



## ETHNOMEDICINAL BELIEF, PRACTICE AND METHODS OF USING OWL IN BUDHIGANGA MUNICIPALITY, BAJURA, NEPAL

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### ABSTRACT

The use of ethnomedicine for disease treatment has been practiced since the early development of human civilization. However, traditional ethnomedicinal practices involving owls and their perceived therapeutic roles remain poorly documented and require further scientific investigation. Owls, considered as important predators that help control of pest populations, are also considered valuable indicators of ecological health. The present study aimed to collect traditional knowledge, medicinal beliefs, and practices associated with the use of owls in Budhiganga Municipality, Bajura, Nepal. A questionnaire survey was conducted among 388 respondents in the far western hilly region of Nepal. Among them, only 32 respondents had substantial knowledge regarding the traditional medicinal uses of owls, with the majority believing that owl-derived remedies could be used to treat cancer. Gender-wise analysis indicated that female respondents were more knowledgeable about the medicine. Similarly, age-group analysis found that  $\geq 59$  age-groups had a high percentage of respondents with that knowledge ( $p < 0.05$ ). Ethnic-group or caste-wise data revealed that most Brahmins had more knowledge but there was no variation on the knowledge with other ethnic groups. Occupational factors showed that respondents in the civil service had a higher level of knowledge of owl ethnomedicine ( $p < 0.05$ ). The data showed that elderly citizens had greater faith in traditional medicinal uses and values of owls than younger generations. Various groups of people residing in Budhiganga Municipality, Bajura, Nepal, possess knowledge regarding owls and their traditional medicinal uses. Therefore, we recommend the development and implementation of appropriate policies and awareness programs to educate local communities about the ecological importance of owls and to discourage their use in traditional medicinal practices. Such initiatives would contribute to the conservation of owl populations while promoting sustainable and evidence-based healthcare practices.

**Keywords:** God's vehicle, Hunting, Owls, Traditional knowledge, Traditional medicine

### INTRODUCTION

Humankind has maintained a close relationship with wildlife since the nomadic period (Alves & Rosa, 2005). It is estimated that more than 60% of remedies used in traditional medicine are derived from biological sources (World Health Organization, 2013). The use of wild animals and plants for medicine, food, cultural practices, and recreation has played a significant role in promoting human health and socio-cultural development (Costa-Neto, 2005; Ghimire et al., 2020). Ethnobiological practices are historically and geographically diverse, particularly in the Hindu-Kush Himalayan regions, including Nepal, where traditional knowledge remains deeply embedded in local communities (Ghimire et al., 2020). Numerous animal and plant species have been

used by ethnic and indigenous people from low to high altitudes in Nepal (Ghimire et al., 2020). Among these, owls have attracted the attention of ethnobiologists because of their traditional medicinal uses. Owing to their nocturnal behavior and unique appearance, owls have long been regarded as both auspicious and ominous birds in different cultures (Cenzato & Santopietro, 1991; House of Good Fortune, 2025).

The most comprehensive global review of owls recognizes approximately 250 species of owl belonging to families, Tytonidae and Strigidae, distributed across all continents except Antarctica (König et al., 1999). Nepal supports 23–25 owl species from these two families, including Critically Endangered species like Dusky Eagle Owl, Tawny

Fish Owl, Eastern Grass Owl, and Endangered species like Spot-Bellied Eagle-Owl at the national status (Shrestha, 2001; Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Baral & Inskipp, 2020; Acharya & Ghimirey, 2023). Owls are wide-ranging nocturnal predators that occupy diverse niches worldwide (Shrestha, 2001; Sharma et al., 2018; Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020). Despite their ecological significance, information regarding their population status and conservation is limited, particularly in the Sudurpashchim Province. Unlike other regions, in the Himalayan regions, livelihood is directly associated with wildlife through food, culture, and rituals (Mussarat et al., 2021). Studies create more understandable relationships between fauna and humankind (Lohani, 2010). It seems that people are only interested in bird conservation in hilly regions in protected areas. The presence of such birds in the natural environment is a subject of interest for many ethnobiologists who believe in using birds for medicinal purposes; for example, use of body parts, including skeletal parts, pellets, meats, and feathers of owls, was also in practice for a long history (Mikkola, 2019; 2022), and animal components were reported to make modern medicine in pharmaceutical practices in overall parts of the world (Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Rashid et al., 2021; Acharya & Ghimirey, 2023).

