

OPINION EDITORIAL

The Interplay between Cultural Practices, Food Insecurity, and Poverty in the Consumption of Wild Meat

Toby Le, University of Manitoba; Kristina Dunkley, University of Manitoba

INTRODUCTION

Zoonotic diseases are a global health threat that have caused billions of dollars in economic damage [1]. The Centers for Disease Control and Prevention, defines zoonotic diseases as infections that can spill over from animals to humans (Figure 1) [2]. Worldwide, zoonotic diseases are believed to account for 2.7 million deaths and 2.5 billion cases of human illness a year [3]. For the past 70 years, over 60% of infectious diseases faced by humanity have been caused by pathogens of zoonotic origins, the most recent being SARS-CoV-2 [1,4]

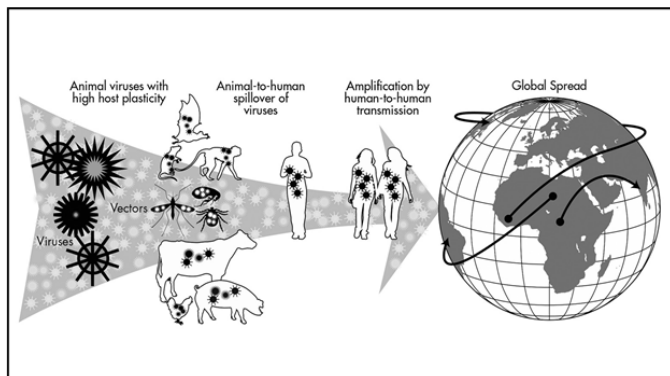


Figure 1. Spillover of Zoonotic Disease from Wild Animals to Human Host. Adopted from Kreuder Johnson et al., 2015 [5].

Unfortunately, SARS-CoV-2 will not be the last zoonotic pathogen to harm humanity. In 2018, Carrol et al. [4] estimated that there are at least 1.67 million unknown viruses harbored by animal hosts, 37-50% of which are expected to have zoonotic potential (Figure 2) [4]. One of the major risk factors

for zoonotic spillover is the consumption of wild animals, also known as wild meat [6]. Wild meat alone has accounted for several zoonotic spillovers that have given rise to multiple highly profiled pathogens that including HIV, ebolavirus, Simian T-lymphotropic virus 1, and anthrax [7,8]. Despite its negative implications, the consumption of wild animals has remained a common practice globally. In this commentary, we aim to provide a brief overview on the utilities of wild meat for human subsistence and key issues that must be addressed to reduce the consumption of wild meat.

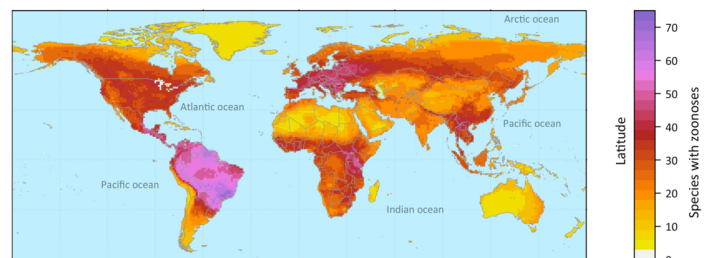


Figure 2. Geographical Distribution of Zoonotic Wild Animals. This map highlights the zoonotic potential of 5007 wild animal species from 27 orders. Adapted from Han, Kramer, & Drake, 2016 [9].

WILD MEAT AND FOOD SECURITY

In low-and-middle-income-countries (LMIC), wild meat is a vital source of protein and is protective against food insecurity [10]. In West and Central African countries, wild meat can account for up to 90% of animal protein consumption [11]. Many communities also depend on wild meat because of its abundance of micronutrients. One modelling study found the absence of wild meat to be

associated with a 29% increase in cases of anemia among children in Madagascar [12]. In the same study, researchers found children from the poorest households had three times the risk for anemia compared to those from middle and high-income households [12]. Such findings indicate the importance of wild meat within low-income settings and their significance in alleviating food insecurity.

FINANCIAL SECURITY AND INCENTIVES

Not only is wild meat important for food security, but it is also a source of income. Wild meat can be a source of immediate income when households face unemployment, crop failure, and other financial hardships. When agricultural production is low, many rural households rely on selling wild meat as a 'safety net' to remain financially afloat [13,14]. Some households even use wild meat as a buffer to raise their domestic livestock for higher returns [15,16]. In some instances, such as in Equatorial Guinea where more 50% of men depend on hunting wild meat as the main source of income [17].

