Indian Journal of History of Science (2025) 60:292–300
https://doi.org/10.1007/s43539-025-00175-2

ARTICLE

Traditional ethnozoological practices of the tribes in Surguja, Chhattisgarh: A historical perspective

Amrita Kumari Panda[1] · Bajrang Dewangan[1] · Sushma Kerketta[2] · Satpal Singh Bisht[3]

Received: 24 January 2025 / Accepted: 30 July 2025 / Published online: 1 September 2025

Abstract
The present study documents the preparation method and use of animal species for medicinal practices by the tribal communities (Oraon, Nagesia, Gond, and Kamar) in Surguja district, Chhattisgarh, India. This study recorded 10 animal species used to treat nine different human ailments confirmed by 33 traditional healers. The consumption of faunal resources differed among ethnic groups, and a cross-cultural analysis indicated that Oraon and Nagesia populations had greater similarity in ethnozoological practices. This practice is highly favored by indigenous tribes unable to access Western medical facilities due to poverty and the exorbitant costs of allopathic care. In the post-independence era, there was a significant revolution in therapeutic practices among practitioners. The majority of healers abandoned the practice of exorcism due to heightened awareness about eclectic, ceremonial, and green witchcraft practices. This study is the first attempt to gather traditional folk knowledge on animal-based therapies used by tribes of Surguja, Chhattisgarh, India.

Keywords Ethnozoology · Surguja · Tribes · Drug formulation · Traditional healers

1 Introduction

India is renowned for its traditional medical practices called "Indian Systems of Medicine" including Unani, Siddha, Ayurveda, Yoga, Homeopathy, and Naturopathy (Prasad, 2002). In pre-Independent India, few British practitioners appreciated Indian systems of medicine, such as Ayurveda. Ayurveda and Western medicine had a lot in common up until around 1800. This made it possible to assess Indian medications against those used in Western medicine. Many of the most prevalent illnesses in India at that time, such as cholera, dysentery, and malaria, could not be treated by Western medicine (Arnold, 2000). Western medicine was initially met with skepticism and resistance, particularly in areas where it conflicted with traditional Indian medical practices (Arnold, 2000). This "openness" in the early 1800s created keenness among scholars to explore Indian Systems of Medicine by more methodical attempts. More than 600 drugs of plant, animal, and mineral origin have been cited in *Caraka saṁhitā* and *Suśruta saṁhitā* for treating various diseases (Ravishankar & Shukla, 2007). Medical social historians and present-day researchers seek to explore non-Western medical practices, such as the ethno-medicine of the tribals, to fill the research gap on the technical details of ethno-medicine drug preparations. According to Nolan et al. (2024), the concept of ecology of practice is a framework in which various activities interact and influence one another, collectively shaping knowledge and experiences. This notion emphasizes the relational aspect of practices, wherein human acts are interwoven with non-human entities, promoting a comprehensive understanding of learning contexts (Smith, 2022). Grasseni (2007) posits that techniques and talents are not solely individual characteristics but are influenced by the surrounding social structures and relationships. The dynamic nature of social material situations in biological laboratories demonstrates how researchers modify their cognitive processes to maneuver through intricate contexts (Goldsworthy, 2019).

Many ethnic communities across India possess extensive knowledge about animals and their therapeutic utility

✉ Amrita Kumari Panda
itu.linu@gmail.com

[1] Department of Biotechnology, Sant Gahira Guru Vishwavidyalaya, Surguja, Ambikapur 497001, Chhattisgarh, India

[2] Department of Farm Forestry, Sant Gahira Guru Vishwavidyalaya, Surguja, Ambikapur 497001, Chhattisgarh, India