While ethnomedicinal values of owls and other animals in the Nepalese society have been reviewed and researched in many parts of the world (Adhikari et al., 2020; Ghimire et al., 2020; Ghimire et al., 2021; Soni, 2022), there is little literature regarding the knowledge of using owls as medicine in Nepal (Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Acharya & Ghimirey, 2023). For example, Acharya & Ghimirey have scientifically described many traditional beliefs of people on these birds as medicine (Acharya & Ghimirey, 2023). Owls' uses as medicine by different populations have been reported globally, for example, in Africa, Europe, Asia, and South America (Gosai et al., 2012; Mikkola, 2019; 2022). Although Department of National Parks and Wildlife

Conservation & Department of Forest and Soil Conservation (2020) reported a few social and traditional beliefs about owls, further research is needed to examine people's perceptions.

However, the perceptions of people at the local level in the Far Western region are incompletely understood. This is very important because identifying people's knowledge of owls would be essential for documenting that knowledge, searching for evidence of medicinal properties, and translating their knowledge into medicine. In addition, it will be beneficial to proceed with the formulation of plans, policies, and programs for the conservation of owls. Thus, this study's main aim is to document the ethnic knowledge and the importance of owls in society, and predict the ethnomedicine of owls, which will also help control illegal hunting and promote owl conservation.

## **MATERIALS AND METHODS**

### **Study area**

The study area was conducted in all ten Wards of the Budhiganga Municipality (29° 18' 06" – 29° 25' 11" N, 81° 23' 28" – 81° 15' 36" E), Bajura, Nepal, the western part of the lesser Himalayan region (Fig. 1). It covers an area of 59.2 km<sup>2</sup> from 708 m to 2500 m above sea level (asl). Climate includes tropical and subtropical weather. About 38% of the land is agricultural, and 37% is forested. The total population of the study area is 20,185 people according to the 2021 census. Dominated by Brahmins, Chhetris, and Dalits, the majority depend on agriculture, with livestock domestication, although a few migrate to nearby regions of India for employment. Some of the essential fauna in the municipality include mammals such as bear, common leopard, langur monkeys, porcupine, and wild boar; reptiles such as green snake, lizard, skink, rat snake, and viper; and birds such as cuckoo, eagle, woodpecker, and whistling thrush. Although a few limitations in the area include diverse geographical landscapes, rural areas, illiteracy, unemployment, traditional and conservative contexts, and the recent initiation of advancement in education, health, communication, professional development, and awareness, these can be evidenced within the Municipality.

