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# Beliefs, taboos, usages, health perceptions, and practices toward wildlife among different ethnicities in Tak and Mae Hong Son Provinces, Thailand

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## Abstract

This concurrent qualitative study was carried out with the main objective to determine wildlife beliefs, taboos, usages, health perceptions, and practices among ten ethnic groups in four communities in Tak and Mae Hong Son provinces of Thailand from November 2020 to January 2021. We also gathered comprehensive information on study respondents' knowledge related to potential risk behaviors that could lead to zoonotic disease transmission and infection. Furthermore, we intended to use the study's findings to develop communication strategies and health literacy improvement interventions for mitigating risky behaviors, with a focus on ethnic groups and particular individuals who live in close proximity to forests and wildlife, to prevent future pandemics. Sixty-five respondents were purposively selected based on their extensive knowledge, active participation in local cultural contexts, beliefs, and exposure to wildlife contact or consuming game animals. Twenty (30.8%) participated in in-depth interviews (IDIs), while 45 (69.2%) participated in eight focused group discussions (FGDs). The results revealed that the characteristics of wildlife contact are similar and distinct based on their beliefs and taboos among various ethnic groups and study locations, which are influenced by cultural backgrounds and traditions. Although some ethnic groups do not have explicit restrictions on the consumption of wildlife, others adhere to specific beliefs and taboos that forbid the consumption or killing of specific wild animals. These beliefs frequently correspond with conservation initiatives, thereby facilitating the preservation of threatened species. The study also revealed a lack of appropriate health knowledge, perceptions, and practices regarding wildlife contact and consumption. As a result, it is recommended that public health officials and local governments develop and execute communication and education initiatives. These campaigns should aim to increase health literacy and promote safe handling, preparation, and cooking practices to reduce the risk of zoonotic disease transmission and infection effectively. Moreover, it is necessary to design and implement wildlife conservation education and outreach activities. The programs should promote environmental stewardship while considering the cultural

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contexts, beliefs, and practices of various ethnic groups. The activities should involve diverse stakeholders, including local leaders, religious influencers, community members, schoolteachers, students, health professionals, village health volunteers, and civil society organizations.

**Keywords** Belief, Culture, Ethnicity, Interface, Mae Hong Son, Perception, Taboo, Tak, Wildlife, Thailand

## Background

The northern region of Thailand, along the borders of Myanmar, is home to various types of ethnic groups residing at different locations, including Pwo Karen, Thais or northern Thai people (Khon Muang), Shan or Tai Yai, Yunnan's Chinese, Mien or Yao, Lahu or Muser, Akha, Lisu or Lisaw, S'gaw Karen, and Bamar. Each ethnicity lives in an area with various elevations and develops its land use systems. The term '*Hill Tribe*' or '*Chao Khao*' is defined by these ethnic groups [1]. The northern Thai people, who were early settlers in Northern Thailand, established wet-rice cultivation based on irrigation from mountain water sources in areas with an altitude of 300–600 m [2]. S'gaw, Pwo Karen, and Shan people have developed forest farming with a model of rotating terraced fields at an altitude of 700–1600 m [2]. Followed by other ethnic minorities, such as Mien or Yao, Lahu or Muser, Akha, Lisu or Lisaw, who have developed shifting cultivation for steep slopes with elevations of 800–2,000 m [2].

Every ethnicity in the northern region of Thailand has a solid connection to nature and the environment, which they incorporate into their daily lives and activities [3, 4], such as entering the forest to collect forestry products and hunting wildlife for consumption. Respect for nature's sustainability is demonstrated through practices and taboos derived from beliefs and cultural contexts, as manifested in ceremonies, rituals, and cultural prohibitions [4], which include beliefs and taboos regarding wildlife contact and consumption because many ethnicities in Thailand have practiced traditional hunting and gathering to meet their food needs [5]. They also presented their beliefs in the form of enigmas, which can maintain natural harmony and provide food sources, such as forest products and hunted animals [4]. However, some beliefs and taboos are counterproductive for wildlife conservation, such as the belief that eating bushmeat can cure particular illnesses [6, 7].

In contrast to traditional hunting, unsustainable mass hunting by commercial hunters has become a significant cause of biodiversity loss in large parts of Asia's forests [7]. Ethnic groups that rely on nature also feel the direct effects of the declining biodiversity, which provides many protein sources [5, 7]. Thailand strictly prohibits the exploitation of wildlife, and the government implemented laws to combat the illegal hunting of wildlife despite the ongoing ethical debate surrounding traditional or commercial hunting practices [5]. Traditional

and commercial hunting are prohibited by Thai laws, which strictly regulate wildlife exploitation [8]. The Wildlife Conservation and Protection Act, B.E. 2562 (2019) [9], the National Parks Act, B.E. 2562 (2019) [10], and the Forest Act, B.E. 2484 (1941) [11], are the primary legislation that applies these restrictions. Although these laws apply to all citizens, specific provisions permit ethnic groups to engage in subsistence hunting within traditional boundaries under regulated conditions, thereby ensuring the sustainability of wildlife populations [5].

In addition, usage and overexploitation of wild animals are contributing factors to the transmission of zoonotic diseases to humans, including leptospirosis from rodents, rabies and Nipah virus from bats, and Ebola from primates [5, 12, 13], and other potential zoonotic diseases that may be caused by future pandemics. These wildlife contact and consumption activities have been associated with beliefs [14] and taboos among individual ethnic groups. [12, 15, 16] Unfortunately, there is currently a lack of information regarding the behaviors of ethnic communities in Thailand concerning wildlife contact and consumption characteristics. However, some reports also indicated that ethnic groups in Thailand and Laos lack appropriate wildlife contact knowledge and behaviors, including information regarding zoonotic diseases [17, 18]. As a result, it was beneficial to implement this study to gather information on the beliefs, taboos, health perceptions, and practices of ethnic communities in relation to wildlife contact and consumption. This was because the interaction between ethnic groups and wildlife is a critical area of concern, particularly in the context of zoonotic disease transmission. Ethnic groups often have cultural practices that involve close contact with wildlife, such as hunting, consumption of bushmeat, or using animal products in traditional medicine [19]. These interactions, while culturally significant, can pose substantial health risks due to the potential for zoonotic spillover [20]. In addition, the results were expected to enhance health literacy, encourage the adoption of appropriate practices for wildlife contact and consumption, and protect wild species in accordance with the unique cultural contexts of each community.

This current study was designed with the main research question, "How do different ethnic groups perceive, practice, and interact with wildlife regarding beliefs, taboos, usages, and health-related activities?" The selected study locations were communities in Tak and Mae Hong Son provinces along Thailand's border with Myanmar, where

various ethnic groups live in and near forests. Our study was also anticipated to provide in-depth information on the characteristics of wildlife consumption behaviors for the quantitative study, which was designed to quantify the levels of wildlife consumption. The mentioned quantitative study is in the process of being published. Based on the study's findings, we may mitigate potential zoonotic infections and future pandemics by developing communication strategies and interventions for safe contact behaviors with wildlife. This could be achieved by tailoring the villagers' socio-cultural beliefs and contextual characteristics to their specific ethnic groups.

## Materials and methods

### Study objectives, study designs, study period, and data collection methods

This qualitative study aimed to determine the beliefs, taboos, usages, health perceptions, and practices related to wildlife interaction among various ethnic groups in communities located in the Tak and Mae Hong Son provinces of northern Thailand. The study was conducted between November 2020 and January 2021. This study was also expected to provide additional information to support a quantitative study on wildlife consumption currently being published.

This study employed in-depth interviews (IDIs) and focus group discussions (FGDs). The data collection methods were carried out to capture individual perspectives and community norms regarding wildlife beliefs and practices among different ethnic groups in Northern Thailand [21, 22]. IDIs provided detailed personal insights, while FGDs facilitated discussions that revealed community perspectives, which is crucial for developing effective public health interventions and strategies for disease prevention, especially in areas at high risk for zoonotic spillover.

