



# **BUSHMEAT**

## **THE HIDDEN DANGERS**



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## INTRODUCTION

The discovery of agriculture, more than 10,000 years ago, which included domestication of animals and augmented food supply, reduced the need for hunting animals as food. It marked the transition from a hunting and gathering society to a farming society. Agriculture also introduced plant foods like pulses which could supply proteins required by the human body. Despite this, bushmeat is still an important source of food and income among rural communities (**Brashares *et al.* 2011**).

The term 'bushmeat' refers to meat derived from wild animals for human consumption (**Milner-Gulland and Bennett 2003**). It includes a wide range of animals, such as invertebrates, amphibians, insects, fish, reptiles, birds and mammals (**Ape Alliance, 2006**). Humans have hunted wild animals for consumption and to protect their crops for millennia (**Davies *et al.* 2007**). In North-East India, consumption of bushmeat is intricately linked with their local cultural traits, and ethnographic studies of local hunting practices have demonstrated the rich traditional knowledge of communities about the species they hunt (**Lohe 20014; Tynsong *et al.*, 2009**). In Meghalaya, some of the animals consumed as meat are wild boar, porcupine, deer, monkey/gibbon, wild birds, wild goat, wild cow/cattle, bear, tiger, fox, elephant, rabbit, rat and monitor lizard. However, the continued harvesting of bushmeat carries great dangers with it.

Although research has focused largely on mammals and, to a lesser extent, birds, theoretically any wildlife species harvested for bushmeat could be a potential source of a zoonotic disease that can spillover during hunting, butchering and preparation processes (**Wolfe *et al.* 2000; Karesh and Noble 2009**). The highest risk of disease transmission occurs during the butchering of animals; e.g. skinning, opening body cavities, removal of organs and cutting meat. Women are more likely to be at risk of disease transmission as they engage in butchering and in food preparation more than men do. Emerging infectious diseases (EIDs) are human diseases that are either newly discovered or are increasing in incidence or geographical range. Of 75% of EIDs in humans are of zoonotic origin, which means the pathogens originate in animals and are then transmitted to humans (**Taylor *et al.* 2001; Jones *et al.* 2008; Karnesh and Noble 2009**).

## IMPORTANT ZONOTIC DISEASES

**Hepatitis E:** It is caused by the *Hepatitis E virus* (HEV). HEV is transmitted primarily by the fecal-oral route through contaminated drinking water. It has been epidemiologically linked to eating undercooked pork liver of wild boar meat (**Yakazi et al. 2003; Matsuda et al. 2003**). Symptoms include jaundice, lack of appetite and nausea. In rare cases, it may progress to acute liver failure. Every year, there are an estimated 20 million HEV infections worldwide, leading to an estimated 3.3 million symptomatic cases of hepatitis E (**Rein et al. 2015**). WHO estimates that hepatitis E caused approximately 44000 deaths in 2015 (accounting for 3.3% of the mortality due to viral hepatitis.)

**Swine influenza:** It is caused by the swine influenza virus. Human infections are primarily acquired through direct contact with infected wild boars or contaminated environments. Symptoms include fever and cough, early sputum production and rapid progression to pneumonia, sepsis with shock, acute respiratory distress syndrome and even death. Conjunctivitis, gastrointestinal symptoms, encephalitis and encephalopathy have also been reported to varying degrees depending on the subtype. In 2013, human infections with the virus were reported for the first time in China. Since then, the virus has spread in poultry population across the country and resulted in over 1500 reported human cases and human deaths (**WHO, 2018**).

**Bovine tuberculosis:** It is caused by the *Mycobacterium Bovis* (bTV). The bacterium is transmitted mainly by aerosol or through consumption of infected meat, milk and other products of wild cow/cattle/goat and elephant, wild birds, wild boars and porcupines. Symptoms include fever, night sweats, persistent cough, diarrhoea, weight loss and abdominal pain. It is endemic in much of sub-Saharan Africa (**Kronke, 2004**). There were an estimated 147000 of zoonotic cases and some 12500 people died of the disease in 2016. According to WHO's Global tuberculosis report (2017), Africa carries the largest burden of human cases, followed by Asia.