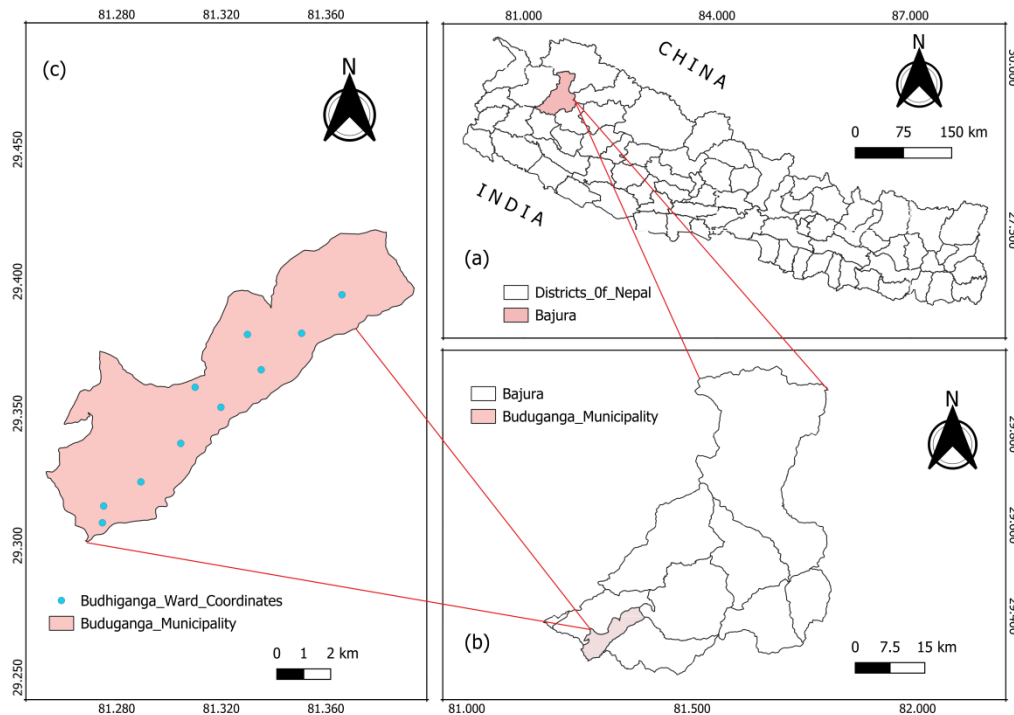


Figure 1. Map of the study area showing household sampling locations

**Study types and sampling**

A random sampling method was used to find the number of participants (n = 388). Given the largest total survey population, Slovin's formula with a 95% confidence interval (error tolerance, e = 5%) was chosen to reduce bias (Tejada & Punzalan, 2012). If n means sample populations, and N means total finite populations above 18 years, then n was calculated by the formula:

$$n = \frac{N}{(1 + Ne^2)} = \frac{13656}{[1 + 13656 (0.05)^2]} = 388$$

[n = the number of populations sampled; N = the total number of populations above 18 years old; e<sup>2</sup> = the error tolerance].

Then, for each Ward of the Municipality, strata were formed containing 40 houses, either grouped or in a straight line along the road/street, resulting in the selection of 400 homes. The choice of participants was based on i. males or females aged 18 years or older; ii. those who were willing to participate in the research voluntarily; and iii. who were willing to respond to the answers and sign the consent forms. Finally, these volunteer respondents were interviewed via convenience sampling with a pretested questionnaire.

**Data collection**

A questionnaire survey and a focus group discussion were conducted in the study area. The study was conducted from April to June 2023. A preliminary visit to the study site was conducted in September 2022 better to understand the survey sites and the study population. At the same time, questionnaires were pretested and verified to ensure that the questions were clear, culturally appropriate, and free of bias. The survey questionnaire was standardized based on the pre-confirmed facts from the focal group discussion (FGD) and with the help of the supervisor (Roopa & Satya, 2012).

**Focal group discussion**

A total of three FGDs were conducted to test the extent of the survey design, collection of pre-consent from locals, and basic observation of the local areas. Meanwhile, each discussion lasted one to three hours, with an average of five to ten individuals from different professions, such as local healers, teachers, politicians, and farmers, based on their availability and knowledge and experience regarding the ethnobiological values of owls.

**Questionnaire and interviews**

The questionnaire and interview survey were conducted to learn about the knowledge, practices, and methods of using owls as medicine, as well as

the different myths and beliefs of the people of Budhiganga Municipality in Bajura district. The questionnaires were distributed to the respondents. Those who could not read and write were interviewed, and their responses were recorded by the investigators. To confirm the genus and species of the owl respondents believed, their sounds were narrated to them. In addition, the photographs of different owls were shown to them (Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Acharya & Ghimirey, 2023).