### Study settings, ethnicities, and environment characteristics

This study was conducted in four communities in Tak and Mae Hong Son provinces in Thailand's northern region, which share borders with Myanmar (Fig. 1). The districts of Mae Sot and Phop Phra in Tak province and Muang and Sop Moei in Mae Hong Son province were selected considering the following criteria: (a) preliminary information on wildlife presentation/ habitats during scoping visits, (b) ethnic diversity in the areas, (c) significant evidence of wildlife contact and consumption among various ethnic groups based on observations, and (d) information/ referral suggestions from local authorities and health officials during scoping visits in the study locations. Profiles of the study locations are explained below.

### *Mae Sot district, Tak province*

Moei River is the boundary between Mae Sot district and Myawaddy province in Myanmar (Fig. 1). The Mae Sot district contains both steep and low terrain. It is a peri-urban area that has been rapidly urbanizing. The study villages primarily comprised northern Thai, Bamar, and Karen people. Most Karen work in agriculture, reside on their employers' farms, and are daily wage employees working in Mae Sot. The northern Thai people are engaged in agriculture, daily wage labor, private sector jobs, trade, and public service. The Bamar people often work in general labor and agriculture, contributing to the diverse economic activities in the Mae Sot district.

### *Phop Phra district, Tak province*

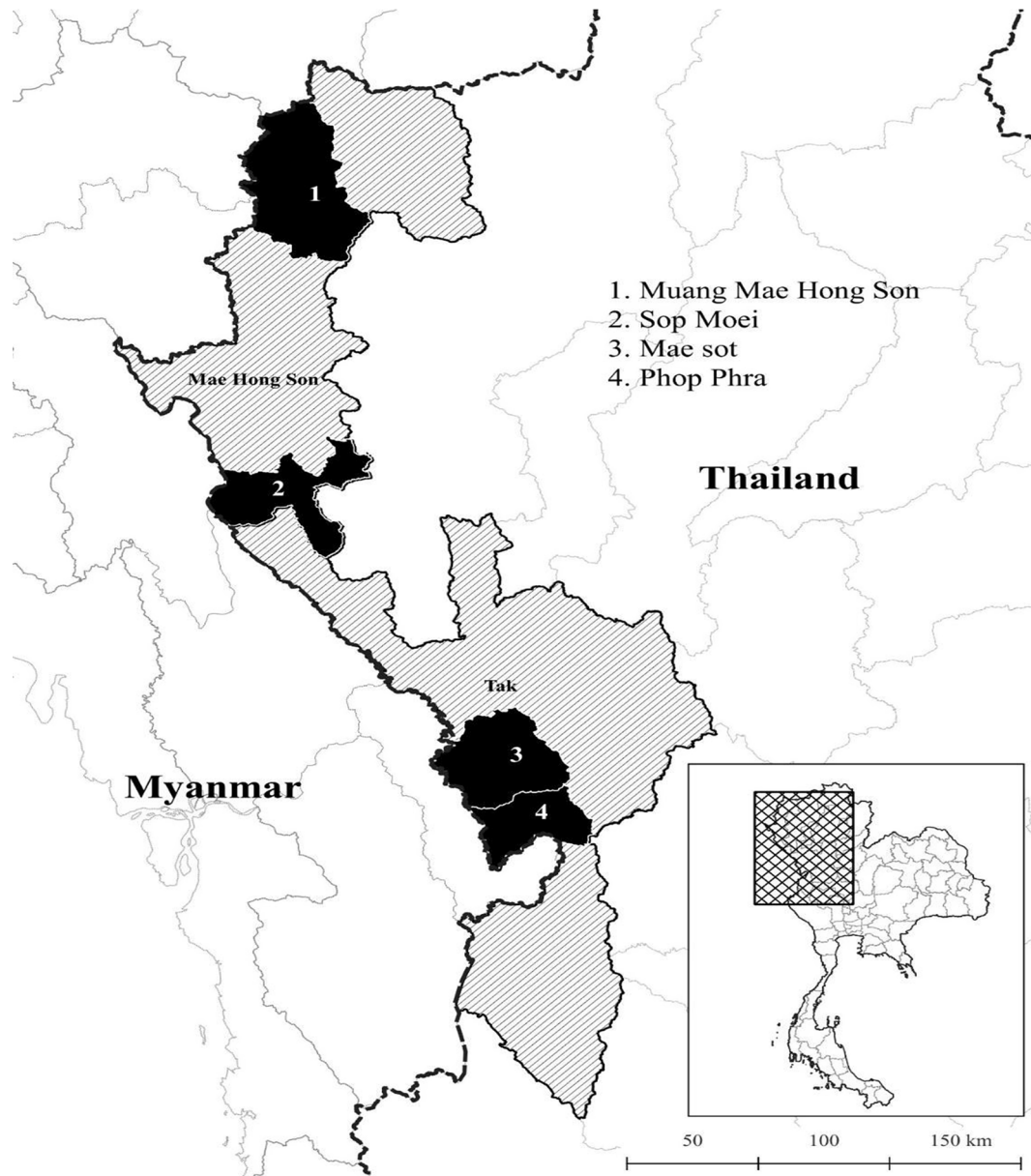
Phop Phra is 135 km southwest of Muang Tak district in Tak province. Starting in Pawo Kayo, the Moei River (Tong Ying), Huai Valley, and Thanon Thongchai (Pawo) ridge connect the west to Myanmar (Fig. 1). The district's study community comprises northern Thais, Lahu, Chinese, Mien or Yao, Akha, and Lisu. This area also contains Bamar and Karen migrants who often cross the border between Thailand and Myanmar; some reside with employers. Most northern Thai people work in agriculture, daily wage labor, the service industry, private sector jobs, trade, and public services. Most Lahu people engage in agriculture, daily wage labor, and handicrafts. Several Yunnan Chinese people are involved in trade, family businesses, and the service industry. Most Mien people work in agriculture, daily wage labor, and trade, and most Akha and Lisu people engage in agriculture and daily wage labor and produce handicrafts.

### *Muang district, Mae Hong Son province*

Muang district is located in the northern part of Mae Hong Son province. Some residents of this study site frequently cross the border between Thailand and Myanmar. This district is linked to the west of Myanmar, approximately 94 km from the border [23] (Fig. 1). Shan, or Tai Yai, is the region's largest ethnic group, followed by northern Thai or Khon Muang, Pwo Karen, and S'gaw Karen. Most of the city's population is engaged in agriculture, but some also work in hospitals and government offices.

### *Sop Moei district, Mae Hong Son province*

Sop Moei is in the southern portion of Mae Hong Son province. The west connects to Pha Pun in the Kotulay State of Myanmar, approximately 45 km from the border, and runs along the Salween and Moei Rivers [24] (Fig. 1). The district's study area is mountainous; the majority of the population is the Pwo Karen being most of the population. Primarily, foraging and hunting served as subsistence and commerce for society. S'gaw Karen inhabits



**Fig. 1** Map of the study sites

the surrounding villages. The main occupations are represented by farmers, agricultural workers, vendors, and temporary employees (e.g., service workers).

#### **Study respondents, recruitment procedures, and data collection procedures**

In the Mae Sot district of Tak province, the majority of the study respondents were northern Thais and Bamar, while Yunnan's Chinese, Lisu, Akha, Lahu, and Mien from the Phop Phra district also participated in the study. The majority of the study respondents in the Muang district of Mae Hong Son province were Shan or Tai Yai, northern Thais, Pwo Karen, and S'gaw Karen, while the Pwo Karen were from Sop Moei district.

As aforementioned, the IDI and FGD respondents were purposively selected based on information from scoping visit results and referrals from local authorities and health officials on their frequent exposure to wildlife. They have extensive knowledge about the study locations and relevant topics related to wildlife interaction activities. The inclusion criteria for the respondents included individuals between the ages of 20 and 65 because they were considered to be actively engaged in active activities, particularly those related to hunting wildlife in the forest and their occupations, a one-year minimum residency in the study locations before data collection, a willingness to participate in the study, the ability to communicate effectively which were not affected by mental

disorders or alcoholic behaviors during the interviews or discussions, and extensive knowledge and experience with wildlife exposure activities, such as hunting, killing, butchering, and preparing animals for food. We included individuals with direct experience and beliefs related to activities related to wildlife to gather accurate and relevant data per our study's objectives. Furthermore, we obtained data regarding the activities of other genders and age groups from the study respondents by using probing techniques.

