threat to other primate species. Indeed, high levels of predation by chimpanzees on red colobus monkeys have led to a reduction in colobus numbers by half over the last twenty-five years at Gombe. It is thought that predation by chimpanzees may be amplifying human hunting pressures playing a part in driving the red colobus to local extinctions.

A huge threat challenging the survival of many primates is the professional hunters who kill large quantities of wild fauna to sell on international and national markets. Mass culling does not allow time for populations to recover and thus makes hunting unsustainable. For example, it has been reported that in the Congo Basin mammals must produce ninety three percent of their body mass, annually to balance current extraction rates. Sixty percent of these mammals are primates [21]. Bushmeat may be far less expensive for consumers to buy than domestic meat making it an attractive purchase, keeping demands high and species hunted for bushmeat vulnerable. It is thought that this trade alone might well pose the biggest threat to the survival of many primate populations in West Africa [22].

Primate parts are traded for medicinal, superstitious and ornamental purposes; chimpanzee skulls are carried open like a cup during periods of drought to encourage rainfall [20]. While small scale hunting for personal use poses no serious threat it is the huge global market for monkey and ape body parts that have an impact on primate population densities. With the trade in traditional medicines increasing across China and Asia, due to an increased demand from a rapidly growing human population, the situation appears to be getting worse for many primate species. The pet trade, hunting trophies and souvenirs such as novelty gorilla hand ashtrays, fur rugs and stuffed body parts also threaten the extinction of a number of primates. For example, the huge trade in colobus skins during the late 1800's and again in the 1970's can be linked directly with the species absence in parts of East Africa today [17]. All five sub-species of gorilla are currently under threat largely as a consequence of being hunted for body parts [9]. In Cameroon alone eight hundred individuals are taken each year. Due to their large size and slow reproductive rate it is impossible for this species to recover from heavy hunting pressures. Most of these sub-species now exist in small isolated populations resulting in devastating effects on population numbers. As a result of hunting, the mountain

gorilla (*Gorilla gorilla beringei*) now faces the greatest threat of extinction, existing in only a small area around the Uganda, Rwanda, Zaire border, with just four hundred to six hundred individuals remaining [23].

Cameroon is well known in both the primate species and population richness. Unfortunately the primate population has faced severe hunting pressure for bushmeat consumption in the recent years despite the conservation restrictions and the primate zoonotic disease spread. Hence, the aim of this study was to examine the primate bushmeat consumption behavior of the inhabitants of Tombel, an area known to be rich primate population.

## Materials and Method

### Description of Study Site

Tombel is located in the South West region of Cameroon. It is situated between latitude 04°16' and 05°15' north and longitude 09°13' and 09°15' East. It lies on the western side of the Kupe Mountain from where the name Kupe Muanenguba comes. It covers a surface of 1007 Km<sup>2</sup> and has a population of 110 178 inhabitants. The climate of the subdivision is tropical in nature with rainfall in most part of the year. Tombel municipality has a volcanic soil supporting rich natural forest and a wide variety of tropical crops both for local consumptions and for exportation.

The rainy season lasts from April to September and dry season from October to March. The relief is dominated by Kupe Mountain (2050m). Kupe witnesses the presence of gentle slopes, deep valleys and some seasonal streams particularly "Esenze" which originates from the mountain. The natural vegetation cover in Tombel has similar characteristics with that of the dense equatorial rain forest, harboring a wide range of varieties of natural resources. The rainforest in Tombel is rich in fauna and flora but is facing enormous pressure from cultivation and poaching. The poaching is causing population reduction of wildlife species such as Chimpanzee (*Pan troglodytes*), Drill (*Mandrillus leucophaeus*), Red Colobus (*Phylocolobus preussi*), Mangabey (*Cercocebus torquatus*), Crown Monkey (*Cercopithecus pongonia*), Mona Monkey (*Cercopithecus mona*), Preuss Monkey (*Cercopithecus spreussi*), Putty Nosed Monkey (*Cercopithecus nictitans*), Red Eared Monkey (*Cercopithecus erythrotis*), Tantalus (*Cercopithecus tantalus*), Cane Rat (*Thryonomys swinderianus*), Giant Rat (*Criceetomys spp.*), Porcupine (*Antherurus africanus*), African Civet (*Civettictis civetta*), Pangolin (*Manis spp*), Red River Hog (*Potamochoerus porcus*), Red Duikers (*Cephalopus spp.*), Blue Duiker (*Cephalopus monticola*), Black Snake (*Naja spp.*), Monitor Lizard (*Veranus niloticus*), Python (*Python sebae*), and Viper (*Bitis gabonica*) [24].