### Data analysis

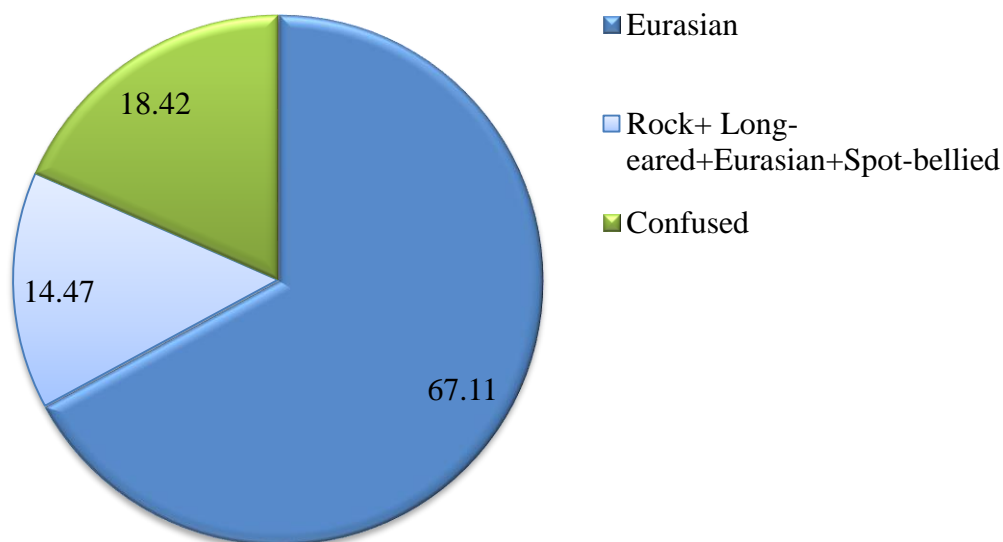
The data were analyzed using quantitative and qualitative methods. The tabulation of data was performed in MS Excel 2016 and SPSS version 21. Chi-square ( $\chi^2$ ) tests were used to analyze the association between the variables. The statistical significance was considered at 95% confidence interval by comparing the respondents' characteristics such as age, sex, and education level using GraphPad

Prism Software (Prism 5 for Windows Version 5.00, 2007). The qualitative data was expressed as the lists of causes of beliefs on owl as religion or methods of using owls as medicines in tables.

## RESULTS

### Types of owls observed or seen

This study recorded a few pieces of information on owls and their ethnomedicinal values. Respondents indicated that the area was previously dominated by the Eurasian Eagle-Owl (*Bubo bubo*) (Himali Hapsilo: *Nepali*) (Fig. 2). According to the respondents, these birds have been seen much less frequently over the past 10 years. Out of 76 individuals who believed they had seen or culled the owls, most of them (67.11 %) claimed that they had seen Eurasian Eagle Owl, and the least of them (14.47%) indicated that they had seen Rock Eagle Owl, Long-eared Owl, Eurasian Eagle Owl, and Spot-bellied Eagle Owl. Still, based on the Photograph Guides/illustrations, 18.42% were confused and could not confirm any owl types