The FGD respondents consisted of around 5 to 8 individuals. We mixed various ethnic respondents to share their information in the same FGDs to ensure equality of ethnic groups and genders. The IDIs and FGDs took approximately 60–90 min. The interview or discussion locations were community meeting areas or meeting rooms of local health-promoting hospitals that were private and not too secluded.

#### Data collection tools and analysis

The interviews and discussions were carried out using qualitative semi-structured interview guides adapted from a study on bat consumption in Thailand [25]. The guides consisted of the following topics: (a) profiles of the respondents, (b) profiles of the communities, (c) types of wildlife contacts and consumption, (d) reasons for contact and consuming wildlife, (e) knowledge, attitudes, beliefs, and taboos about wildlife contact and consumption, (f) perceptions and awareness of diseases that may be risky from contact with or consumption of wildlife, (g) health status of the community members and the study respondents, and (h) prevention measures for protecting oneself, family members, and the community from diseases related to wildlife contact and consumption characteristics.

The IDIs and FGDs were carried out by the study team, including facilitators and notetakers with qualitative research experience to gather necessary information. The Principal Investigators (PIs) also served as the facilitators, directing other facilitators and notetakers to gather insights and relevant information based on study objectives, procedures, and themes while adhering to the study protocol, data collection techniques, and ethical considerations for protecting study respondents' confidentiality. Each facilitator was accompanied by a notetaker, who took notes, recorded audio, and observed the IDIs and FGDs.

The data were analyzed using content analysis to categorize, interpret, and derive meaning from qualitative data [26]. The audio recordings were transcribed and translated into central Thai from local dialects by humans and manually before being analyzed for key ideas, concepts, or statements and grouped into meaningful themes determined by the objectives and discussion guides. Two

main research team members conducted the content analysis using NVivo. A codebook was created to ensure consistency and reliability. The analysis process involved initial independent coding, collaborative codebook development, regular consensus meetings to refine codes, final coding of the entire dataset, and analysis to identify patterns and themes aligned with the research objectives. We carefully documented the decisions, justifications, and interpretations made during the study implementation and aligned them with the study objectives to ensure the analysis was accurate and precise [27].

#### Results

This section contains information about respondent profiles, beliefs, and taboos about wildlife, perceptions of wildlife-associated diseases, and practices related to wildlife contact and consumption. We presented study results based on the study locations and themes. Summaries of the findings below can be found in Tables 1, 2 and 3.

#### Respondent profiles

Sixty-five respondents were invited to participate in the study. They have extensive knowledge and active participation in local cultural contexts, beliefs, contact, and consumption behaviors related to wildlife in the study locations. Among them, 20 individuals (30.8%) participated in IDIs, while 45 individuals (69.2%) participated in eight FGDs. The respondents were Thais or Khon Muang (19, 29.2%), followed by Pwo Karen (18, 27.7%), Shan or Tai Yai (13, 20.0%), Chinese from Yunnan (3, 4.6%), Mien or Yao (3, 4.6%), Akha (3, 4.6%), Lahu or Muser (2, 3.1%), Lisu or Lisaw (2, 3.1%), S'gaw Karen (1, 1.5%), and Bamar (1, 1.5%) (Table 1).

#### Beliefs and taboos about wildlife

The findings revealed that people's beliefs and attitudes toward wildlife can be influenced by their background and family upbringing, often inspired and passed down through generations by adults or older community members. Wildlife taboos vary among ethnic groups in the study locations. These ethnic groups' cultural practices, traditions, and spiritual beliefs frequently influence their perceptions toward wildlife contact, consumption, and conservation concerns.

#### Beliefs related to wild animal consumption

In Tak province, some northern Thais in the Mae Sot district believe that certain wildlife, such as wild deer and barking deer meat, should not be consumed by children, women, pregnant women, or seniors because it causes body aches and pains, which are toxic to young mothers. The beliefs of using wildlife meat as medicines aligned with the prohibition on eating wild meat were observed by the Pwo Karen ethnic group in the Sop Moei district.

**Table 1** Number of respondents for in-depth interviews (IDIs) and focus group discussions (FGDs)

Provinces	Districts	Ethnic group	Respondents in IDIs		Respondents in FGDs		Total
			Males	Females	Males	Females	
Tak	Mae Sot	Thai	5	0	9	0	14
		Bamar	1	0	0	0	1
		Pwo Karen	0	0	1	0	1
		<b>Subtotal</b>	<b>6</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>16</b>
Tak	Phop Phra	Akha	1	0	2	0	3
		Yunnan's Chinese	1	0	1	1	3
		Mien or Yao	1	0	2	0	3
		Thai	0	1	1	0	2
		Lahu or Muser	0	0	2	0	2
		Lisu or Lisaw	0	0	2	0	2
		<b>Subtotal</b>	<b>3</b>	<b>1</b>	<b>10</b>	<b>1</b>	<b>15</b>
		<b>Total (%)</b>	19 (29.2%)	1 (1.5%)	34 (52.3%)	11 (16.9%)	65 (100.0%)
Mae Hong Son	Muang	Shan or Tai Yai	3	0	6	4	13
		Thai	3	0	0	0	3
		S'gaw Karen	0	0	1	0	1
		<b>Subtotal</b>	<b>6</b>	<b>0</b>	<b>7</b>	<b>4</b>	<b>17</b>
Mae Hong Son	Sop Moei	Pwo Karen	5	0	6	6	17
		<b>Subtotal</b>	<b>5</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>17</b>
		<b>Total (%)</b>	19 (29.2%)	1 (1.5%)	34 (52.3%)	11 (16.9%)	65 (100.0%)
<b>Grand Total (%)</b>			<b>20 (30.8%)</b>		<b>45 (69.2%)</b>		<b>65 (100.0%)</b>

They reported that women who had recently given birth were advised to avoid consuming wild deer and barking deer meat due to a musty and foul odor since the odor could hinder blood flow and result in joint aches and pains.

*It is widely believed here (Mae Sot district) that consuming the meat of these animals (wild deer and barking deer) can cause significant health issues, so it's forbidden for children, women, especially if pregnant or elderly.*

*A northern Thai male in Mae Sot District, Tak province (FGD\_002)*

Yunnan's Chinese, Mien, Muser, and Lahu ethnic groups have a similar ban on wildlife consumption, as they do not eat rodents (rats) because they are known as "Pacha," which translates to dirty meat. In contrast, the Lisu and Thai ethnic groups reported eating rodents and were not forbidden from eating other wild animals. Furthermore, the consumption of monitor lizards or snakes is uncommon among Thais in the community. Most ethnic groups, particularly Mien, Muser, and Lahu, reported being forbidden from eating turtles and elephants because they are long-lived animals.

*It's forbidden to eat turtles and elephants. We respect them because they (turtles and elephants) live very long.*

*A Lahu male in Prob Phra district, Tak province (FGD\_001)*

The Mien ethnic group in Prob Phra district reported a ban on eating wild animals like turtles, elephants, dogs, and rats. This was because turtles are considered beneficial animals that support the Mien ethnic group by bringing good luck and prosperity or assisting the community during times of hardship or conflict. Similarly, Bamar and Pwo Karen respondents reported that it is forbidden for people to eat turtles or ducks together unless they are family members, friends, or relatives because this may cause people to separate and live apart. Furthermore, they reported that individuals should refrain from consuming frogs or unfamiliar wild animals due to their accumulation of toxicity in the body, which can lead to allergic reactions and blisters. Some Pwo Karen stated that people born in the Year of Goat on the Chinese calendar should avoid eating goat meat because it is their birth year. Most northern Thai respondents reported being prohibited from eating poisonous wildlife like poisonous snakes. The northern Thais in the community do not have any specific beliefs regarding the consumption of wildlife. However, they believe that the appearance of certain animals, such as owls, can be omens that affect their daily lives.