### Data collection and Analysis

Data were collected in the month May 2017, just after a pilot survey was conducted to test this method, questionnaires administration was done alongside the oral interview to 550 five inhabitants of Tombel. After the authorization was granted

by the administrators of the town an agreement was reached to start the administration of the questionnaires to the residents on confidential grounds. However, in the process of questionnaires administration some of the respondents asked for incentive support but immediately they were made to understand the study did not have a research grant they turned down their request. Demographically, the gender and age-class status of the respondents were considered. In addition, the respondents were questioned on whether they have knowledge on the existence of Ebola on some monkeys and eat bushmeat [25]. The work was done with the help of two local field assistants. The field assistants helped in the local dialect communication translation between the researcher and the respondents whenever necessary. The administration of questionnaires and the oral interview was done in five different areas chosen by sampling and deemed to potentially have more variation in opinions, and more participant availability. Quantitative and qualitative data collected from the respondents were coded according to various variables and organized for computer analysis using SPSS Version 20.0. Analysis of this data included running of descriptive statistics such as frequency distribution and results are presented in tables and pie charts, while the inferential statistical analysis done used chi-square and correlational analysis.

## Results

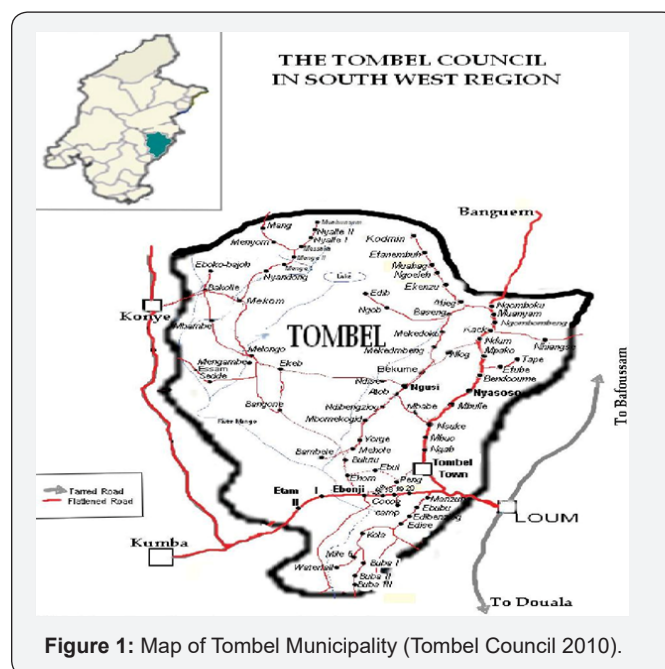


Figure 1: Map of Tombel Municipality (Tombel Council 2010).

The results of this survey have shown that the Age-class and awareness of Ebola disease is significantly related  $X^2 = 13.53$   $DF = 3$  at  $P < 0.05$  (Figures 1 & 2). The Age range with 15-25yrs has the highest knowledge 31.52% on the Ebola disease. This age group is made up of the student population which is inquisitive in acquiring knowledge from reading news reports from the media. The new knowledge acquired by this age group from reading

helps in building their career and future dreams. The age group with 46-55yrs and above 55yrs recorded the lowest awareness 11.85% and 9.09% respectively in this survey. This age group seems to be more concern with income generating activities such as business, farming and office service. The culture of reading news reports from media and text books might be reducing, for this reason their knowledge on Ebola disease from the primates bushmeat consumption is limited.