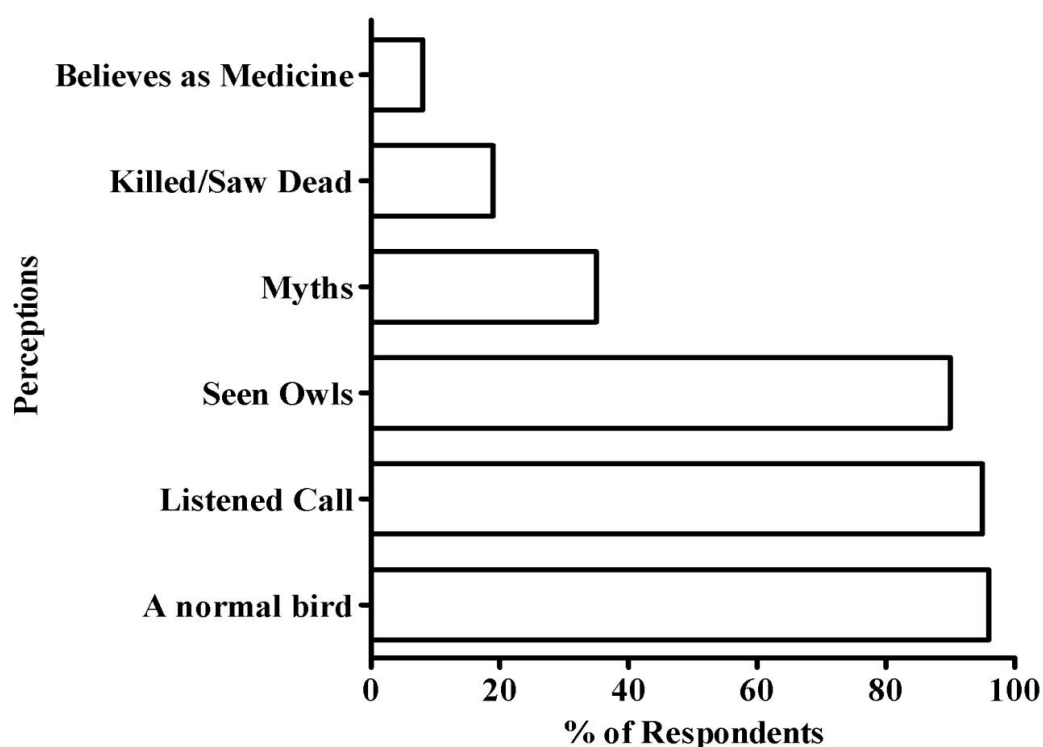


**Figure 2.** Percentage of respondents believing on evidence of different types of the owls in Budhiganga Municipality, Bajura District of Nepal

### Respondents' perceptions and views towards owl

Then, responses regarding perceptions and experiences of owl observation were recorded. Most of the respondents (90-96%) stated that owls were normal birds and prioritized that 'they had seen and heard their calls'. Few respondents (19%) believed

that 'they killed those birds' or 'saw them dead'. About 8.25% of the respondents believed that 'these birds could be used as medicines'. A few respondents still responded that 'owls were evil omens and fierce creatures' (Fig. 3).



**Figure 3.** Respondents' perceptions and views towards owl in Budhiganga Municipality, Bajura District of Nepal

### Medicinal uses of owls

In the current survey, among 388 respondents, 32 people (8.2%) reported medicinal uses of owls. Sex-wise data indicated that a higher percentage of females were known to use owls for medicine ( $p > 0.05$ ), although the number of females was lower than that of males. Similarly, age-group analysis

found that  $\geq 59$  age-groups had a high percentage of respondents with that knowledge ( $p < 0.05$ ). Ethnic-group- or caste-wise data revealed that most Brahmins knew, although the difference was not statistically significant across all listed ethnic groups. Occupational factors showed that respondents involved in civil service had a comparatively higher knowledge of ethnomedicine ( $p < 0.05$ ) (Table 1).

**Table 1.** Characteristics of the respondents with medicinal uses of owls (n=388). F = Fisher exact tests, two-sided and C=Chi-square tests were used to compare the respondents of different characteristics known to medicinal uses of owls.

Respondent Characteristics	Respondents (n = 388)	%	Respondents known to medicinal uses of owls (n)	%	p	
Sex	Male	255	65.5	18	7.059	
	Female	133	34.5	14	10.53	$p > 0.05$ (F)
Age-groups (Years)	18-38	173	44.6	5	2.89	$p < 0.05$ (C)
	39-58	145	37.4	10	6.89	
	$\geq 59$	70	18	17	24.29	
Ethnic groups/Casts	Brahmin	106	27.32	11	10.38	$p > 0.05$ (C)
	Chhetri	189	48.71	14	7.41	
	Dalit	93	23.91	7	7.53	
Occupation	Farming	203	52.3	20	9.85	$p < 0.05$ (C)
	Teaching	20	5.2	3	15	
	Study	65	16.9	0	0	

<b>Civil Service</b>	16	4.2	2	12.5
<b>Unemployed</b>	63	16.2	4	6.35
<b>Politics</b>	7	1.8	2	0.53
<b>Retired</b>	4	1.0	0	0
<b>Business</b>	13	3.4	1	7.69

