

Wild meat consumption in urban Sierra Leone during the Covid-19 pandemic

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Abstract Wild meat is associated with an increased risk of zoonotic diseases. In some West African countries wild meat consumption declined as the result of official restrictions following Ebola outbreaks during 2013–2016, and was also affected by the current Covid-19 pandemic. In Sierra Leone, a country affected by these diseases, we documented wild meat use in four markets in the capital, Freetown. From a total of 197 interviews, we analysed the influence of age and gender on the types of wild meat eaten and the reasons for their consumption. We found that more men than women consumed wild meat, and for both genders taste was the main reason for eating wild meat. Age did not affect wild meat consumption amongst women. Evidence for changes in consumer behaviour in response to zoonotic disease risk was mixed. Although some consumers avoided wild meat because of disease risk, none stated this was the primary reason for not eating wild meat, and monkeys (presumed to carry a high zoonotic disease risk) were amongst the species cited as being consumed often. More work is needed to identify the best pathway towards safe and sustainable consumption of wild meat in urban Sierra Leone.

Keywords Age, bushmeat, Covid-19, pandemic, preferred species, Sierra Leone, urban residents, wild meat

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In sub-Saharan Africa the meat of wild animals is a crucial source of protein and nutrients for rural people (Nasi et al., 2011). It is also consumed by urban inhabitants, where it is often a luxury item and status symbol (Fa et al., 2006; Brashares et al., 2011; Wilkie et al., 2016) sold openly in markets in urban centres in West and Central Africa (Fa et al., 2019). However, the consumption of wild meat is associated with an increased risk of zoonotic diseases such as Ebola virus disease and, potentially, Covid-19 (Roche et al., 2020).

During the 2013–2016 Ebola outbreak in West Africa, governments across the region imposed a ban on hunting and the consumption of meat from wild animals as a means of controlling zoonotic diseases (WHO, 2016). Decreases in wild meat consumption during and after the Ebola outbreak were seen in some countries (Liberia: Ordaz-Németh et al., 2017; southern Nigeria: Funk et al., 2021) but possibly not others (Togo: Seytre, 2016), reflecting either increased citizen concerns about zoonotic disease risk or the direct effects of official bans (Funk et al., 2021). The arrival of Covid-19 could have led to a reduction in wild meat sales in sub-Saharan Africa (McNamara et al., 2020; Funk et al., 2022). Gaining a better understanding of what motivates the consumption of wild meat and how these motivations change during and after zoonotic disease outbreaks could help develop strategies to reduce unsustainable wildlife harvesting and improve human livelihoods and health.

Despite being one of the countries most affected by the 2013–2016 Ebola outbreak (> 12,900 cases and > 3,900 deaths as of 7 July 2015; WHO, 2021), quantitative data on wild meat consumption in urban Sierra Leone are lacking. Here we investigate the patterns of wild meat consumption by residents in Freetown, the capital city of Sierra Leone, during the Covid-19 pandemic (which has led to 7,725 cases and 125 deaths as of 21 July 2022; WHO, 2022). In Sierra Leone, under the Wildlife Conservation Act 1972, the hunting and consumption of meat from wild animals is only illegal for a limited range of protected species. Although there was no public health messaging against wild meat consumption during the Covid-19 pandemic, we hypothesize that previous public health messaging during the Ebola outbreak could have discouraged urban residents from wild meat consumption.

We conducted our study in four marketplaces in Freetown (Big Market, Congo Market, Kroo Town

Road Market and Lowcost Market) that sell wild meat and a wide range of other products. We conducted brief, face-to-face surveys of 197 market shoppers (61 men, 136 women) selected randomly whilst visiting the markets. We used semi-structured interviews based on a questionnaire that has been used previously to interview urban citizens in other West African countries (Nigeria, Togo, Burkina Faso, Côte d'Ivoire and Niger; Luiselli et al., 2018). We used this questionnaire to facilitate comparability between Freetown and the urban centres in these other countries, although we acknowledge that the questions are limited in terms of depth and only provide categorical data on consumption frequency. The aims of the questionnaire were to assess the effects of gender and age on the frequency of consumption of wild meat and domestic meat, to determine the reasons for consuming or not consuming wild meat and to record the most preferred and the most regularly consumed species (Supplementary Material 1; see Supplementary Material 2 for summarized responses).