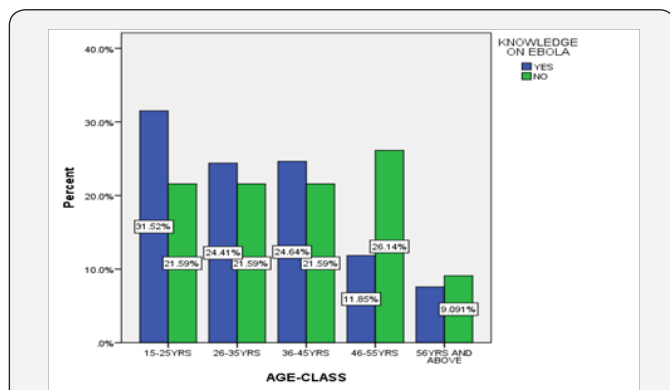


Figure 2: Age-class and the awareness of the Ebola disease.

The survey recorded a significant correlation between Gender and the Awareness of zoonotic diseases  $R^2 = 0.728$  at  $P < 0.05$  (Figure 3). The female respondents recorded the highest knowledge on the existence of zoonotic diseases from primates 53.32% while the male respondents recorded 46.68%. This knowledge difference might be because of the long standing traditional believes more deeply rooted in men than females. Most of the men might believe that their traditional inheritance from ancestral background is protecting them from becoming victims of these infections. They also say most often that the research claim and allegation that some of the human diseases descended from the monkeys is untrue. Whereas, an average Cameroonian female today might not easily share that opinion due to their stronger zeal in new knowledge acquisition and the western culture assimilation.

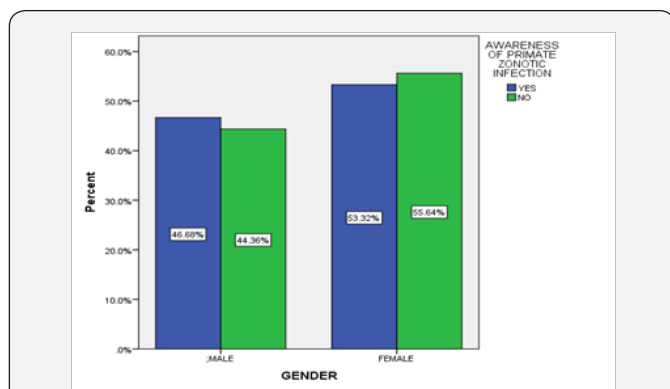


Figure 3: Gender and the awareness of zonic diseases.

The study has shown that 75.88% of the respondents consuming primates are aware that their illnesses are transmissible to humans while 24.12% are unaware (Figures

4 & 5). When some of the respondents were asked why they consume primate even as they are aware that they can contract diseases from them, they said that extreme poverty has left them with very little or no choice than to eat the monkeys as a major source of protein. Majority of those eating monkey bushmeat stated that domestic meat source such as cattle; fish, goat, horse, and pig are not often affordable. The state government has been unable to effectively subsidies the animal farming in Cameroon as some other countries in sub-Saharan Africa like Kenya, Ethiopia, Boswana and South Africa. The government subvention granted to the youths interested in animal farming also serves as an employment source and strengthen the local economy for the people. However, bushmeat hunting and butchering is a key – though not the only – mechanism by which human populations come into contact with reservoirs of disease, including Ebola virus, circulating in the wild. As the Ebola virus can remain viable in untreated carcasses for up to 3-4 days, there is a risk of transporting it to bushmeat markets (although there is no evidence of this to date). However, the risk of transmitting Ebola in bushmeat overseas to Europe or the USA is extremely low, given the total travel time and the fact that these carcasses are usually smoked (which probably inactivates the virus).

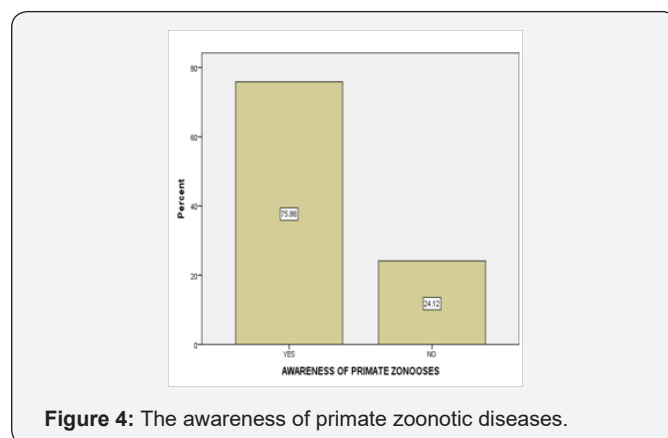


Figure 4: The awareness of primate zoonotic diseases.