**In Mae Hong Son province**, some Pwo Karen respondents reported that if someone consumes gibbon meat, that person will have to leave the village because they believe that something unusual will happen. If someone eats a small bird (a Chang Chi bird), that person will become a widower. Some Shan and northern Thais have similar beliefs about prohibiting consuming moles in the household. Wild boar meat is not likely to be eaten raw

**Table 2** Beliefs and taboos about wildlife among ethnicities in take and Mae Hong Son provinces

Provinces	Districts	Ethnicities	Wildlife animals	Beliefs and Taboos	
Tak	Mae Sot	Northern Thai	Snake	An omen of fortune, but some people considered it a bad omen and prohibited poaching due to potential intoxication	
			Dove & Owl	An omen of death to the family	
			Red-Wattled Lapwing	An omen of death	
			Muntjac or Serow wandering in the village	An omen of possible tragedy	
			Deer or Barking Deer	Prohibited from consumption due to high allergic	
			Frog	Prohibited from poaching due to potential intoxication	
		Bamar	Muntjac or Serow wandering in the village	An omen of possible tragedy	
			Ducks and Turtles	An omen of breaking companionships	
			Pwo Karen	Muntjac or Serow wandering in the village	An omen of misfortune or tragedy
				Duck and Turtle (Meat)	An omen of breaking companionships
		Phop Phra	Akha	Goat	Prohibited to consume for people born in the Chinese year of Goat
				Killing any wildlife in the village	Bring evil spirits to the village
				Snake entering household	Omen of misfortune. Caught the snake and removed using an unhusked rice bag.
				Bulky animals	Prohibited from slaughtering, an omen of evil spirits.
				Bull and Buffalo	Prohibited from slaughtering due to their sacred nature, making their slaughter taboo due to their spiritual significance.
				Dog (dog meat)	Prohibited from consumption as it is an omen of misfortune
	Yunnan's Chinese		Pangolin	Seeing Pangolin in a burrow is an omen of bad luck	
			Muntjac or Serow wandering in the village	An omen of possible tragedy	
			Rodent	Prohibited from being consumed	
			Mien or Yao	Turtle	An omen of assistance to the Mien community also prohibited from being consumed
	Wild animals wandering in the village			An omen of tragedy	
	Rodent			Prohibited from being consumed	
	Dog (dog meat)			Prohibited from being consumed	
	Elephant			Prohibited from being consumed	
	Northern Thai			Wild animals wandering in the village	An omen of tragedy
			Monitor Lizard and Snake	Prohibited from being consumed	
		Rodent	Prohibited from being consumed		
		Dog (dog meat)	Prohibited from being consumed		
		Lahu or Muser	Wild animals wandering in the village	A sign of catastrophe	
			Bull and Buffalo	Prohibited from slaughtering due to their sacred nature, making their slaughter taboo due to their spiritual significance.	
	Elephant		Prohibited from being consumed		
	Turtle		Prohibited from being consumed		
Rodent	Prohibited from being consumed				
Lisu or Lisaw	Wild animals wandering in the village		An omen of misfortune and disaster		
	Bull and Buffalo	Prohibited from slaughtering due to their sacred nature, making their slaughter taboo due to their spiritual significance.			
	Rodent	Allowed to be consumed			
	Mae Hong Son	Muang Yai	Shan or Tai Yai	Barking Deer and Monitoring Lizard entering in the households	An omen of misfortune
Tiger (roaring tiger sound)				An omen of a pandemic or disaster.	
Peacock (feathers and tails)			An omen of fortune		
Owl (owl sound)			A symbolizes potential illness or accident		

**Table 2** (continued)

Provinces	Districts	Ethnicities	Wildlife animals	Beliefs and Taboos
			Any wild animals	Those who feed on wild animals will gain prosperity
			Wild boar	Prohibited from being consumed because it diets on waste
			Moles	Prohibited from being consumed due to foul odor affecting vulnerable residents
			Barking Deer	Hunting is prohibited as it impacts the community
			Cobra	Allowed to be consumed but rarely
		Northern Thai	Any wild animals entering the house	An omen of misfortune, villagers have House merit ceremonies to eliminate bad omens
			Snake	An omen of fortune
			Owl	A symbolizes potential illness or accident to the resident.
			Any wild animals	Those who feed on wild animals will gain prosperity
			Moles	Prohibited from being consumed due to foul odor affecting vulnerable residents
			Barking deer wandering in the village	An omen of bad luck to harm
			Cobra	Allowed to be consumed but rarely
			Wild Boar	Prohibited from being consumed because it diets on waste
		S'gaw Karen	Peacock (feathers and tails)	An omen of fortune
			Barking Deer and Bear (meat)	Prohibited from being consumed by women in the perinatal period
	Sop Moei	Pwo Karen	Muntjac	Allowed to be consumed
			Bear	Refrain from killing in the forest
			Python	Refrain from killing in the forest
			Wild animals wandering in villages	An omen of misfortune
			Snake entering the house	An omen of bad luck, but prohibited to kill
			Wild animals entering the house	Prohibited to kill
			Wild Boar and Barking Deer entering a household	An omen of potential calamity
			Snake and stillbirth phenomenon	If a pregnant woman notices a baby footprint on a snake's head, it believe to cause stillbirth
			Hornbill	Shooting a hornbill is believe to cause severe drought
			Pig	A pig is killed as an offering in ceremonies to receive forgiveness from ancestral spirits
			Wild animals like Bear, Wild Boars, and Barking Deer	Allowed to be hunted and consumed
			Bear (Bear meat)	Pregnant women should be prohibited from consuming bear meat to avoid complications in newborns.
			Gibbon	Prohibited to be consumed, people consuming gibbon meat must leave the village due to potential devastations.
			Chang Chi bird	A person believes to lose their spouse by consuming this bird
			Wild Boar (male)	Allow to be consumed, but prohibited from being consumed by women in the perinatal period due to toxins in their testicles
			Wild boar	Prohibited from being consumed by people with respiratory diseases
			Cobra	Prohibited from being consumed by people prone to health complications
			Barking deer	Prohibited from being consumed by people who have respiratory diseases and the prenatal conditions of vulnerable people.

because the animals tend to consume muddy and messy food.

**In Tak and Mae Hong Son**, some Shan, northern Thai, and Pwo Karen reported that a pregnant person or a woman giving birth should not eat wild boar, as they believe the boar's testicles contain poison. Likewise, those with underlying medical conditions, especially asthma and lung disease, should not consume boars. Cobras are

wild animals that people with health problems rarely eat because they cause body pain. People from Shan, Northern Thai, S'gaw Karen, and Pwo Karen have cautioned against consuming barking deer, especially those with underlying health conditions like asthma or women who have recently given birth, as it may lead to disability or even death.



**Table 3** Perceptions or awareness toward diseases associated with wildlife exposures of ethnicities in Tak and Mae Hong Son provinces

Provinces	Districts	Ethnicities	Diseases associated with wildlife exposures	Disease prevention measure
Tak	Mae Sot	Northern Thai, Bamar, Pwo Karen	<ul style="list-style-type: none"> <li>– Lack of awareness that consuming wild meat can spread communicable diseases.</li> <li>– Lack of public health awareness received from local authorities.</li> <li>– Unable to identify symptoms of a specific disease.</li> <li>– Undercooked wild meat can expose the risk of zoonotic diseases.</li> </ul>	<ul style="list-style-type: none"> <li>– Villagers believe that consuming proper-cooked wild meat minimizes the risk of zoonotic diseases.</li> <li>– Border restrictions between Myanmar and Thailand limit the accessibility of wildlife hunting activities.</li> <li>– Local belief reported that a bruised person should not butcher hunted wild animals to avoid the risk of spreading infections.</li> </ul>
	Phop Phra District	Akha, Yunnan's Chinese, Mien or Yao, Thai, Lahu or Muser, Lisu or Lisaw	<ul style="list-style-type: none"> <li>– Lack of awareness that consuming wild meat can spread communicable diseases.</li> <li>– The majority consume wild meat for an alternative diet.</li> <li>– The Lahu ethnic group prefers consuming uncooked wild meat, which potentially causes diarrhea and parasitic infections.</li> <li>– Records of health concerns in the communities relate to food intoxication or poisoning are not available.</li> <li>– Many Yunnan's Chinese, Mien, Akha, and Lisu ethnic groups believe that consuming wild meat cures body aches.</li> <li>– Some people in ethnic groups do not believe in the health risks of consuming wild meat.</li> <li>– Women of Yunnan's Chinese ethnic group prefer only cooked wild meat to consume.</li> </ul>	<ul style="list-style-type: none"> <li>– Villagers believe that cooking meat reduces the risk of communicable diseases from wild animals.</li> <li>– Pre-cooked wild meat is considered safe to consume, yet to prevent diseases recommended to stop consumption.</li> </ul>
Mae Hong Son	Muang District	Shan or Tai Yai, Northern Thai, S'gaw Karen	<ul style="list-style-type: none"> <li>– There was no belief in transmissible diseases from animals to humans.</li> <li>– Consumption of wild meat causes multiple health conditions like aches, helminths, diarrhea, ear malaise, allergic reaction, and infections leading to death.</li> <li>– Cobra meat with alcohol as food leads to death.</li> <li>– Villagers experienced toothaches after consuming venison.</li> <li>– Consuming raw boar meat causes parasitic infections like flukes.</li> <li>– Consuming venison increases the risk of infectious diseases and skin conditions due to poor blood circulation.</li> <li>– Consuming bat meat in raw form increases the risk of communicable diseases.</li> </ul>	<ul style="list-style-type: none"> <li>– Some villagers consumed cooked wild meat rather than raw meat to minimize contamination.</li> </ul>
	Sop Moei District	Pwo Karen	<ul style="list-style-type: none"> <li>– The villagers were informed about leptospirosis by health officials that leptospirosis could be transmitted by exposure of the skin, eyes, mouth, or nose to urine or tissues from infected animals, such as rodents, or through indirect contact with contaminated soil or water.</li> <li>– Respective to COVID-19, it was said to be spread by infected bats and snakes to humans.</li> <li>– People who never consumed wild meat might have weak immunity to adverse infections.</li> <li>– The community believe that living in the forest for days could cause malaria infection.</li> <li>– Most villagers consume wild meat, particularly the men in the communities.</li> </ul>	<ul style="list-style-type: none"> <li>– Inadequate preventive measures for diseases consuming wild meat.</li> <li>– Abstain consumption and contact with poisonous wildlife to avoid zoonotic diseases.</li> <li>– Allergies consuming wild meat are remediated by the elderly with herbal medicines made by boiling and baking betel leaves, which cleanses and excretes toxins trapped in the body.</li> </ul>