We conducted the survey during 22 May–5 June 2021. In each market, this process involved stopping the first adult met after a given time (in minutes), with this time interval generated by a random number generator. Interviewees were informed of the aim of the study and their prior informed consent was secured verbally before proceeding. We preserved the anonymity of the respondents. FW-C conducted the interviews in the Krio language. We only interviewed people > 18 years of age. It is unlikely that responses were biased because of fear of repercussions for consuming wild meat given that only consumption of protected species is illegal (and law enforcement is limited),

we informed all interviewees that our study was not linked to any government department, and the interviewer was a student. Only 10 people of the 207 approached declined to answer the questionnaire, mostly because of time constraints rather than because of the topic.

More men than women preferred wild meat over domestic meat (57% of men and 25% of women) and consumed it more frequently (87% of men consumed wild meat and 46% ate it at least twice per month compared to 55% and 13%, respectively, for women). We related these binary responses (preference: wild vs domestic; consumption: yes vs never; regular consumption: at least twice per month vs rarely or never) to gender and age using a binomial generalized additive model with the *mgcv* package (Wood, 2017) in R 4.02 (R Core Team, 2020). This allowed non-linear relationships with age to vary by gender. Men were more likely than women to prefer wild meat ($z = 4.2$, $n = 195$, $P < 0.001$), consume wild meat ($z = 3.8$, $n = 197$, $P < 0.001$) and consume it regularly ($z = 4.7$, $n = 197$, $P < 0.001$; Fig. 1). There was a non-significant tendency for older men to be more likely to consume wild meat ($\chi^2_1 = 3.2$, $P = 0.076$; Fig. 1), but other response variables (preference, regular consumption) were not related to age for men or women ($P \geq 0.333$; Supplementary Table 1).

Respondents who consumed wild meat stated they did so because they liked the taste (women = 89%, men = 91%), because of cultural values (women = 13%, men = 9%) or its low price (women = 9%, men = 19%; note that respondents could give multiple reasons). In free discussion following the interviews, some men also highlighted that when they had an important meeting with someone they would offer wild meat to their guests, indicating the importance of