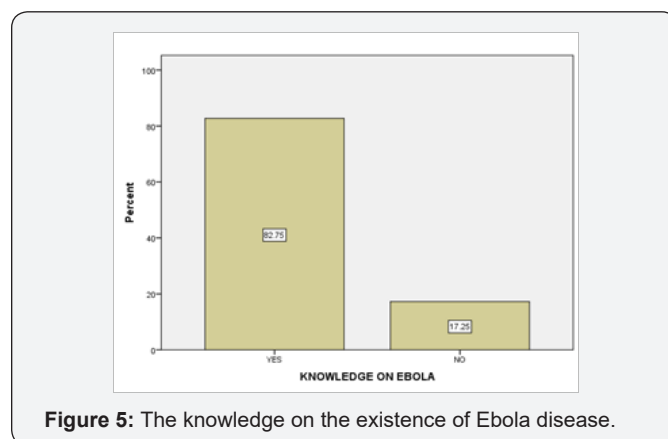
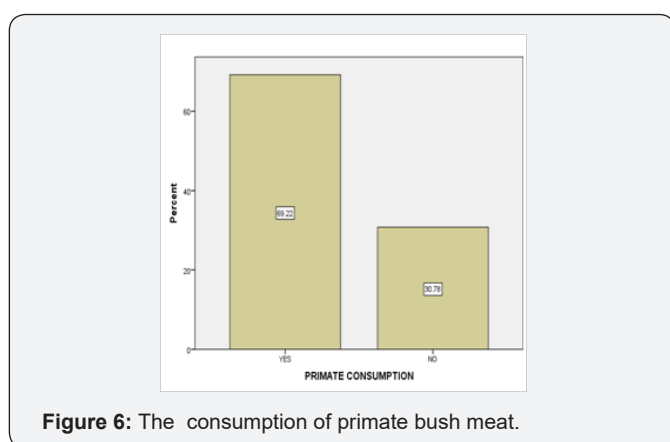


Figure 5: The knowledge on the existence of Ebola disease.

In this survey, it was discovered that 82.75% of the respondents have heard about Ebola diseases from the monkeys while 17.25% has no knowledge on the existence of Ebola. The residents of Tombel area believe that this disease cannot be

transmitted from monkey to humans, and the scientific claim that the monkey disease called Ebola can be transmitted to humans is not possible. Some would even say they have been consuming these monkey bushmeat from the time they were born and till date they have contracted no Ebola infection. While others would say that it is witchcraft which is called Ebola. They believe that Ebola exist in monkeys is defeated by the unbelief that it can be transmitted to humans. The study also discovered that some people have not heard about the existence of Ebola disease. The awareness sensitization teams sent to the cities of Cameroon to educate the local village inhabitants about this particular disease, and its transmission to humans from the monkey bushmeat consumption has not really reached the people in remote areas likely to be more vulnerable to the infection.



**Figure 6:** The consumption of primate bush meat.

About 69.22% of the respondents accepted that they consume the monkey bushmeat while 30.78% do not consume (Figure 6). The monkey bushmeat-consuming population in Tombel seems to be on the decline because the monkeys are already scarce to hunt or trap. Those who claim they do not consume the bushmeat accepted that they have been regular consumers when it was easily affordable. Secondly, the government wildlife and forest management authorities seem to be the reason for which a few people are scared of consuming the monkey bushmeat. During this study, it was discovered that almost all the conservation authorities interviewed accepted that they consume the primates but those that are not endangered and earmarked by the national government for conservation. Until the latest outbreak, more great apes (gorillas and chimpanzees) than humans were believed to have died from Ebola, and the virus is a major conservation threat to the persistence of these threatened species. While primates should not necessarily be singled-out as posing a particularly high risk of transmitting Ebola to people (28 species from 6 mammal orders, including rodents, carnivores and cetartiodactyls, have been linked to Ebola as they are known to get sick with the disease, they are likely to develop high viral loads which could threaten public health [26].