*Barking deer should not be consumed by people with health conditions, especially for those having underlying asthma or women who have recently given birth. It can lead to disability or even death.*

*A Pwo Karen male in Mae Sot District, Tak province (FGD\_001)*

#### **Beliefs concerning the killing of wild animals**

**In the Tak and Mae Hong Son provinces,** some Shan, Northern Thai, S'gaw Karen, and Pwo Karen respondents shared a common belief that some wild animals should not be harmed or killed. For example, they avoid catching, shooting, or killing a barking deer when it wanders

into their villages, as these activities might bring about trouble and disturbances in their communities. Similarly, they believe that slaughtering large wild animals, such as bulls or wild buffalo, may lead to negative consequences, such as death, because these animals are thought to have ghost owners (a spiritual entity believed to own or protect an animal) who could cause harm or death to someone in their village or neighboring villages.

*Killing large wild animals like bulls or wild buffalo can lead to negative consequences, including death. We believe they (bulls or wild buffalo) have ghost owners (a spiritual entity believed to own or protect an animal).*

*A Pwo Karen male in Sob Moei district, Mae Hong Son Province (IDI\_002)*

Shan and northern Thai people in the **Muang district of Mae Hong Son** are prohibited from killing wild animals that enter the community because it would bring misfortune to the community and may cause a negative impact. S'gaw Karen and Shan in the area consider hunting to be a way of life. Thus, forest officials enforce the law only under certain conditions. When hunting, gun hunters must be cautious because the local conservative officer will arrest them, record their use of the gun, and release them without prosecution. However, exceptions exist for certain groups, such as indigenous people, who may have traditional hunting rights. Additionally, indigenous people can obtain hunting permits for specific animals under regulated conditions.

*As hunters, we know we must be careful with our guns. The forest officials will arrest and record our use of the gun. We can hunt under specific conditions, but we must be cautious because they strictly enforce hunting laws.*

*A Shan male in Muang district, Mae Hong Son Province (IDI\_004)*

Some Pwo Karen villagers in the **Sop Moei district** hold the belief that it is illegal to shoot gibbons. As reported, gibbons are abundant in the Tiphon Win and Doi Pha Tang forests. The belief is that killing a gibbon will destroy one forest area. Additionally, if the villagers kill a hornbill, it will destroy all large trees and cause a drought. Pwo Karen villagers also have beliefs about pregnant family members, such as that when family members enter the forest, they should not kill bears or pythons, and pregnant women should not eat bears, as this may result in the death of a child or infant. Even though the respondents had never encountered such a circumstance, it is part of their beliefs and way of thinking.

#### **Signs of good luck**

Snakes entering the house are considered lucky and bring good fortune, as reported by northern Thais in **Tak and Mae Hong Son provinces**.

#### **Signs of bad luck**

##### **Seeing wildlife in the forest**

In **Tak province**, some Yunnan Chinese believe that seeing wild animals that live in holes and scales, like pangolins, during the day will cause bad luck. Some Akha respondents stated that if they encounter a loris on the day they go into the forest to plant, they should abandon that area and seek out a new location for cultivation, as continuing to farm there will result in low agricultural productivity. This belief derives from previous generations.

*When we see a loris on the day we go into the forest to plant, we will abandon that area. If we continue to farm there, it will result in poor productivity.*

*An Akha male in Prob Phra district, Tak province (FGD\_002)*

Most Northern Thai and Bamar respondents also reported that if a dove or owl flew into a house, it was considered a bad omen that someone would die. If the red-wattled lapwing had chirped and flown through the village, there would have been a death.

*If a dove or an owl fly into the house, it means someone will die. It is a bad omen.*

*A northern Thai male in Mae Sot District, Tak province (IDI\_006)*

In the **Mae Hong Son province**, the Pwo Karen villagers believe that if a pregnant woman sees baby footprints on the head of a snake, particularly a Boa, the baby may die shortly after birth.

##### **Hearing the sound of wildlife**

In the **Mae Sot district of Tak**, the Shan and northern Thai mentioned that if an owl flies to the front of the settlement and the residents hear someone's name shouted, they may get sick or be in danger. The Shan also reported that hearing the sound of a tiger roaring would bring misery and disaster to the village.

*Actually, most beliefs are related to big animals. For example, a tiger roaring will cause misfortune to the whole village. When I was a child, my elders told me the villagers would evacuate to other places when a tiger roared like this.*

*Shan males and females in Muang district, Mae Hong Son Province (FGD\_002)*

**Wildlife entering the community**

In the Mae Sot district of Tak, the northern Thai villagers reported that if a four-legged wild animal enters the village area, it is forbidden to attack, catch, and eat it because it will cause the people who eat it to suffer misfortune and cause trouble for the village. Most of the respondents thought they should believe the stories of the seniors. Otherwise, something terrible might happen. Beliefs have diminished in recent years due to the frequent entry of wild animals into villages. Eventually, there is a decrease in forest coverage.

In the Sop Moei district of Mae Hong Son, Pwo Karen villagers stated that bringing live wild boars or chamois into the village is forbidden because the animals bring bad luck. This belief was passed down from previous generations. They also consider snakes in the community to be a bad omen. As a result, villagers prohibited the killing of snakes. Nowadays, beliefs are significantly reduced; however, in the community, a person fell down a tree, and people suspected that it was related to this type of transgression.

*We believe that bringing live wild boars or chamois into our village brings bad luck. This belief has been passed down from our ancestors.*

*A Pwo Karen male in Sob Moei district, Mae Hong Son Province (IDI\_003)*

According to reports from northern Thais, bringing live wild animals into the village causes bad luck or negative occurrences. Some Pwo Karen mentioned that if barking deer or wild boars enter a home or community, it is seen as a bad omen. This can lead to unusual events, such as people feeling haunted by ghosts or experiencing legal disputes within the community. Community elders also recounted tales of terrible events when wild animals intruded upon the community, such as a herd of untamed deer entering due to adultery. As a result, a person who did the wrong thing had to organize a ghost-raising ceremony to ask for forgiveness from the ancestors' spirits, known as "Mawi Te" (the ritual involves killing pigs as an offering). This ceremony involves offerings to the ancestors' spirits, typically by sacrificing pigs, to ask for forgiveness and restore harmony to the community. Although this practice is rooted in deep cultural traditions, it has become less common in modern times. This belief still exists, but it rarely happens.