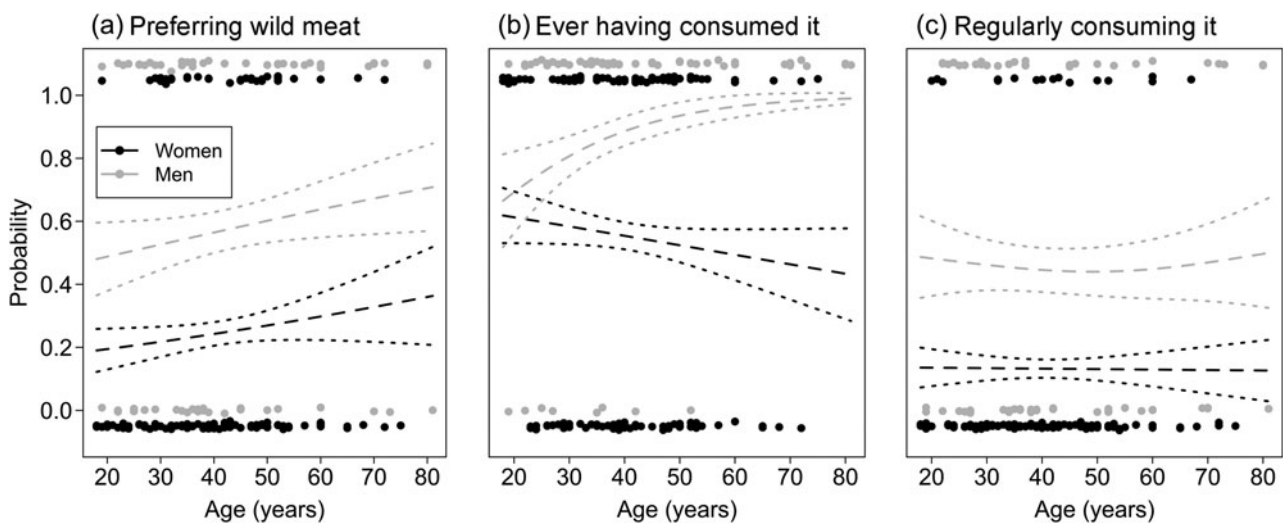


FIG. 1 Probability of marketplace interviewees from urban Sierra Leone (a) preferring wild meat to meat from domesticated animals, (b) ever having consumed wild meat (yes vs no), and (c) regularly consuming wild meat (at least twice per month vs rarely or never). Dashed lines show modelled relationships (significantly different intercepts between genders in all cases but non-significant slopes with age) and dotted lines show standard errors. Points show raw interview responses (top is positive, e.g. consumed wild meat; bottom is negative, e.g. never consumed wild meat).

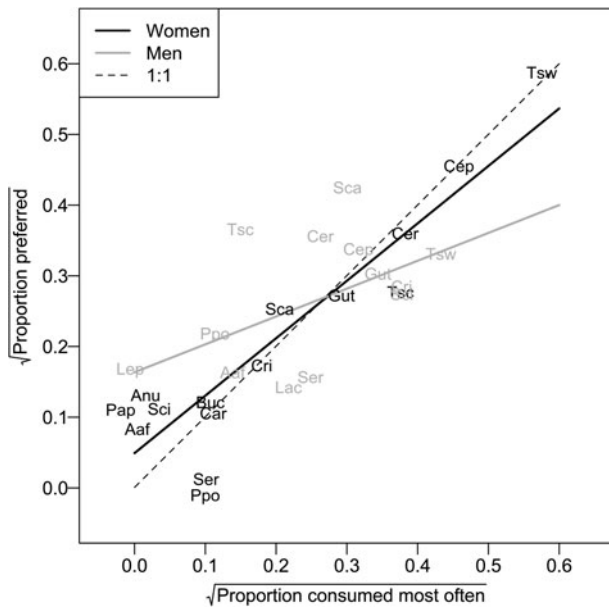


Fig. 2 Relationship between preference and consumption for the meat of wild taxa for men and women (square root transformed) interviewed in urban markets of Sierra Leone. Solid lines show relationships and the dashed line shows the expected relationship if preference and consumption were equal for each species. Note that points are jittered to avoid over-plotting. Taxa abbreviations are as follows: Aaf, *Atherurus africanus*; Anu, Anura; Buc, Bucerotidae; Car, small species of Carnivora; Cep, Cephalophini; Cer, Cercopithecidae excluding *Papio* sp.; Cri, *Cricetomys gambianus*; Gut, *Guttera pucherani*; Lac, Lacertilia; Lep, *Lepus* sp.; Pap, *Papio* sp.; Ppo, *Potamochoerus porcus*; Ser, Serpentes; Sca, *Syncerus caffer*; Sci, Sciuridae; Tsc, *Tragelaphus scriptus*; Tsw, *Thryonomys swinderianus*.

wild meat as a luxury item and status symbol. Amongst respondents who did not consume wild meat, the main reasons given for this were lack of availability (women = 56%, men = 75%), cultural values (women = 20%, men = 13%) and its high price (women = 7%, men = 38%). Although nobody cited health concerns in their initial responses, concerns about Ebola were brought up in follow-up questions (e.g. 'If there were no constraints on availability, would you eat more wild meat?') by 52% of respondents (all women) who did not consume wild meat.