Beyond Ebola, because humans and other primates are closely-related, there is higher cross-transmission risk of

diseases in general (simian immunodeficiency virus (SIV) in chimpanzees and sooty mangabeys mutating into HIV in humans). As above, the main risk is to people who butcher and handle infected animals, especially a sick animal showing signs of disease. Loss of forest to agriculture, and other forms of development, increases human-wildlife contact and provides the potential for previously-contained zoonotic diseases to adapt to new anthropogenic environments (zoonotic spill-over when domestic animals are reared in recently-cleared areas and act as a bridging, or amplifier host, as occurred with Nipah virus emergence in Malaysia). However, increased access to intact forest (e.g. through the construction of logging roads) might present a higher risk of spill-over events [26]. To date, most Ebola outbreaks have occurred in areas with high levels of forest cover, such as Democratic Republic of Congo, Republic of Congo and Gabon, but these have been contained due to low human population densities and their remote locations. Entry of people into forest areas, particularly for high risk activities such as hunting, increases the risk of an infected person exporting the disease from the forest with resultant human-to-human transmission and, hence, outbreak detection [26].

## Discussion

Protected areas and forest zones constitute important habitats for wildlife [27,28], but this is increasingly threatened by hunting. Indeed, bushmeat remains the main source of animal proteins for people living close to forests and also contributes significantly to the diet of people living in urban areas [29]. Africa, the high human and primate population density in the area may be cause for concern, especially given findings such as those by [30] suggesting that merely entering primate habitats can facilitate zoonotic retroviral transmission. The potential for zoonotic infection may thus impact residents living near primate habitats who do not engage in practices that would be considered risky according to the "bushmeat paradigm." People living in fragment communities rely on resources collected from inside the fragment to support their subsistence livelihoods and as a buffer for economic uncertainty [31]. Therefore, the role of the forest fragment is critical for their well-being and livelihood, but may simultaneously place individuals at risk for zoonotic infections.

The results of this study revealed that the inhabitants of Tombel area do not yet seem to see any good reason for not consuming monkey bushmeat, and inherited ancestral long standing tradition. The fact that the poverty situation of these people is still not addressed by the government through the animal farming subventions and employment, hunting and trapping of the wild monkeys for bushmeat still remains a way of living and source of livelihood. Research statistics has shown that sub-Saharan Africa is rich in wildlife life. In particular, the forest regions of Central and West Africa have a high level of extraction of, and dependence on, wild meat, as alternative sources of protein are limited and there are still some relatively intact faunas which can support high levels of off take. In Asia, by

contrast, there is comparatively more marine fish available and wildlife populations are depleted in many areas [27]. In Latin America, domestic livestock and fish are more widely consumed, although the bushmeat trade is more significant than commonly assumed. The surveyed Brazzaville population appears heterogeneous and characterized by great ethnic diversity, with varied dietary habits. From that perspective, the ethnic groups all showed a great propensity for bushmeat consumption, close to 94%. In Brazzaville, bushmeat thus constitutes a significant contribution in the diet [28,29]. Bushmeat consumption was closely associated with rooted cultural values. It appears that the majority of household heads' attachment to this wildlife diet is due to the underlying links existing between the urban consumers of bushmeat and their geographic origin [32,33]. Also found that other urban populations of the Congo Basin remain attached to their traditional diet. Bushmeat consumption involved a great proportion of all religious believers. However, animist heads of household, although a minority, were the greatest consumers of bushmeat. This corroborates a previous report of [34] in Libreville.

