



## SHORT COMMUNICATION

## HUNTING BATS FOR BUSHMEAT DESPITE NIPAH CONCERNS IN IDUKKI, KERALA, INDIA

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### INTRODUCTION

The consumption of bushmeat affects both wildlife conservation and human well-being, where the challenges include depletion of threatened and endangered species (Milner-Gulland et al. 2003), as well as the transmission of zoonotic diseases (Daszak et al. 2000, Wolfe et al. 2005, Chua et al. 2007, Simons et al. 2014). In recent times, bats have been suspected as one among the hosts of zoonotic viruses such as Marburg virus (Martina and Osterhous 2009), Hendra virus (Clayton et al. 2013), Middle East respiratory syndrome Corona virus (Ithete et al. 2013) and Nipah virus (Luby 2013). The viral infections are suspected to occur during the hunting and butchering processes potentially through the body tissues and fluids (Leroy et al. 2009). Nipah virus, belonging to the family Paramyxoviridae was detected in India during the zoonotic outbreak in the summer 2018. It is nominated as a 'Category C' pathogen by the US National Institute of Allergy and Infectious Diseases and classified as a 'Bio-safety Level 4' pathogen with a high fatality rate (Lam et al. 2017). Fruit bats belonging to the genus *Pteropus* are being considered to be the natural host of Nipah virus (Chua et al. 1999, Thanapongatharm et al. 2014).

The recent Nipah outbreak in Kerala, India is in fact a re-occurrence after two decades, since its first outbreak was reported in Siliguri, West Bengal during January 2001. Forty-five people died during that first outbreak. The second outbreak occurred in 2007 in Nadia district of West

Bengal, India causing five deaths (WHO 2012). The third outbreak, during May 2018, at Kozhikode district of Kerala, India killed 17 individuals (WHO 2018). Finally, the fourth Nipah outbreak in Kerala happened in June 2019 and affected about five people. Fortunately prompt medical surveillance has saved their lives. It is believed that these infections occurred through direct or indirect contact of humans with virus-carrying pteropodid bats (Chattu et al. 2018). Bats as a bushmeat may be one of the reasons behind the infection by this virus, where there is a high chance of direct transmission through their body fluids (Hossain et al. 2013, Yu et al. 2018).

The frequent consumption of bat bushmeat has been reported in Idukki district, Kerala, in Kuthumkal cave which once served as the roost for many thousands of Indian fruit bats, *Rousettus leschenaulti*. Currently, however, only a few hundred individuals remain due to frequent cave vandalism and killing of bats for bushmeat consumption (Mahandran & Nathan 2014). Accordingly the broad aim of this study has been to understand and evaluate if the perception of local people of Idukki on bats as bushmeat has changed after the recent Nipah outbreak in Kerala, as a measure to derive strategies to control further outbreaks.

### METHODS

This study was carried out in Idukki district after the third spell of post-Nipah outbreak in May 2018. Face-to-face interviews were conducted using a standard



questionnaire in the local language, Malayalam. From the Idukki district, a total of 180 people were sampled, which comprised equal number of male and female participants belonging to three age groups, viz. 18–24, 25–49 and >50 ( $n = 30$  each for both genders). Interviewees were conducted in gathering places such as health centres, ration shops, tea shops and toddy shops. Interviews were conducted using the method of Nuno and John (2015). This meant that we started our interview with the first adult (>18 years) we met after a given time period in minutes, with the time interval generated by a random number generator. Interviewees were informed of the aims of this study and we then obtained their verbal consent before proceeding. Their identity remains anonymous to ensure their privacy.

The following questions were asked in the questionnaire-survey:

- (i) Have you ever had bat bushmeat (pre-Nipah outbreak, i.e. May 2018)?
- (ii) Do you still continue to have bat bushmeat (post-Nipah outbreak)?
- (iii) If 'Yes'; what is the reason for consuming bat bushmeat?
- (iv) If 'No'; what is the reason for not consuming bat bushmeat?