Overall, 15 taxa were identified as being consumed most often (the accumulation of species with sampling effort did not reach an asymptote, indicating that some additional species would probably be identified with further sampling; Supplementary Fig. 1). The species most frequently consumed by both genders was the marsh cane rat *Thryonomys swinderianus* (women = 32%, men = 21%). For women, other species consumed often were duikers (20%), the bushbuck *Tragelaphus scriptus* (15%) and monkeys (13%), whereas for men these were squirrels (13%), the guineafowl (presumably *Guttera pucherani*; 13%) and giant pouched rat *Cricetomys gambianus* (13%). For women,

there was a close relationship between preference and consumption (regression slope = 0.81, $t = 7.1$, $df = 13$, $P < 0.001$; Fig. 2), but this relationship was weaker for men (regression slope = 0.40, $t = 2.0$, $df = 11$, $P = 0.069$; Fig. 2), who were less homogenous in their preference for taxa (Supplementary Fig. 2) and often listed preferred taxa (especially the African buffalo *Syncerus caffer*, bushbucks and the red river hog *Potamochoerus porcus*) that were not consumed frequently.

A limitation of our rapid survey approach is that the people surveyed (market shoppers) may not be representative of the wider urban population in Sierra Leone (e.g. there was a larger sample of women than men). However, as the markets primarily sold products other than wild meat, our sample is unlikely to be biased towards wild meat consumers. Our sample size (197 respondents) is small relative to the population of Freetown; however, our inferences regarding the extent of wild meat consumption were robust to subsampling the data into smaller sample sizes (Supplementary Fig. 3). We therefore consider that, although our study is preliminary, it provides statistically robust and meaningful results.

We highlight several key findings. Men were the main consumers of wild meat and taste was the main reason for consumption, agreeing with previous work in other cities in West Africa (Luiselli et al., 2018). Although social norms (e.g. wild meat as a status symbol) could have led to men exaggerating their frequency of wild meat consumption relative to women, they were also more likely to state that they preferred or had ever consumed wild meat. We found two main differences compared with other cities in West Africa (Luiselli et al., 2018): (1) in Freetown, 46% of men interviewed said that they consumed wild meat often, which is much higher than in other West African cities; and (2) age did not affect wild meat consumption amongst women, whereas in other cities younger people eat less wild meat. The frequent consumption of marsh cane rats, giant pouched rats and squirrels is consistent with findings from other studies in West Africa (Cowlshaw et al., 2005; Bene et al., 2013; Gonedel  et al., 2017), although duikers were also consumed frequently in south-eastern Cote d'Ivoire (Gonedel  et al., 2017). Differences in the amount and the species of wild meat consumed between cities are likely to be affected by the habitat types surrounding each city. For example, consumption of monkeys and bushbucks in Freetown is notable, as these species are often depleted in agricultural landscapes (Cowlshaw et al., 2005). The proximity to the c. 51,800 ha Western Area Peninsula Forest National Park could explain the availability of such slow-reproducing animals in the Freetown markets.

In a health-orientated study in Sierra Leone (1,413 respondents from 9 of 14 districts), 52% of the respondents suggested that eating wild meat could be related to Ebola virus disease (Jalloh et al., 2017). However, it has also been

found that wild meat hunting proscriptions accompanied by public health messages emphasizing the infectious potential of wild meat contradicted the experiences of the target populations in rural Sierra Leone, who consumed wild meat frequently without incident (Bonwitt et al., 2018). Our study also suggests that most of the urban residents we interviewed consumed wild meat, including disease-associated species such as monkeys, although bats were not mentioned as being consumed. Some respondents mentioned disease risk as a contributing factor for why they did not consume wild meat, but this was not the case for most of our respondents.

Wild meat consumption is a sensitive issue, and establishing approaches that allow people dependent on wild meat to continue extracting wild species for food at the same time as protecting them from disease remains challenging. The West African Ebola outbreak polarized the debate over the significance of bans as a public health measure (Pooley et al., 2015) and refocused attention on top-down land and resource management. New strategies of working with consumer communities will help reach groups who are not concerned about disease risk. An iterative process that brings together multiple actors (including urban residents), such as the ‘science with society’ participative approach (Steger et al., 2021), could help us to identify the best path towards safe and sustainable consumption of wild meat.

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Conflicts of interest None.

Ethical standards We followed the principle of free, prior and informed consent (provided verbally by participants) and the guidelines on ethical research of the British Sociological Association (2017). All research abided by the *Oryx* guidelines on ethical standards and was approved following ethical review by Manchester Metropolitan University (project ID 31424).

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