Wild meat has grown to be a large market globally. In China, the wild meat industry employs millions and is estimated to be valued at US \$7.1 billion [18]. There are several favourable characteristics of wild meat that contribute to its profitability as a sector. In particular, wild meat has a high price-to-volume ratio and can easily be preserved through smoking or salting [19,20]. Through the establishment of commodity chains (i.e. supply, producers/hunters, wholesalers, retailers, and market demand), transportation of wild meat has also become more accessible, enabling rural hunters to generate income at distant markets at reduced transportation cost [21–23].

ALTERNATIVE OPTIONS

Overall, wild meat has become an important tool for addressing food and financial insecurities in low-resource settings. To reduce the consumption of wild meat, it is imperative that these communities

be provided with alternative venues that can ensure their food and financial securities.

An initiative that has been proposed to address these combined issues is small-scale sustainable farming. An example of this would be 'family poultry', which are small-scale poultry systems that are managed by local families [24]. Family poultry is suggested to have important benefits for poor communities due to the affordability of chickens in LMIC and their associated nutritional values. In a report by Aklilu et al. [25], farmers from Ethiopia shared an expression that "Poultry are the seeds you sow to get the fruits, cattle". This expression is a reference to how poultry is a last source of capital for poor households to overcome poverty. In family poultry, poor households can maintain a steady source of income from selling eggs as long as they can sustain regular production cycles. Eggs are also one of the most affordable animal sources for several nutrients, including proteins, fatty acids, Vitamin A, selenium, Vitamin B12 and more [26]. Other similar approaches include small-scale pig farming, pulse/legumes farming, and grass cutter farms [27–30].

CULTURAL SIGNIFICANCE

In some cultures, wild meat can also be recognized as a prestigious commodity or a symbol of social status [10]. In the Republic of Congo, wild meat is regarded as an exclusive luxury food item, as it is perceived as a natural, pure, organic and fresh [31]. Since wild meat is viewed as a rarity, it is customarily consumed at special occasions [31]. The perception of wild meat as a status symbol bestows a special status to those who can afford to provide or consume wild meat [31]. These cultural practices are also observed in China, where the consumption of wild meat is associated with elite status [23].

In a 2014 survey, over 80% of respondents from Guangzhou province reported consuming wild meat in the past year [32]. To counter the cultural perception and value of wild meat, researchers have suggested public health education around risk awareness of wild meat as potential measure.

RISK AWARENESS AND EDUCATION

Researchers found that individuals in rural, central Africa who recognized the disease risk of wild meat were less likely to butcher wild animals than individuals who did not perceive the associated risks [33]. However, this risk perception did not translate to reduced consumption and hunting of wild meat. Authors of the study speculated that this discrepancy could be attributed to individuals acting on their perception of what activities constituted as high-risk (i.e. butchering wild meat) versus low-risk (i.e. wild meat consumption, hunting) [33]. Consistently, another study also found risk perception of bat wild meat to be higher among groups who did not consume or hunt wild meat, compared to those who did [34]. Based on these associations, health-risk education might be an effective approach to mitigating wild meat consumption, which empowers communities with the basic knowledge of zoonotic infections in wild meat consumption. With that in mind, these ideas require further research that considers the complex incentives that contribute to the consumption of wild meat in different populations.

CONCLUSION

Despite the associated risk of zoonotic infections, wild meat is essential for addressing food and financial insecurity in LMIC and is an important aspect of cultural practices in many countries. To ban the consumption of wild meat is to neglect its role in cultural practices and its utilities among populations facing food insecurity and poverty. Governments and public health figures need to consider the contextual importance of wild meat in different settings and to recognize that there is no one-size-fits-all solution for reducing the consumption of wild meat.

ACKNOWLEDGEMENTS

Thank you to Dr. Jason Kindrachuk for always sharing his knowledge and passion for emerging infectious diseases and feedback on this article.