After data collection, a McNemar's change test was used to compare the difference in the perception of local people towards bushmeat consumption between the pre-Nipah outbreak period and post-Nipah outbreak period. A Mann–Whitney's U-test assuming a  $z$  distribution was used to compare the gender-based differences. The statistical analyses and graphing were performed using IBM SPSS ver.22.0 statistics package (SPSS Inc., Chicago, IL, USA) and OriginPro ver.2020b (OriginLab Corporation, Northampton, MA 01060, USA), respectively.

## RESULTS

This study shows that the recent Nipah outbreak has had no significant impact on the perception of local people towards the consumption of bat bushmeat. Few differences were found between the number of bushmeat consumers of pre-Nipah and post-Nipah outbreak periods, respectively, for either gender (i.e. males: 28.88% vs.

24.44%;  $p = 0.125$ , females: 13.33% vs. 10.00%;  $p = 0.250$ ) (Table 1). Similarly, the effect of age on bushmeat consumption among the three age groups of both the genders before and after the Nipah outbreak showed no significant differences (males: 18–24:  $p = 0.500$ , 25–49:  $p = 0.500$ , >50:  $p = 1.00$  and females: 18–24:  $p = 1.00$ , 25–49:  $p = 0.500$ , >50:  $p = 1.00$ ) (Fig. 1). From these results, it is also understood that adults (25- to 49-year group) eat bushmeat more often than the young (18- to 24-year group) and elderly (>50 age group) age-groups. However, none among the elderly people (>50-year group) gave up bushmeat consumption even after the Nipah outbreak. Furthermore, females ate bat bushmeat less often than did males but this difference was statistically non-significant ( $z = 0.0157$ ;  $p = 0.492$ ).

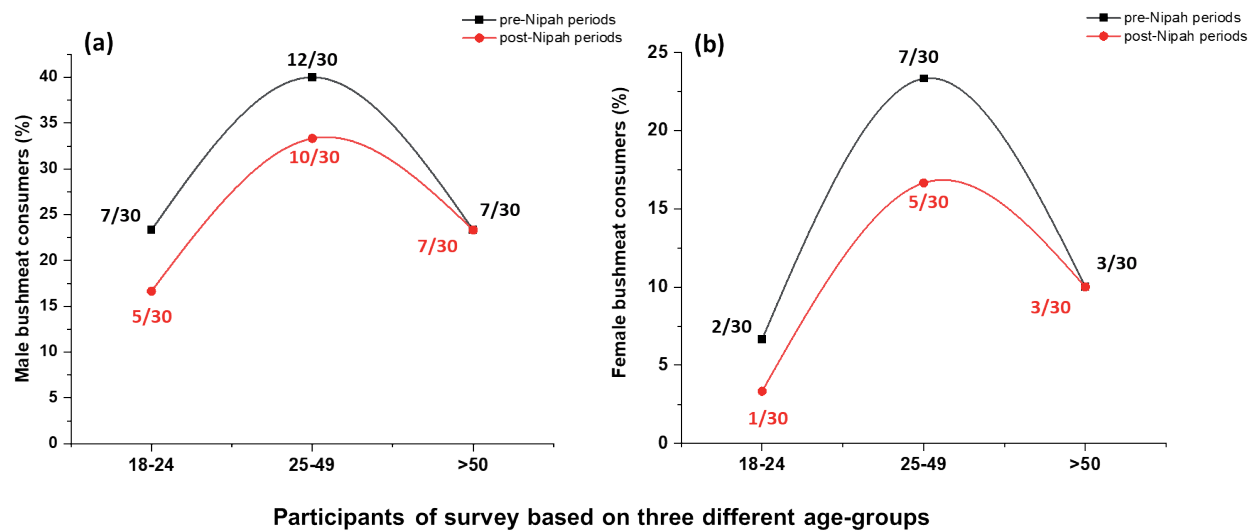
It is further evident that a major proportion of the local people ( $n = 149$ ; 82.77%) does not consume bat bushmeat. From our survey, 71.11% people believe that it is risky to consume bats as they are known to carry viruses, whereas 11.66% people believe that bats provide essential ecosystem services and it is essential for humans to coexist with nature. On the contrary, a sixth of the local population ( $n = 31$ ; 17.22%) often consume bat bushmeat. Ten percent overall believe that bat bushmeat is good for health and/or that it can cure illnesses such as prolonged asthma and breathing difficulties. (Some of the elderly cohort, aged above 80, were consuming it once a fortnight). 7.22% of the survey group believe that bats are pests, because they steal/damage commercial crops, such as cashew nuts, coffee seeds, gamboge, jackfruit and mangoes resulting in economic loss for them (Fig. 2).