**Ethnomedicinal beliefs and practices**

A rich traditional medicinal knowledge among local respondents indicated that they were known to cure eleven illnesses by using owls. One or more respondents said that they had different ethnomedicinal knowledge of using owls. Most respondents (53.1%) believed that consumption of owls could cure cancer, whereas only one respondent

(3.1%) believed that using owl could treat epilepsy. Other illnesses included asthma, body aches, hair fall, jaundice, liver problems, otorrhea, skin allergies, and snakebites, and their treatment methods were the use of flesh, beak, or organs of owls. For a few illnesses, using mantra (chanting) would be necessary for a perfect cure for the diseases and consumption of owls' organs/tissues (Table 2).

**Table 2.** Ethnomedicinal beliefs and practices among the respondents in Budhiganga Municipality, Bajura District of Nepal

Diseases	Body part/Organs	Using Methods	Respondent numbers	Percentage (%)
Asthma	Head	The Cooked soup consumption	16	50.0
	Meat	Cooked/Dry meat consumption		
Body pain	Meat	Cooked or raw meat consumption	9	28.1
Cancer	Head	Cooked soup consumption	17	53.1
	Beak	Paste of Beak consumption		
Ear bugs, Otorrhea	Blood	Putting blood into the ear to control or extract ear bugs	3	9.4
Epilepsy	Meat, Right leg	Cooked meat consumption	1	3.1
		Hanging of right leg in the neck		
Eye replace	Eye	Eyes are replaced in humans for better vision	2	6.3
Hair fall	Feathers	The powder of feathers mixed with mustard oil is used before baths	7	21.9
		Cooked meat consumption	13	40.6
Jaundice	Meat	Raw liver (Without cooked) consumption		
	Liver Gallbladder	Raw gallbladder (Without cooked) consumption		
Liver problems	Liver	Raw liver consumption	14	43.8
	Gallbladder	Raw gallbladder consumption		
Skin allergies and Tinea	Feathers	or Powder/Paste of feathers or beak Whole body is burnt and mixed with mustard oil and applied in skin	5	15.6
	Beak			
Snake bite	Beak	The paste is made (with Mantra) and is used in the bitten part	2	6.3
	Feathers			

**Owl-related myths**

Finally, all respondents were asked about their beliefs regarding owls. Out of 388 respondents, only 35 (9.0%) stated that they would believe in one or more myths. Those who believed in owl-related myths were related to Hindus and followed 'The

Eternal Law of Righteousness'. For example, the percentage of respondents with different views were different like owls to be predictors (34.3%), guards (31.4%), symbol of fortune (40%), good omen (5.7%), and bad omen or the ghost of the night (2.9%) (Table 3).

**Table 3.** Owl-related myths of respondents (n=35)

Myths and beliefs	Religious/Cultural myths/Beliefs	Respondent numbers	Percentage (%)
Owl is a time teller/indicator	Brahmin (Wise) of birds	12	34.3
Guard of paddy field	Vahana (Vehicle) of goddess Laxmi	11	31.4
Fortune (God Gift)	Belief as a Swami Bird (Owner) that represents the God in Hinduism	14	40.0
Good omen	Keeping dead owls, feathers, claws, or head in the main entrance of the home is believed to protect from evil or negative energies.	2	5.7
Bad omen (Ghost of night)	Intruder to house and may cause illnesses	1	2.9

## DISCUSSION

This study provides the detail information on the beliefs, practices, and methods of using owls as alternative medicine in the Sudurpaschim Province, Nepal. People had knowledge and had seen Eurasian Eagle Owl frequently, and people used owls as medicinal purpose.