REFERENCES

1. Karesh WB, Dobson A, Lloyd-Smith JO, Lubroth J, Dixon MA, Bennett M, et al. Ecology of zoonoses: Natural and unnatural histories. Vol. 380, *The Lancet*. Lancet Publishing Group; 2012. p. 1936–45.
2. Centers for Disease Control. Zoonotic Diseases | One Health | CDC [Internet]. *One Health*. 2017. Available from: <https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html>
3. Gebreyes WA, Dupouy-Camet J, Newport MJ, Oliveira CJB, Schlesinger LS, Saif YM, et al. The Global One Health Paradigm: Challenges and Opportunities for Tackling Infectious Diseases at the Human, Animal, and Environment Interface in Low-Resource Settings. Bethony JM, editor. *PLoS Negl Trop Dis*. 2014 Nov;8(11):e3257.
4. Carroll D, Daszak P, Wolfe ND, Gao GF, Morel CM, Morzaria S, et al. The Global Virome Project. *Science* (80-). 2018;359(6378):872–4.
5. Kreuder Johnson C, Hitchens PL, Smiley Evans T, Goldstein T, Thomas K, Clements A, et al. Spillover and pandemic properties of zoonotic viruses with high host plasticity. *Sci Rep* [Internet]. 2015 Oct 7 [cited 2021 Jan 31];5(1):14830. Available from: www.nature.com/scientificreports
6. Milner-Gulland EJ, Bennett EL, Abernethy K, Bakarr M, Bennett EL, Bodmer R, et al. Wild meat: The bigger picture. Vol. 18, *Trends in Ecology and Evolution*. Elsevier Ltd; 2003. p. 351–7.
7. Kurpiers LA, Schulte-Herbrüggen B, Ejotre I, Reeder DAM. Bushmeat and emerging infectious diseases: Lessons from Africa. In: *Problematic Wildlife: A Cross-Disciplinary Approach*. 2015.
8. Mossoun A, Calvignac-Spencer S, Anoh AE, Pauly MS, Driscoll DA, Michel AO, et al. Bushmeat Hunting and Zoonotic Transmission of Simian T-Lymphotropic Virus 1 in Tropical West and Central Africa. *J Virol*. 2017 May;91(10).
9. Han BA, Kramer AM, Drake JM. Global Patterns of Zoonotic Disease in Mammals [Internet]. Vol. 32, *Trends in Parasitology*. Elsevier Ltd; 2016 [cited 2021 Jan 31]. p. 565–77. Available from: [/pmc/articles/PMC4921293/?report=abstract](https://pmc/articles/PMC4921293/?report=abstract)
10. Brashares JS, Golden CD, Weinbaum KZ, Barrett CB, Okello G, Environ V. Economic and geographic drivers of wildlife consumption in rural Africa. *Proc Natl Acad Sci U S A*. 2011 Aug;108(34):13931–6.
11. Fa JE, Currie D, Meeuwig J. Bushmeat and food security in the Congo Basin: Linkages between wildlife and people's future. *Conserv*. 2003;30(1):71–8.
12. Golden CD, Fernald LCH, Brashares JS, Rasolofoniaina BJR, Kremen C. Benefits of wildlife consumption to child nutrition in a biodiversity hotspot. *Proc Natl Acad Sci U S A*. 2011;108(49):19653–6.