**Brucellosis:** It is caused by the bacterium - *Brucella suis*. There are many cases of human infection due to the handling of infected feral and wild boars, wild cow/goat/cattle and bison (**Golfroid et al. 2006**). Symptoms include joint and muscle pain, fever, weight loss and fatigue. Some people also develop stomach pain and cough. Incidences of brucellosis in wild boar populations have attained a very high level in southern Spain and pose a serious threat to

both, local domestic pigs, hunters, and animal-care professionals. Starnes et.al (2004) reported two cases of brucellosis in members of a hunt club who had killed and prepared meat from wild boars. Brucellosis outbreak was also recorded in Penang, Malaysia. Over a period of 1 year, 79 patients who had consumed milk from the same goat farm were diagnosed with brucellosis (**Leong et al. 2015**).

**Leptospirosis:** It is caused by the bacteria *Leptospira spp.* People can be infected through direct contact with either the urine or reproductive fluids from infected animals, contact with urine-contaminated water (floodwater, rivers, streams, sewage), wet soil, ingestion of food or water contaminated by urine or urine-contaminated water of wild boar, wild cow/cattle and rodents. Transmission occurs through mucous membranes, conjunctiva, and skin cuts or abrasions. Symptoms include high fever, headache, bleeding, muscle pain, red eyes and vomiting. In Kerala, at least 100 deaths were reported yearly before 2010. In 2006, there were 1821 cases of which 104 (5.7%) died and in 2007 there were 1359 cases with 229 (16.9%) deaths. The number of cases in 2008, 2009 and 2010 was 1305, 1237 and 1016 with a mortality rate of 136 (10.0 %), 107 (8.6%) and 85 (8.4%) respectively (**DHS, 2018**). In 2011 and 2012, the number of cases was 944 and 736 with a death rate of 70 (7.4%) and 18 (2.4%). It has been reported that in 2013 and 2014, cases were at 814 and 717 which led to 34 (4.2%) and 19 (2.6%) deaths respectively (**Sukumuran and Pradeepkumar, 2015**).

**Trichinosis:** It is caused by the parasite *Trichinella spp.* People can get the disease by eating raw or undercooked meat from infected wild boar, bear and fox. Symptoms include diarrhoea, abdominal pain and vomiting. The first outbreak of human trichinosis in the United States was known to be caused by the sylvatic *Trichinella* species *T. murrelli*. This outbreak exemplifies the changing epidemiology of trichinosis in the United States from a disease caused primarily by the ingestion of contaminated domestic pork, typically infected with *T. spiralis*, to a disease more frequently associated with the consumption of raw or undercooked wild animal meat infected with sylvatic *Trichinella* species (**Gottstein et al. 2009; Roy et al. 2003**).

**Toxoplasmosis:** It is caused by the parasite, *Toxoplasma gondii*. The transmission occurs by ingestion of either water, vegetables or soil contaminated with oocysts from cat feces, raw or undercooked meat containing viable tissue cysts of wild boar, tiger and fox characterizing this disease as a foodborne zoonosis (**Tenter et al. 2000**). Symptoms include pain in the muscles, fatigue or fever, enlarged neck lymph nodes or headache. In Brazil, 50 to 80% of

adults have been infected with *Toxoplasma* (Dubey *et al.* 2012), demonstrating the need for greater emphasis on measures to prevent the disease, which involve meat and water quality control (Dubey, 2004; Tenter *et al.* 2000). Several toxoplasmosis outbreaks have been reported in Brazil, the first one being described in the 1960s was in a university (Magaldi *et al.* 1969). After this report, several others have been described in all regions of the Brazilian subcontinent, as in the Midwest (Reinoier *et al.* 2007), Southeastern region (Ekman *et al.* 2012), Amazon/Northern region (Carmo *et al.* 2010) and Southern region (Bonametti *et al.* 1996) attributing the outbreaks to several infective forms of *T. gondii*.

**Ebola:** It is caused by the *Ebola* virus. Ebola was introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as fruit bats, chimpanzees, gorillas, monkeys, forest antelope or porcupines found ill or dead or in the rainforest. The virus causes fever, body aches, and diarrhoea, and sometimes bleeding inside and outside the body. As the virus spreads through the body, it damages the immune system and organs. Ultimately, it causes high levels of blood-clotting cells to drop. This leads to severe, uncontrollable bleeding. The 2014–2016 outbreaks in West Africa was the largest Ebola outbreak since the virus was first discovered in 1976. The outbreak started in Guinea and then moved across land borders to Sierra Leone and Liberia. The current 2018-2019 outbreak in the eastern Democratic Republic of Congo is highly complex, with insecurity adversely affecting public health response activities (WHO, 2020).