In this study, the number of males who knew the medicinal uses of owls was higher than that of females. This might be because males are usually out of homes and could get more information about the owls and their medicinal knowledge. However, the recent rapid outbreak of social media and online sources might provide equal opportunities for knowledge sharing among youths of both genders. Therefore, it is not easy to explain the predilection of the existing knowledge of owls as ethnomedicine in males compared to females. However, conflicting results have been reported across various ethnic/indigenous groups regarding the use of other animals and plants nationwide (Adhikari et al., 2020; Ghimire et al., 2020). Naturally, people aged 59 and above were aware of the ethnomedicinal knowledge of using owls. Compared with young people, older people tend to believe in traditional medicine based on animal use (Vats et al., 2015), which is predominant in the Hindu Kush Himalaya (HKH) regions, probably due to long experience, traditions, and cultures (Ghimire et al., 2020). Young people do not usually prefer ethnomedicine or learning traditional medicines (Nieman et al., 2019). Due to modernization, novel drug discoveries, advances in medicine, and the need for clear evidence to support conventional medicines (Lohani, 2011; Ghimire et al., 2020), young people often do not respond positively to old stories, religious myths, and traditional medicines. That is why they are less aware of the traditional knowledge of using animals. The sharing of traditional knowledge and practices of ethnomedicinal values; thus, has bearable gaps with

decreasing trends (Ghimire et al., 2020; Ghimire et al., 2021). Farmers usually have a rich knowledge of traditional medicine. Farmers work in a complex landscape where animals, plants, and the local environment are connected, and the milieu becomes a part of their lives. In these contexts, farmers believe in their environment and are attracted to using the environmental members as medicines. Second, most farmers follow the pedigree of their ancestors, who might have taught them the values of alternative medicine. In addition, modern farmers would acquire knowledge from their ancestors' copies. In these contexts, they follow alternative medicine because they have historical evidence or because their ancestors have guided them. The attitude of farmers toward alternative medicine has also been reported in other studies (Hellec et al., 2021).

The current study found that owls were used for curing many diseases. For example, eating meat of the head, legs, and body to cure asthma, cancer, jaundice, epilepsy, and body aches, using a paste of feathers and beak with mustard oil for reducing hair fall, tinea, and skin allergy, using a blood drop to reduce otorrhea and remove ear bugs and consuming liver and gallbladder to cure asthma and jaundice. Interestingly, Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation (2020) and Acharya & Ghimirey (2023) have listed a few superstitious beliefs associated with medicinal uses of owls in Nepal. For example, consuming owl meat relieves body aches, joint pain, asthma, and diarrhea. In addition, they also recorded that people believed in replacing the human eye with an owl that enables them to see at night (Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Acharya & Ghimirey, 2023). Other medicinal uses included bone soup to cure cancer, paste of feathers with mustard oil to reduce hair fall, and blood drops to cure ear infections

(Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Acharya & Ghimirey, 2023). Similar reports of medicinal uses are found in the global population (Mikkola, 2019; 2022), although the efficiency and effectiveness of using any tissue or organ of an owl lack scientific proof.

While consumption of owl and owl products may be beneficial as ethnomedicine, it can sometimes be problematic in the context of zoonosis. For example, many bacterial and viral infections are reported to be transmitted to nearby humans (Smith et al., 2005; Beaufre & Lanieste, 2016; Kanwal et al., 2023). Therefore, proper precautions should be taken before consuming such birds at the community and individual levels.

According to the current survey, many people have seen owls and heard their calls; thus, they probably treat owls as ordinary birds. Owls are often viewed with a mixture of fear and fascination by local communities, with some believing they possess medicinal properties or symbolize bad as well as good omens. Such perceptions have contributed to their persecution, making encounters with dead or hunted owls relatively rare. Across Nepal and elsewhere, these birds are sometimes killed for food, traditional medicine, or superstitious reasons, including associations with witchcraft (Mikkola, 2019; 2022; Acharya & Ghimire, 2023). Insights from our focus group discussions reveal that owl populations have declined noticeably over the years, partly due to nocturnal hunting driven by fear or cultural beliefs. Historically, night hunting was common in rural areas (Britannica, 2023), often carried out indiscriminately, leading to the disappearance of many important bird species, including owls (Ferrero-García, 2017). Seasonal migration of wildlife such as pheasants, wild boar, deer, tigers, bears, and Himalayan goral to lowlands during snowfall further increases the risk of poaching (Singh, 2021). Compounding these pressures are habitat loss and degradation, pesticide use, illegal hunting, ethnomedicinal exploitation, limited rescue and release facilities, and insufficient coordination among stakeholders. Collectively, these challenges highlight the urgent need for conservation measures that are culturally sensitive, scientifically informed, and community-driven to ensure the survival of owls in Nepal (Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Acharya & Ghimirey, 2023). Notably, few species of owls are already critically endangered or threatened not only in Nepal (Baral & Inskipp, 2020; Department of National Parks and Wildlife Conservation & Department of Forest and Soil Conservation, 2020; Acharya & Ghimirey,