Despite back-to back Nipah outbreaks, hunting bats for bushmeat is still practiced in the Idukki district of Kerala. Here, bat bushmeat consumption is mostly practiced either as recreational hunting and/or with recreational toddy parties. Local people used to hunt canopy roosting bats (*Pteropus giganteus*) with country-made guns and cave-dwelling bats (*Rousettus leschenaulti*) using thorny/spiny branches of trees (e.g. Genus: *Erythrina*, *Ziziphus*, *Prosopis*) by blocking the cave entrances. Groups of bats captured in this manner were killed, skinned, and seasoned with spices before being roasted for consumption (Fig. 3).

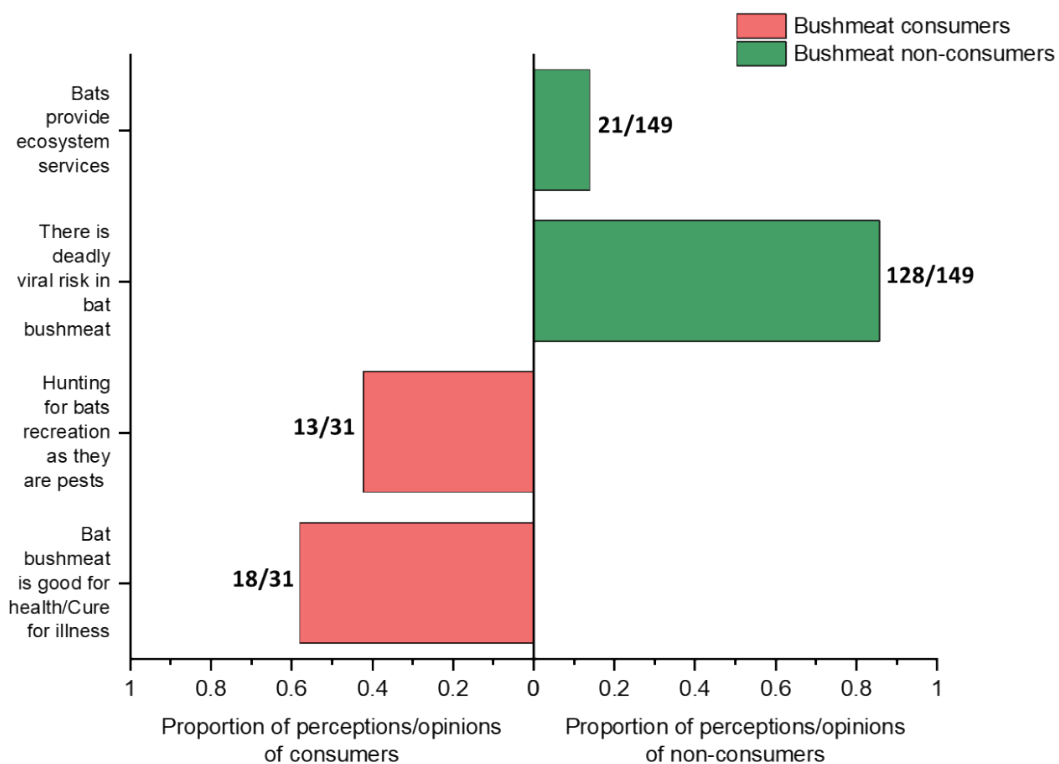
**Table 1.** Gender-based difference in the bushmeat consumption during pre-Nipah and post-Nipah outbreak periods