**Diarrheal disease:** It is caused by the bacteria, *Escherichia coli* (*E. coli*) and *Campylobacter* spp. It is transmitted to humans primarily through consumption of contaminated foods, such as raw or undercooked ground meat products, raw milk and contaminated raw vegetables and sprouts. Wild birds, porcupine, wild goat, wild cow/cattle, monitor lizard carry the pathogen. Symptoms include nausea, vomiting, stomach cramps, diarrhoea that often is bloody, fever, loss of appetite and mild dehydration. During September 2000, an unexpectedly large number of cases of *E. coli* infection occurred in Montgomery County, Pennsylvania, and surrounding counties (Crump *et al.* 2002).

**T-cell leukemia:** It is caused by the pathogen, HTLV-1. Pathogen transmission from non-human primates to humans is through the hunting and butchering of animals or birds, because of the broad range of fluids and tissue types, hunters and butchers encounter (Sintasath *et al.* 2009). Symptoms include anemia – due to lack of red blood cells, weakness, tiredness, shortness of breath, light-headedness, palpitations, infections – due to lack of normal white



blood cells. Approximately 5 to 20 million people worldwide are infected with Human T cell Leukemia Virus type I (HTLV-I) (**Gessain and Cassar, 2012**). The highest prevalence of infection is found in Japan, the Caribbean, Africa, South America, and the Pacific islands (**Proietti et al. 2005**).

**HIV/AIDS:** It is caused by HIV (human immunodeficiency virus). Human exposure to blood or other secretions of infected primates, through hunting and butchering of primate bushmeat, represents the most plausible source for human infection. In addition, bites and other injuries caused by primates kept as pet animals can favor a possible viral transmission. The symptoms are being tired all the time, swollen lymph nodes in your neck or groin, fever that lasts more than 10 days, night sweats, weight loss with no obvious reason, and purplish spots on the skin that don't go away. As of 2018, approximately 37.9 million people are infected with HIV/AIDS globally. There were about 770,000 deaths from AIDS in 2018 (**UNAIDS, 2020**).

**Cryptosporidiosis:** It is caused by the bacterium, *Chlamydophila psittaci*. Humans get the disease by breathing in dust containing dried saliva, feathers, mucus and droppings from infected birds. Humans are infected by consuming food or water contaminated with the excreta or feathers of the organism or by failing to wash their hands after exposure to infective feces or animals. Wild birds, wild cow/cattle, rabbit carry the pathogen causing the disease. Symptoms include fever and chills, nausea and vomiting, muscle and joint pain, diarrhoea, weakness, fatigue and dry cough. In the US the department of health reported an outbreak of psittacosis which occurred at poultry slaughter plants owned by a corporation (**CDC, 2019**).

**Salmonellosis:** It is caused by *Salmonella spp.* Humans can catch the infection through contaminated water or food. Humans also acquire *Salmonella* from undercooked contaminated meat, infected eggs, or unpasteurized milk products of wild birds, wild goat, and wild cow/cattle. Symptoms include stomach cramps, nausea, vomiting or headache. Nearly one in three foodborne outbreaks in the European Union in 2018 were caused by *Salmonella*. In 2018, EU Members States reported 5146 foodborne outbreaks affecting 48365 people. Slovakia, Spain and Poland accounted for 67% of the 1581 outbreaks (**EFSA, 2019**).

**Listeriosis:** It is caused by *Listeria monocytogenes*. This foodborne infection occurs through the consumption of contaminated foods, particularly unpasteurized milk, soft cheese, vegetables and prepared meat products such as pate. The infection usually occurs after eating

contaminated processed meats or unpasteurized milk products of wild goat/cow/cattle. Transmission is also possible from mother to fetus or from mother to child during birth. In pregnant women, it causes fever and abortion. Newborn infants, pregnant women, senior citizens and immunocompromised individuals are particularly susceptible. The number of people affected by listeriosis in 2018 was 2549. In Europe, listeriosis accounts for the highest proportion of hospitalized cases (97%) and the highest number of deaths (229), making it one of the most serious foodborne diseases (EFSA, 2019).

**Anthrax:** It is caused by *Bacillus anthracis*. People develop anthrax when the organism enters a wound in the skin, is inhaled in contaminated dust, or consumed through undercooked meat from infected wild cow/cattle. Symptoms include flu-like symptoms such as sore throat, mild fever, fatigue and muscle aches, which may last a few hours or days, mild chest discomfort, shortness of breath, nausea, coughing up blood and painful swallowing. From 2010 to 2014, nine outbreaks of anthrax were recorded in Koraput district of Odisha with 325 suspected cases and 5 deaths. The outbreak was associated with eating and handling the carcasses of ill cattle in a context of low vaccination coverage of livestock and inadequate carcasses disposal practice (Nayak *et al.* 2019).