In Cameroon, bushmeat is a source of protein and in some places like remote areas is almost replacing the domestic meat which is not always affordable. Thus, the desire to consume bushmeat is explained essentially by its organic qualities and the social habits of the consumers [28,29]. The survey showed that artiodactyls were the most preferred, followed by rodents, then primates. The lowered frequency of consumption of primates, recently observed in Brazzaville households, is probably due to respect for many dietary taboos and the occurrence of emerging diseases such as viral hemorrhagic fever (Ebola) which may affect consumers of great apes [35]. This observation suggests that the appearance of zoonotic diseases constitutes a powerful psychological brake on primate consumption. Nowadays, because of the reduction of risk of catching the disease about which there is raised awareness, reticence about primate consumption is much reduced. Consumers' concerns, except for the risk of gout, resulting from consumption of meat over a long period of time, and about other diseases (except Ebola), are linked above all to preservation and transport conditions of bushmeat not conforming to the required hygienic standards [36].

The Cameroonian population still does not seem to believe that there is transmissible link of Ebola to humans from the primates. So many people in Cameroon claim when the meat is well cooked any traces of zoonotic disease the animal carries would automatically disappear. Moreso, they still believe in keeping monkey pets in their homes to be fed with banana and other ripe fruits. In 2003, a Congolese outbreak of Ebola-Zaire killed 114 out of the 128 humans who contracted it [37]. Around the same time, 600–800 western lowland gorillas (*Gorilla g. gorilla*), encompassing two-thirds of the local population, disappeared from the nearby Lossi Gorilla Sanctuary [38]. Contact with contaminated primates constitutes a major risk of

viral infections in humans. A decrease of primate consumption has the potential to reduce the probability of such an occurrence [39]. Elsewhere, the survey showed that the survival or the persistence of dietary prohibitions or taboos might, to some extent, limit the consumption of species whose population numbers are naturally lower. It is particularly the case for the lowland gorillas and apes whose disappearance from the forests of Africa would be as much a loss for the culture as for the ecosystem [6,40]. From that perspective, in western Madagascar, taboos and strong dislikes limited the consumption of domestic pigs, bush pigs, goats, lemurs, and fruit bats [41]. However [42], reported that dietary taboos have never prevented trapping of wild animals. The role of taboos is mainly to show the place of an individual within his social group, not to protect the species concerned, which continue to be sold in markets.

Hunting at a sustainable level may prove to be an effective conservation strategy for many species. However, recent reports suggest that current sustainable rates of harvesting gorillas and chimpanzees may be just 1% and 4% respectively [20]. Therefore for primates, sustainable hunting may not be a realistic option. As a result of the diminishing natural environment it has been calculated that further losses in primate diversity could occur as soon as within the next twenty to fifty years [19]. If predictions are accurate, large, highly conspicuous, specialized, terrestrial primate species inhabiting areas prone to habitat degradation are most likely to be lost first. While religious, cultural and traditional beliefs protect certain species from hunting pressures, people's personal views and attitudes towards primates will, in addition, shape the future of their communities. However, throughout history humankind has decidedly influenced the diversity and distribution of primate species and will continue to do so for as long as the two co-exist. Ultimately it is the rate at which the human population continues to grow, combined with species-specific resilience to anthropogenic pressures that will decide the future of remaining primate populations.

### Conclusion

This study has revealed that the inhabitants of Tombel are very much into the behavior of monkey bushmeat consumption despite the fact that most of them have heard of Ebola disease outbreak in West Africa. The truth is that some people here seem not to even believe that the claim of Ebola disease transmission from the monkeys to human is possible. Others are with the opinion that the claim of Ebola disease infection from the primates is used by the wildlife conservation authorities to discourage them from bushmeat consumption, especially the monkeys which are more accessible to the hunters and trappers, since they are diurnal and are often found around the farmlands where they eat the farmers' crops. However, the subsistence farming practice in this area seems not to yield much benefit today due to the increase in living standard, secondly the academic certificates do not produce office jobs any longer, pushing these people into depending more on the rainforest resources. The unemployment

and heavy business taxes at all scales in Cameroon undoubtedly seems to be the main reason for the spiral poverty situation, and consequently the monkey bushmeat dependency even as some know very well they might not be safe from zoonotic diseases. For this to be reversed the national government of Cameroon needs to lower business taxes and even waive some. This would generate employment and would attract foreign investment in the country. The youthful population that seems to dominate wildlife hunting would reduce, hence the consumption of primates. This wildlife conservation method is the only solution and rescue to primate zoonotic disease vulnerability to the human population in Tombel and other parts of Cameroon.

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