The Akha of the Prob Phra district has strong cultural practices regarding omens and wildlife. For example, they believe that if a snake enters the house, it is a bad

omen, so they must kill it, pack it with unhusked rice, and transport it outside the village. Some Akha people still consume dog meat, but they refuse to kill dogs in their homes because they believe it will bring bad luck to the village.

*When a snake comes into the house, we believe it is a sign of bad luck, so we have to beat it to death and then wrap it with rice before taking it out of the village.*

*An Akha male in Prob Phra district, Tak province (FGD\_001)*

Some Akha people still prefer to eat dog meat but will not kill them in their homes because they believe it will bring bad things into the village.

In the Muang district of Mae Hong Son, the Shan and northern Thais mentioned that barking deer and monitor lizards are not permitted to enter their homes or villages because they are considered bad omens. If they enter the village, the villagers are required to perform a house merit ceremony.

The ethnic groups of northern Thai, Pwo Karen, Lahu, Chinese, Mien, Akha, and Lisu in the Mae Sot and Phop Pra districts have similar beliefs about the wildlife like a muntjac or a serow walking into the village was a bad omen, and an accident or a disaster would happen. Notably, they would not kill large and medium-sized wild animals entering the village, believing this might cause bad things or bring evil.

Shan and S'gaw Karen in the Muang district of Mae Hong Son reported that anyone who enters the forest and accidentally encounters a peacock would perish. If the individual only sees the feathers and tail and not the entire peacock, it will bring them good fortune for the day.

**Perceptions toward diseases associated with wildlife exposure**

**Awareness and concern regarding zoonotic diseases**

In Tak province, most of the northern Thai men, including Bamar and Pwo Karen people in the community, have no concern about communicable diseases and lack knowledge of communicable diseases from the consumption of wild animals. The perception or awareness of animal-borne diseases and their prevention is relatively low because the local community authorities and health staff have not directly communicated to provide knowledge. In addition, there is no clear disease situation in the areas that could be linked to wildlife consumption. Nonetheless, most northern Thai respondents mentioned that the slaughtering process is unlikely to cause infectious diseases in wildlife. However, they reported that if a person

has a wound on their hand, they should not dissect wild animals to avoid contracting a blood infection (Table 3).

*I don't know (about the diseases) either. The way to prevent it (disease transmission) from the animal (we) need to cook the meat first (before eating). I understand that if we have a wound, it might be infected, but I think it's probably a blood infection. A northern Thai male in Mae Sot District, Tak province (IDI\_001)*

The majority of northern Thai, Bamar, Pwo Karen, Akha, Yunnan's Chinese, and Mien respondents in Tak province believe that infectious diseases caused by wildlife consumption are possible if food is undercooked, which can lead to parasitic diseases, and wild chicken consumption can be a carrier of avian influenza.

*Wild animals don't get vaccinated like us. It (wild chicken) could cause any disease. We ate it instantly, some cooked, some raw, something like that. Northern Thai males in Mae Sot District, Tak province (FGD\_001)*

Some northern Thai and Bamar respondents from Tak province reported the potential health risks associated with consuming wild animals, indicating that there may be certain dangers in consuming these animals without proper preparation or understanding of potential health hazards.

*My daughter used to eat it (wild boar meat), and there was excess saliva in her mouth. It (wild boar meat) probably contained an infection. A bamar male in Mae Sot District, Tak province (IDI\_002)*

Some northern Thai villagers in the Mae Sot district also reacted adversely after consuming wild animals. The adverse reactions mentioned specifically include leptospirosis and allergies.

*There should be a lot (of pathogens in the wild animals). Like me, I had leptospirosis and allergies (after consuming wild animals). Northern Thai males in Mae Sot District, Tak province (FGD\_002)*

Furthermore, northern Thai respondents in the Mae Sot district claimed that learning about COVID-19 was a communicable disease due to eating unusual dishes.

*There is strange eating of bats by simply scalding them with water and eating them (that seeing from*

*the news). The first coronavirus patient had a history of eating bats that carried viruses, causing COVID-19.*

*Northern male in Mae Sot district, Tak province (IDI\_003)*

**In Mae Hong Son province**, some Pwo Karen, Shan or Tai Yai, Northern Thai, S'gaw Karen obtained information from a health-promoting hospital (HPH) about a communicable disease related to the consumption of wildlife in the community that occurred, such as leptospirosis. The disease can be transmitted in many animals, most commonly in rats, possibly from eating contaminated food or contacting disease-carrying animals. Regarding COVID-19, some respondents reported that infected bats or snakes caused it and then spread to humans. Furthermore, some people reported that those who have never eaten wild animals or have low immunity may develop allergic reactions to consuming wild animals, such as barking deer.

*I think the rat is probably the carrier of diseases; I think the rat is the carrier of leptospirosis, which is at risk of causing contagious disease. Personally, I'm not sure. I'm afraid of rats.*

*Pwo Karen males in Sop Moei district, Mae Hong Son Province (FGD\_001)*

**In Tak province**, the majority of Lahu, Yunnan's Chinese, Mien, Lisu, and Akha ethnic respondents are unaware of cases of contagious diseases caused by eating wild animals directly. Most people prefer wild animal meat, such as wild boar, because it tastes better than market meat, and certain ethnic groups attribute special properties to game meat. Some people in the community, especially the Lahu ethnic group, also consume undercooked wild animal meat, which can cause diseases from parasites or diarrhea. However, there is no information on whether people in wildlife-eating communities have illnesses or transmission of infectious diseases from animals to humans. Some northern Thais also reported that COVID-19 is a contagious disease caused by the consumption of wildlife, but the consumption of well-done meat can reduce the risk. However, wildlife consumption is currently declining dramatically because the Thai-Myanmar border was closed due to COVID-19 travel restrictions. Also, wildlife on the Thai side of the border in the Tak province is declining, making it more difficult for community members to find wildlife.

#### **Consequences of consuming wild animals**

Most Yunnan, Mien, Akha, and Lisu in **Tak province** believe that eating wild animals is able to cure body pain. Some people who reported eating wild animals felt better

and thought there was no harm or direct harm to their bodies. However, some respondents in the **Tak and Mae Hong Son provinces** emphasized the danger of consuming wild animals without proper cooking methods and the possibility of allergic reactions. Some respondents reported that many people consume wild animals and subsequently die. It was understood that wild animals themselves were not inherently poisonous but that there were cases where individuals who consumed them suffered fatal consequences. The Mien male specifically mentioned the tragic death of his brother, who passed away after consuming raw wild boar Larb (a spicy salad mixed with fresh vegetables).

Similarly, the Pwo Karen male from Sop Moei district explained that consuming wild meat had the potential to cause allergic reactions that could result in redness and itching of the skin.

*If we consume bushmeat, it might cause us to have an allergic reaction. It becomes red on our skin and causes the sensation of itching. The main allergy symptoms will cause a rash on the skin like this (he showed his skin to the researcher). Some people can't eat wild meat because they have allergies to it.*

*Pwo Karen male in Sop Moei district, Mae Hong Son province (IDI\_005)*

**In Muang district, Mae Hong Son province**, some Shan community members consumed venomous animals raw, causing body aches, helminth infestation, diarrhea, ear malaise, allergic reactions, and a risk of infection until death. Most respondents in the community reported that some community members died from eating cobras with alcohol.

Some of the northern Thai also reported that some community members got toothaches from eating venison or wild deer meat, and they were more likely to get parasites if they ate them raw.

*If we have a toothache, eating venison will worsen it. A northern Thai male in Muang district, Mae Hong Son Province (IDI\_003)*

Some respondents stated that infectious diseases caused by animal consumption are dependent on the wildlife species. For example, eating venison causes skin disease or makes a person more susceptible to infectious diseases than other animals because it causes people with poor blood circulation to suffer from more side effects than the average.

Some Shan also stated that wild boars should not be eaten raw because they may harm their health. They noted that wild boars are omnivorous and may be more susceptible to diseases, including parasites such as flukes,

because they consume a variety of foods, including potentially dirty ones.