13. De Merode E, Homewood K, Cowlshaw G. The value of bushmeat and other wild foods to rural households living in extreme poverty in Democratic Republic of Congo. *Biol Conserv*. 2004;118(5):573–81.
14. Allebone-Webb SM. Evaluating dependence on wildlife products in rural Equatorial Guinea [Internet]. PhD Thesis. 2009. Available from: <http://scholar.google.com/scholar?hl=en&btnC=Search&q=intitle:Evaluating+dependence+on+wildlif e+products+in+rural+equatorial+guinea#0>
15. Nasi R, Taber A, Van Vliet N. Empty forests, empty stomachs? Bushmeat and livelihoods in the Congo and Amazon Basins. *Int For Rev*. 2011;13(3):355.
16. Altrichter M. Wildlife in the life of local people of the semi-arid Argentine Chaco. *Biodivers Conserv*. 2006;15(8):2719–36.
17. Kümpel NF, Milner-Gulland EJ, Cowlshaw G, Rowcliffe JM. Incentives for hunting: The role of bushmeat in the household economy in rural equatorial guinea. *Hum Ecol* [Internet]. 2010 Apr 16 [cited 2021 May 28];38(2):251–64. Available from: <https://link.springer.com/article/10.1007/s10745-010-9316-4>
18. Mallapaty S. China set to clamp down permanently on wildlife trade in wake of coronavirus. *Nature* [Internet]. 2020 Feb; Available from: <https://www.nature.com/articles/d41586-020-00499-2>
19. Ajayi SS. *Wildlife Conservation in Africa: A scientific approach*. Wildlife Conservation in Africa: A Scientific Approach. Elsevier; 2019. 1–274.
20. Schulte-Herbrüggen B. The importance of bushmeat in the livelihoods of cocoa farmers living in a wildlife depleted farm-forest landscape, SW Ghana. *Dep Anthropol Univ Coll London*. 2011;degree of(May):1–296.
21. Edderaï D, Dame M. Short Communication A census of the commercial bushmeat market in Yaoundé, Cameroon. *ORYX*. 2006;40(4):472–5.
22. De Merode E, Cowlshaw G. Species Protection, the Changing Informal Economy, and the Politics of Access to the Bushmeat Trade in the Democratic Republic of Congo. *Conserv Biol*. 2006 Mar;20(4):1262–71.
23. Volpato G, Fontefrancesco MF, Gruppuso P, Zocchi DM, Pieroni A. Baby pangolins on my plate: Possible lessons to learn from the COVID-19 pandemic. Vol. 16, *Journal of Ethnobiology and Ethnomedicine*. 2020.
24. FAO. Decision tools for family poultry development. *FAO Animal Production and Health Guidelines* [Internet]. Vol. 16, *FAO Animal Production and Health Guidelines*. 2014 [cited 2021 May 15]. Available from: <http://www.fao.org/publications/card/en/c/577e4e7b-3741-572c-a37e-0de393280445/>
25. Aklilu HA, Udo HMJ, Almekinders CJM, Van der Zijpp AJ. How resource poor households value and access poultry: Village poultry keeping in Tigray, Ethiopia. *Agric Syst*. 2008 Mar 1;96(1–3):175–83.
26. Drewnowski A. The nutrient rich foods index helps to identify healthy, affordable foods. *Am J Clin Nutr* [Internet]. 2010 Apr 1 [cited 2021 May 18];91(4). Available from: <https://pubmed.ncbi.nlm.nih.gov/20181811/>
27. Haldar A, Das D, Saha B, Pal P, Das S, Das A, et al. Smallholder Pig Farming for Rural Livelihoods and Food Security in North East India. *J Anim Res*. 2017;7(3):471.
28. Iriti M, Varoni EM. Pulses, healthy, and sustainable food sources for feeding the planet [Internet]. Vol. 18, *International Journal of Molecular Sciences*. MDPI AG; 2017 [cited 2021 May 20]. Available from: </pmc/articles/PMC5343791/>
29. Global Pulse Confederation. 10-YEAR RESEARCH STRATEGY FOR PULSE CROPS [Internet]. 2016 [cited 2021 May 20]. Available from: www.emergingag.com
30. Menz A. A Means to Alleviate the Bushmeat Crisis? The Feasibility of Establishing Sustainable Grasscutter Farms in Kenya. *Cons J Sustain Dev* [Internet]. 2014 [cited 2021 May 20];13(1):130–64. Available from: <https://academiccommons.columbia.edu/doi/10.7916/D8DF6QX9>
31. Chausson AM, Rowcliffe JM, Escoufflaire L, Wieland M, Wright JH. Understanding the Sociocultural Drivers of Urban Bushmeat Consumption for Behavior Change Interventions in Pointe Noire, Republic of Congo. *Hum Ecol*. 2019 Mar;47(2):179–91.
32. Zhang L, Yin F. Wildlife consumption and conservation awareness in China: A long way to go. *Biodivers Conserv*. 2014;23(9):2371–81.
33. LeBreton M, Prosser AT, Tamoufe U, Sateren W, Mpoudi-Ngole E, Diffo JLD, et al. Patterns of bushmeat hunting and perceptions of disease risk among central African communities. *Anim Conserv* [Internet]. 2006 Nov 1 [cited 2021 May 20];9(4):357–63. Available from: <https://zslpublications.onlinelibrary.wiley.com/doi/full/10.1111/j.1469-1795.2006.00030.x>
34. Kamins AO, Rowcliffe JM, Ntiemoa-Baidu Y, Cunningham AA, Wood JLN, Restif O. Characteristics and Risk Perceptions of Ghanaians Potentially Exposed to Bat-Borne Zoonoses through Bushmeat. *Ecohealth* [Internet]. 2015 Mar 1 [cited 2021 May 20];12(1):104–20. Available from: </pmc/articles/PMC4416116/>
35. Kindrachuk J. A Virologist Explains Why It Is Unlikely COVID-19 Escaped From A Lab [Internet]. *Forbes*. 2020. Available from: <https://www.forbes.com/sites/coronavirusfrontlines/2020/04/17/a-virologist-explains-why-it-is-unlikely-covid-19-escaped-from-a-lab/?sh=73a8985d3042>