2023), but also around the globe (Mikkola, 2022), indicating the importance of protecting these birds further from hunting.

In the present interview survey, the myth among respondents was 'owls as time indicators' because of their precise call times in the morning and evening. Owls were considered bad omens because people usually believed that fierce calls of larger species of owls would be regarded as a pre-notification of something terrible to happen in the family. If owls screeched/hooted from the top of the house, the respondents believed that it would take the people's lives. They considered owls ghosts of the night because of their nocturnal habits. Like current perceptions, people in different cultures and geographies think of owls as sources of evil, including witchcraft and other black magic, generating illnesses and deaths in the enemies (Rashid et al., 2021; Mikkola, 2022). However, these types of misapprehensions are globally prohibited.

Notably, few respondents considered owls to be Brahman (Professor of Brahma) of all birds because they thought that owls would undergo fasting on Wednesday. In Hindu culture, fasting is practiced worshipping many gods and goddesses, including Mercury (Lord Budh Dev) and Lord Ganesha, for intelligence, wealth, wisdom, and success. Therefore, the current study has rationally described the multidimensional values, including traditional knowledge, beliefs, and practices related to owls, in communities in the far-western regions of Nepal. For example, people in the current study believed that keeping dead owls at home's entrance indicates the value of owls in positive magical things. In another context, they are vital to farmers because they serve as the critical guards of the paddy field. The owls are aggressive hunters and feed on rodents and insects, which can help farmers avoid agricultural and economic losses (Noor, 2019). That might be why farmers of the current study thought that owls are helpers of agriculture.

## **CONCLUSION**

The study found that local communities retain significant knowledge of the medicinal use of owls, and many continue these practices. Older individuals typically have more extensive knowledge and are more likely to use owls for treatment. Various owl parts are used to address conditions such as asthma, jaundice, cancer, skin disorders, hair loss, snakebites, body pain, ear infections, and allergies, often with specific preparation methods. However, consuming raw owl meat or blood may increase the risk of zoonotic disease transmission. Owls are both valued and exploited within local communities. Farmers acknowledge their medicinal significance, supported

by statistically significant awareness, appreciate their contribution to natural rodent control, and associate them with positive cultural symbolism. However, these beliefs also contribute to increased hunting pressure. These findings indicate the need for broader, demographically detailed studies across wider regions. Additionally, laboratory and molecular research should be conducted to assess the efficacy and safety of owl-based remedies. Targeted government and conservation interventions in mid-hill areas are also necessary to reduce illegal hunting and protect the ecological and cultural roles of owls.

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#### AUTHORS' CONTRIBUTIONS

Conceptualization: MJ; Methodology: MJ, TRG; Validation: TRG; Investigation: MJ; Data analysis: MJ, TRG; Writing-original draft: MJ; Writing-review & editing: MJ, TRG; Supervision: TRG

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#### CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest regarding the publication of this article.

#### ETHICAL STATEMENT

We declare that it is our original work and has not been previously published or submitted for publication elsewhere. Ethical approval was obtained from the Institutional Research Committee (Regd. No 98/079/080). Similarly, permission for data collection was obtained from the Budhiganga Municipality, Bajura (Regd. No. 480/079/06/30).

#### DATA AVAILABILITY STATEMENT

All data obtained and generated have been incorporated into the manuscript.

#### SUPPLEMENTARY INFORMATION

None

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