**Pseudocowpox:** It is caused by *Pseudocowpox* virus (Parapoxvirus). Humans acquire pseudo cowpox through direct contact with infected cows. Humans develop painful scabby sores on their hands and arms. Turkey has reported *Parapoxvirus* infection in a hospital burn unit in Gaziantep. The outbreak lasted from October to December 2012 and involved a total of 13 cases (Midilli *et al.* 2013).

**Q fever:** It is caused by *Coxiella burnetii*. Humans are usually infected when they are assisting the birthing process and are exposed to reproductive fluids. They may also be infected by drinking infected unpasteurized milk of wild cow/cattle. Humans develop fever, night sweats, pneumonia and hepatitis in severe cases. Miscarriages, premature delivery, and infections of the placenta are possible in pregnant women. In 2005, Q-fever was diagnosed on two dairy goat farms and 2 years later it emerged in the human population in the South of Netherlands. From 2007 to 2010, more than 4,000 cases were notified with an annual seasonal peak (Freerika *et al.* 2012).

**Plague:** It is caused by *Yersinia pestis*. The disease is transmitted from rodents to humans by the bite of infected fleas. The disease can also be caught by inhaling contaminated aerosols or

from direct contact with infected animal tissue. Symptoms include high fever, chills, headache, chest pain, rapid breathing, and severe shortness of breath and cough that may have blood. In Madagascar, over 1500 human plague cases were reported between the year 1997 and 2001 (**Migliani *et al.* 2016; Andrianavoarimanana *et al.* 2013**). Moreover, inhabitants of Madagascar recently suffered from a large plague outbreak with over 2000 reported cases in a period of fewer than three months (**WHO, 2017**). Plague is wide-spread and present in large areas of North and South America, Asia and Africa (**Gage and Kosoy, 2005**).

**Lassa virus:** It is caused by the *Lassa mammarena* virus. It is transmitted directly or indirectly from the multimammate rat (*Mastomys natalensis*). The virus causes fatal hemorrhagic fever. An endemic of Lassa virus in Nigeria was reported in February 2020. Around 90-95% of human infections are due to direct or indirect exposure to infected rats (**WHO, 2020**).

**Hemorrhagic fever with renal syndrome (HFRS):** It is caused by Seoul hantavirus (SEOV). It is transmitted to humans via aerosols of infectious excreta from chronically infected wild rodents. It is characterized mainly by high fever, fatigue and severe kidney problems with a mortality of 2–3% (**Meerburg *et al.* 2009**). A laboratory in Japan caused a Hantavirus outbreak with 13 doctors and 1 veterinarian infected (**Umenai *et al.* 1979**). Dozens of Hantavirus infections in laboratory animals also occurred during 1980 in China (**Liu and Chen, 1991**).

## CONCLUSION

It is accepted that Covid-19 had its origin among bats. After the initial cases began to emerge the spread of the virus has been unprecedented. Within a couple of months, the entire globe was reeling under the pandemic. All of this came about because of the continued intrusion of humans into the natural world. This took the form of destruction and degradation of the natural habitat. But in many cases, consumption of bushmeat was also an important factor. Many of the disease discussed above were an outcome of human consumption of infected wildlife. As such the risk of disease transmission would be reduced if people stopped harvesting bushmeat. However, that is easier said than done.

Any intervention aiming to restrict access to wildlife will have to involve stakeholders during public outreach to reduce the risk of alienating communities (**Monroe and Wilcox, 2006**). The risk of disease transmission can be reduced through community education that focuses on people with high levels of exposure to wild animals (**Wolfe et al. 2007**). Communicating with hunters and butchers about the risks associated with bushmeat and promoting awareness of safer techniques may reduce the levels of transmission. The social and environmental issues surrounding bushmeat represent a complex problem for conservation, global public health and sustainable development, as it is often the poorest and vulnerable populations who depend on bushmeat for income or food security (**Kurpiers et al. 2016**). Bushmeat continues to be important for many communities around the world and will continue to remain so for some time to come. Till then continued vigilance is very important to ensure that the risks posed by bushmeat are contained as soon as it becomes manifest. That is the only possible solution momentarily.

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