	Males		Females	
	Consumers	Non-consumers	Consumers	Non-consumers
Pre-Nipah outbreak	26 (28.88)	64 (71.12)	12 (13.33)	78 (86.67)
Post-Nipah outbreak	22 (24.44)	68 (75.57)	09 (10.00)	81 (90.00)

The values given in parentheses are represented in percentages.



**Figure 1.** Age-based differences in the proportion of bat bushmeat consumers, (a) males and (b) females, during pre-Nipah and post-Nipah outbreak periods.



**Figure 2.** Perception of bushmeat consumers and non-consumers on bats, ecosystem services and zoonotic viruses.





**Figure 3.** Local people engaged in hunting and cooking of bat bushmeat (a, b: *Pteropus giganteus*, c, d: *Rousettus leschenaulti*, e: bushmeat preparation).

## DISCUSSION

Wild bat populations are vulnerable to a multitude of stress factors including environmental (seasonal fluctuations in food availability and climatic variations) and anthropogenic disturbances (Kessler et al. 2018, Banerjee 2020). Activities such as hunting bushmeat for consumption and roost vandalism raise serious concerns for the risk of zoonotic virus spill-overs and further human disease outbreaks. It is also apparent that by disturbing and/or distressing bats their immune system may be weakened, leading to viral infection (Olival et al. 2017, Plowright et al. 2017). Bats usually urinate and defecate under stress (such as being captured; personal observation, Mahandran et al. 2016), which may lead to viral spillover into humans (World Organization for Animal Health 2013, Chattu et al. 2018). We suggest that the risk of Nipah infection in people can be avoided through awareness programmes and by educating people about the measures that can be taken to reduce exposure to the virus.

From this study, we estimate that about a sixth of the local population (Idukki, Kerala) has the habit of hunting bats for bushmeat, which could result in further decline of local bat populations. The reasons for this practise as stated by bushmeat consumers seem to be driven by misconceptions. Accordingly we suggest and advocate outreach programmes to increase awareness about the ecosystem services provided by fruit bats in terms of pollination and seed dispersal of many economically important plants (Nathan et al. 2009, Mahandran et al. 2018), and by insectivorous bats in terms of pest control (Kunz et al. 2011). Bats also serve as food for animals at higher trophic levels such as hawks and kites (Kasso & Balakrishnan 2013, Rathinakumar et al. 2017).

Globally, about 528 plant species of plants are known to be dependent on bats for their pollination (Fleming et al. 2009), and about 300 for seed dispersal (Corlett 2009). Anthropogenic activities such as deforestation, hunting and bushmeat consumption, however, are affecting bat populations across the globe (Jones et al. 2009). In certain pockets of southern India, faith-based conservation practices associated with sacred caves and groves are effectively practiced and add value for bat conservation (Mahandran et al. 2015). As much as almost half of all bat species are facing threats. Perhaps 40% of them are predicted to be extinct by the end of this century if current deforestation rates persist (Kingston 2010). This would have major flow-on impacts within ecosystems. We suggest that, next to deforestation, bushmeat trade and consumption have a significant impact on global bat populations. People across many regions of the World have ancient but persisting traditions of eating bats (Mickleburgh et al. 2009).

In India, fruit bats are listed in 'Schedule V' of the 'Wildlife Protection Act of 1972', and receive no statutory protection as they are listed as 'vermin' (Singaravelan et al. 2009). It is high time this 'vermin' status of fruit bats is lifted and they are provided with legitimate protection. If so protected we would hope bushmeat consumption and roost vandalism would diminish and the risk of further zoonotic transmissions would be reduced.

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