*Wild boars can't be eaten raw. Wild boars are omnivorous and, therefore, more vulnerable than other wild animals. Wild animals that do not eat plants are the most dangerous.*

*A Shan male in Muang district, Mae Hong Son Province (IDI\_004)*

*Wild boars are at risk of getting parasites because they eat dirty food.*

*Shan males in Muang district, Mae Hong Son province (FGD\_002)*

#### **Practices related to wildlife contact and consumption**

##### **Practices and practices from slaughtering wild animals**

**In the Tak and Mae Hong Son provinces**, most villagers slaughtered wild beasts (including species such as wild boars, barking deer, and other large wild animals); they did not put on protective gear. When the slaughter was done, they did not have to clean up the blood. A Shan male from Muang district also emphasized that if a person who dissected and came into contact with the wild animal's blood had wounds, there might be some risk of infection.

*If the person who dissected and touched the wild animal's blood and if we have wounds, there might be some risk.*

*A Shan male in Muang district, Mae Hong Son province (IDI\_004)*

##### **Practices of consuming proper cooked wild meats**

There are different methods for preventing contamination from infected wild animals. Some Mien, northern Thai, and Shan respondents in **Tak and Mae Hong Son provinces** reported that they began to consume cooked wild meat and tried to avoid eating it raw during and after the COVID-19 pandemic. However, there is no other belief about any diseases being transmitted from animal to human. Some Yunnan's Chinese villagers in **Tak province** reported that all wildlife should be cooked before eating. Even if it is cooked, it can still be harmful to someone's health.

**In the Phop Phra district of Tak province**, some respondents reported that the best way to prevent the disease from eating wild animals is to stop eating wild animals and that pre-cooking wild animal meats will make the consumption of wild meat safer. Most people in the community believe that cooking can reduce the risk of disease or harm from consuming wildlife.

*I think all wild animals are poisonous. If we ate well-done meat, it would be safer. However, even if we ate well-done meat, it might also be poisonous (for some people).*

*A Mien male in Phop Phra district, Tak province (FGD\_002)*

## Conclusions and discussions

This concurrent qualitative study provided comprehensive information on wildlife-related beliefs, taboos, usages, health perceptions, and practices among ten ethnic groups in Tak and Mae Hong Son provinces. The study respondents consisted of northern Thais, Lahu, Chinese, Mien, Akha, Lisu, Pwo Karen, and S'gaw Karen.

The results showed that the northern Thais, Bamar, S'gaw Karen, and Pwo Karen of this study have no explicit restrictions on the consumption of wildlife. Additionally, individual beliefs and taboos regarding the contact, usage, and consumption of wildlife vary based on their families' backgrounds. The Akha, Lisu, and Lahu ethnic groups share similar beliefs about wildlife, such as the belief that ghosts inhabit large wild animals like bulls or wild buffalo. However, some Shan and northern Thai people in this current study believe that eating wild animals shows a man's ability to hunt and demonstrate wealth. A previous study of ethnic Hmong in Laos revealed that the Hmong engaged in hunting as part of their traditional practices and livelihoods [28]. Likewise, previous studies in Laos regarding the belief that consuming wild animals could promote better health and the frequency of wildlife consumption demonstrates the social significance of these animals [29–31].

This current study also reported that some northern Thais believe that children, women, pregnant women, and seniors should avoid consuming some wildlife, particularly wild deer and barking deer meat, because it causes body aches and pains and is toxic to the young mother. These results are consistent with a previous study's findings that traditional Thai beliefs and practices are obviously intended to protect a new mother and baby's life and well-being [32]. Also, a study on the beliefs and taboos of the people of the northern periphery of Korup National Park revealed that pregnant women are barred from eating brush-tailed porcupines because of their potentially negative impact on a child's intellectual capacity and some other wildlife species restricted from pregnant women [33].

According to this current study, some families' Bamar and Pwo Karen beliefs are transferred from their parents; for example, eating frogs or strange wild animals is prohibited because they accumulate toxicity in the body, causing allergic reactions and blisters. There is also the belief that it is forbidden for people to eat turtles or ducks

together unless they are family members, friends, or relatives, as this will cause people to separate and live apart. People born in the Year of the Goat (Chinese calendar), according to some Pwo Karen, should refrain from eating goat meat. These findings were consistent with previous studies that reported the association between religious or cultural taboos and wildlife use [34, 35], and several species-specific taboos have their origins in beliefs that animals are religious symbols or even just as an aversion to the presence of toxins due to their poisons or unpleasant physical characteristics [36].

As per our current study respondents' perceptions or awareness of diseases associated with wildlife contact behaviors, most male respondents from all ethnic groups were unconcerned about communicable diseases and lacked information on communicable diseases caused by wild animal consumption. Our few respondents indicated that wildlife should not be consumed raw or uncooked. Some cooked meat could still harm one's health. The consumptions may cause diarrhea, body aches, allergic reactions, COVID-19, ear malaise, helminths, parasitic, and other animal-borne diseases, and a risk of infection until death. Some respondents mentioned being aware of some diseases caused by eating wild animals, such as diarrhea, influenza, asthma, and skin diseases. The above results were similar to a study of zoonotic disease risk perception in Cameroonian bushmeat markets, revealing that most bushmeat workers lacked understanding and did not wear gloves because they thought that disease risk was low despite contact with wildlife. However, respondents with a higher level of education were more concerned about outbreaks and more willing to accept the risks associated with butchering and preparing meat [37]. Therefore, addressing knowledge about wild animal contact and its health implications is crucial to increasing awareness of animal-borne diseases and promoting the prevention of the appropriate contact characteristics with wildlife.

In this study, several ethnic groups, such as the Shan, Northern Thai, S'gaw Karen, and Pwo Karen, have beliefs that discourage the killing of certain wild animals, viewing them as bad omens that could bring misfortune to their communities. These beliefs reflect a strong connection between cultural practices and wildlife conservation. Similarly, a previous study showed that ethnic minority communities practicing several beliefs and taboos in northern Thailand positively affect the sustainable management of natural resources, while others have adverse effects [6, 7]. For example, a study showed that the Karen believe the sound of gibbons near the people's agricultural land will bring good crops [38]. A taboo against hunting and eating gibbons indirectly contributes to the conservation of endangered species in the Mae Hong Son forest [38, 39]. On the other hand, the study found that

some wild animals, such as snakes, are seen as signs of good luck for Shan and northern Thai but as bad omens for the Akha ethnic group. These beliefs reflect the deeply rooted spiritual connections that ethnic communities have with wildlife and their natural environment.

The Shan or Tai Yai community in Chiang Rai province has a distinct perspective on beliefs and taboos, as indicated by a prior study [40]. They are prohibited from killing any wildlife due to their adherence to traditional beliefs, as it would cause significant destruction or disorder in their community [40]. Individuals who transgress taboos by killing protected animals may face social isolation and loss of status, underscoring the community's commitment to cultural traditions and wildlife conservation. [40]. Similar to the results of this current study, several ethnic groups, such as the Shan, Northern Thai, S'gaw Karen, and Pwo Karen, have beliefs that discourage the killing of certain wild animals, viewing them as bad omens that could bring misfortune to their communities. This showed the strong impact beliefs and cultural practices may have on wildlife conservation.

Previous studies highlighted the Yunnan Chinese community's adherence to a mixture of Buddhism and Taoism, which results in specific prohibitions on wildlife consumption [41, 42]. Similarly, Colding and Folke emphasized that cultural taboos often served as effective conservation measures by restricting the hunting and use of certain species [43]. [44] also found that the Dayak people's traditional beliefs in Borneo encouraged using resources sustainably and prevented overuse. Additionally, Talukdar and Gupta highlighted the significant role of local communities' beliefs and conservation traditions in wildlife protection through community involvement and cultural practices [45]. These previous studies aligned with the findings of the current study, where various ethnic groups such as the Pwo Karen, Shan, Northern Thai, and S'gaw Karen hold strong beliefs against killing specific wild animals. These beliefs are frequently associated with conserving endangered species, as harming these animals is believed to bring misfortune or negative consequences to communities.

A previous study highlighted the close ties of tradition and belief that the Akha people in Northern Thailand have with animals, particularly chickens [46]. They used chickens as offerings in their daily rites and prohibited killing certain types of chickens, such as the junglefowl, which the gods believed to be favored [46]. However, this current study focused on a different group of Akha people in the Phop Phra district of Tak province, and it found no mention of prohibitions against killing chickens among them. Instead, the Akha people in this district mentioned taboos related to snakes entering households and prohibited the slaughtering of bulky animals like

bulls and buffalos. Additionally, they avoided consuming dog meat due to its association with misfortune.

Our results showed that the characteristics of wildlife contact are both similar and different in the beliefs and taboos of various ethnic groups and study locations, which are influenced by cultural backgrounds and traditions. While some ethnic groups have no explicit restrictions on the consumption of wildlife, others adhere to specific beliefs and taboos that prohibit the consumption or killing of specific wild animals. These beliefs frequently correspond with conservation initiatives, thereby facilitating the preservation of threatened species. Furthermore, the study findings revealed that different levels of awareness regarding the health risks associated with wildlife consumption exist, suggesting the necessity of targeted education and risk communication. Importantly, our findings could provide in-depth information to suggest health implications, such as proper interactions with wildlife, particularly wildlife contact and consumption characteristics, and how to protect themselves from the spread of zoonotic diseases among different ethnic groups at the study locations. These findings were consistent with previous studies in the North American Arctic and Boreal Biomes [47] and China [48]. The health implications of these interactions are profound. For example, the Ebola virus, HIV, and various coronaviruses, including SARS-CoV-2, have been linked to wildlife reservoirs [49]. These pathogens can cause severe illness and death in humans, leading to significant public health crises [50]. Furthermore, once a zoonotic disease establishes itself in the human population, it can spread rapidly, as seen with the COVID-19 pandemic, leading to global pandemics with devastating socioeconomic impacts [51]. Therefore, it is imperative to emphasize the importance of minimizing risky interactions with wildlife to prevent the emergence and spread of zoonotic diseases. Public health interventions should focus on educating ethnic groups about the risks associated with wildlife contact, promoting safer practices, and developing sustainable alternatives to wildlife use that respect cultural practices while reducing health risks. Finally, the health implications of wildlife interactions are far-reaching, with the potential to spark outbreaks of zoonotic diseases that can escalate into global health emergencies. Strengthening surveillance, promoting intersectoral collaboration through a One Health approach, and engaging communities in prevention strategies are crucial steps in mitigating these risks.

This is to note that our study's strengths included the ability to provide perspectives, beliefs, and cultural contexts for various ethnic groups that influence how people interact with specific species of wildlife in different provinces and locations. This study was able to collect data on illegal interactions with wildlife, such as hunting and

consumption, even though some respondents tended to conceal their actual behaviors since some were afraid of being arrested by local authorities. Our researchers successfully employed probing and trust-building techniques to protect the respondents' identities and information while allowing them to feel trust to share their actual activities and information. However, our study's limitations comprised data collection among different genders, which was not a top priority because the primary goal was to collect extensive data on beliefs and taboos regarding wildlife in the target locations. Giving that hunting is predominantly a male activity, we mainly recruited males with histories of hunting and consuming wildlife to obtain information for this study. In addition, we attempted to gather data on different genders, various age groups, different occupations, and various sociodemographic backgrounds from those who participated in our study. Fortunately, we were able to gather information about females and children in the communities, as they were also involved with the preparation and consumption of wildlife meats within the communities. It is important to note that our research team made every effort to ensure gender balance, which included addressing gender and ethnicity equity and diversity during the field implementation.

### **Recommendations**

The findings mentioned above can offer recommendations for the development of communication and education strategies, implementation plans, and additional research, as described below.

#### **Improve health literacy levels and promote health awareness**

Public health officials and local authorities should develop and implement communication and educational initiatives to address the lack of appropriate knowledge and practices related to zoonotic disease risks from wildlife contact and consumption activities. These campaigns should aim to enhance appropriate health literacy and promote safe handling, preparation, and cooking practices, which can effectively minimize the risks of zoonotic disease transmissions and infections that might lead to potential future pandemics. The Health Belief Model (HBM) [52, 53] should be employed in campaigns to raise health-risk awareness and encourage behavior change among community members, taking into account cultural contexts and beliefs. Additionally, the HBM should be applied because it is widely accepted as a framework for changing individual health behaviors and has been applied in numerous studies [54–57]. The process includes evaluating one's perceived vulnerability to risky conditions or illnesses, the severity of the situation, the benefits of changing behavior, and the barriers

to action [53], and it can be used during the design and implementation stages of campaigns. Moreover, the Food and Agriculture Organization (FAO) recommended that there should be interventions related to risk communication and raising awareness about public health, hygiene, conservation, and animal protection, particularly regarding public health messages that should be communicated prior to, during, and after zoonotic disease outbreaks [58]; therefore, these ethnicities should be provided the necessary aforementioned knowledge.

#### **Conservation education and outreach activities**

To promote suitable interactions with wildlife, forests, and environments among different ethnic groups, occupations, and sociodemographic statuses of villagers in the study areas, it is necessary to design and implement wildlife conservation education and outreach activities using the "Theory of Planned Behavior (TPB)" [59, 60]. Conservation education has the potential to assist individuals in comprehending the risks associated with the illegal hunting and trade of wildlife, the improper handling of wildlife, and the destruction of habitats, all of which contribute to the transmission of zoonotic diseases. Outreach activities may also foster adherence to local and global regulations intended to safeguard both human and wildlife populations. Communities that understand and adhere to these regulations may significantly reduce their chance of getting zoonotic disease infections. Moreover, community engagement is important. By engaging local communities in wildlife conservation initiatives, programs may develop a sense of responsibility and obligation towards the natural environment. This collaborative initiative has the potential to promote the acceptance of environmentally sustainable practices and decrease activities that pose a threat to both human and wildlife populations. These can be achieved by considering the cultural contexts, beliefs, taboos, and practices of various ethnic groups.

#### **Enhance various stakeholder collaborations**

The aforementioned recommendations should involve a diverse range of stakeholders, including local leaders, religious influencers, community members, schoolteachers, students, health professionals, village health volunteers, and civil society organizations, in order to promote optimal health practices and conservation initiatives. By working together, these stakeholders can design effective educational communication plans, strategies, interventions, and materials tailored to different literacy levels and cultural backgrounds.

#### **Plan for future research implementations**

It is recommended that future research be conducted with a diverse range of genders, including females who



have also interacted with wildlife by preparing and consuming wild meat [25], children who may have the opportunity to enter the forest and encounter wildlife, and individuals from a variety of professional occupations, pregnant women, children, and sociodemographic statuses, including those may have different activities that bring them into contact with wildlife.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-19941-5>.

Supplementary Material 1

## Acknowledgements

We would like to express our appreciation to the Provincial Chief Medical Officers (PCMOs) of Tak and Mae Hong Son, as well as their respective local health officials and municipal authorities, for their assistance and cooperation throughout the research process. In addition, we would like to express our gratitude to Associate Professor Dr. Pratap Singhasivanon and Ms. Sara Woldehanna for their valuable guidance in preparing the manuscript. Additionally, we would like to thank Mr. Watthanachai Boonlakorn for his support during the data coding procedures.

## Author contributions

K.S.S. and A.A. designed study. K.S.S., K.T., and A.A. wrote the main manuscript text. K.S.S., K.T., T.P., W.T., N.S., P.K., S.P., K.K.S. carried out data collection implementation in fields. K.S.S., T.P., K.B., and K.T. analyzed the data.

## Data availability

The data can be obtained upon request. However, it is strictly prohibited to disclose the identities of respondents and their practice information to maintain confidentiality, especially in cases related to sensitive behaviors such as hunting and wildlife consumption. To obtain the raw data used for the analysis of this manuscript, please reach out to either the corresponding author or the first author.

## Declarations

### Ethics approval and consent to participate

The study protocol (Ref. No. 075.1/63) was approved by the Research Ethics Review Committee for Research Involving Human Research Respondents, Health Sciences Group, Chulalongkorn University. Provincial, district, and community-level health officials approved the study's implementation and collaboration. IDs and FGDs were conducted only after receiving written informed consent, which included permission to record audio of the interviews and discussions. The respondents were ensured that the research team would maintain the confidentiality of their identities and the information they shared. The data and documents of the study are stored in a password-protected computer and locked cabinet at the Faculty of Veterinary Science at Chulalongkorn University for three years following the completion of data collection and publication.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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Received: 14 February 2024 / Accepted: 29 August 2024

Published online: 06 September 2024

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