[3] Soban Singh Jeena University, Almora, Uttarakhand, India

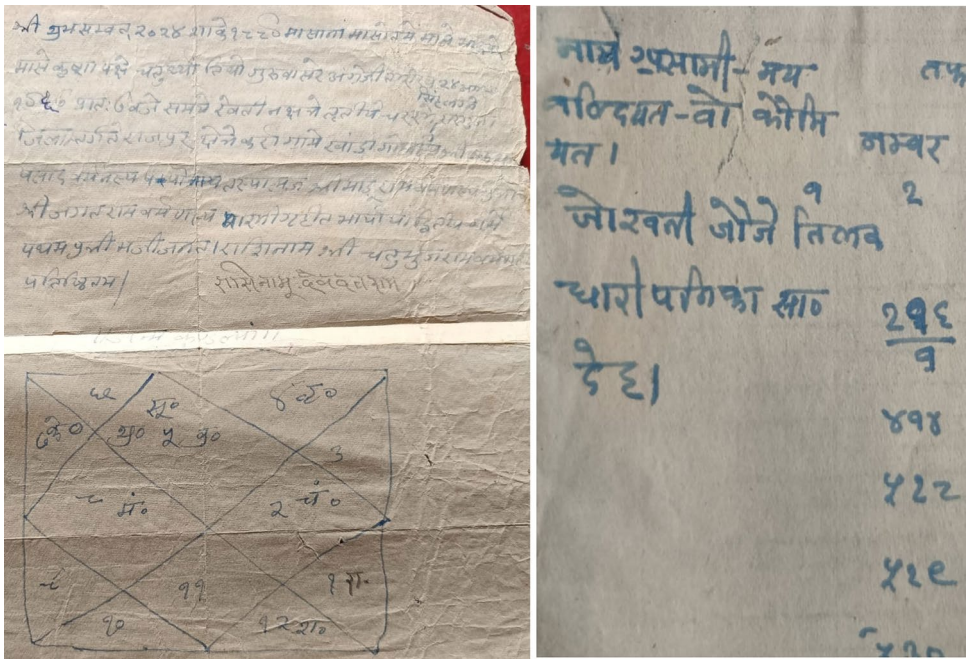

Fig. 1 Scripts from Baiga's dairy

for fulfilling their basic medical needs (Mahawar & Jaroli, 2008). The lifelong interaction of tribes with nature and the forest ecosystem enriches their traditional knowledge, which is unknown to the outside world. Dietrich vanEngelhardt notes: "Medicine needs history and culture because it is not only a natural science but also a humanistic science and art" (Birkle, 2013). The rich cultural tradition of the tribals is meticulously linked with their environment, adding great value to the ethno-biological reputation of the studied area. The historical perspectives of ethnozoological practices among tribal communities reveal a deep-rooted connection between humans and animals, where fauna have been integral to traditional medicine and cultural practices. These practices, passed down through generations, highlight the use of various animal species and their parts for treating a wide range of ailments. The documentation and understanding of these practices provide insights into traditional healing systems and emphasize the importance of preserving this knowledge for future therapeutic and conservation efforts. The Madia tribe in Chhattisgarh utilizes 31 animal species for treating 24 different ailments, using parts like blood, scales, and bones for conditions such as asthma, arthritis, and tuberculosis (Singh et al., 2020). This paper focuses on the ethnozoological practices of the tribes (Oraon, Nagesia Gond, and Kamar) of Surguja in central India. Though a few articles have been published on the ethnobotanical knowledge of the Oraon community, the ethnozoological practices have been discussed least in the literature. The present study includes extensive visits to various tribal settlements adjacent to the forests and the mountainous areas of Surguja. The hilly regions are crucial for healers due to their diverse array of medicinal fauna. We supplemented our fieldwork with the written scripts from Baiga's dairy (Fig. 1) and collected naturally dead animal specimens for identification. Only a limited number of images of animals are provided, which are merely representational (Fig. 2a–i).

2 Study area and methodology

The study was conducted at the Surguja district bordered by Balrampur district in the north, Korba and Raigarh districts in the south, Jashpur in the east, and Surajpur in the west. The study area is about 350 km north of the state capital, Raipur. Field visits were conducted to five villages of Batauli and Ambikapur Tehsils of Surguja district of Chhattisgarh (Fig. 3). Geographically, the study areas are located at Taparkela 23.0317° N Latitude, 83.2881° E Longitude; Bansajhal 23.0296° N, 83.5230° E; Kardana 22.9068° N, 83.3411° E; Boda 22.9813° N, 83.5017° E, and Bhatko 22.9452° N, 83.4142° E (Fig. 3). Criteria for the selection of villages were the approach to the tribal community and population density. A cross-sectional study was conducted to gather ethnozoological data concerning therapeutic animals and their products employed in traditional medicine. Snowball technique (Haq et al., 2020) was used to collect data using personal interviews, meetings, and group discussions. The second author visited the villages with local volunteers

Fig. 2 Photographs of some animals with therapeutic values used by Oraon and Nagesia tribes; **a** River Snail **b** Woolly alder aphid **c** Mussels **d** Beetles **e** Red Ant **f** Turtle shell, **g** Scorpion, **h** Earthworm, **i** Millipede

several times. The entire team interacted with the local people and informed them about the purpose of the study. Local languages were employed during the interviews and discussions to facilitate effective communication. The naturally deceased animal species were excavated alongside images during the survey. The corresponding photographs for each species (N = 10) were then identified using field guides, with the help of a local taxonomist and the Regional Centre, Zoological Survey of India, Jabalpur, Madhya Pradesh, India. Taxonomic verification was also carried out by using the online databases "The National Zoological Collection" https://zsicollections.in/. Before data collection, we ensured that every informant gave written prior informed consent. The semi-structured questionnaire included the following key inquiries: the local vernacular name of the animal utilized as a remedy, the part(s) employed, the preparation method, the conditions addressed by the remedy, the dosage, the mode of administration, the rationale for the preference of animal-based remedies, the efficacy of the animal-based remedy, and any side effect (s). The questionnaire also had multiple-choice, Likert-scale, and open-ended questions to evaluate the preference for ethnomedicine relative to modern medicine, the rationale for selecting ethnomedicine (e.g., tradition, accessibility, less side effects), and the perceived efficacy in addressing various conditions.

3 Results and discussion

Data regarding traditional ethnozoological techniques were gathered from 33 informants, including tribal leaders and traditional healers, between August 2023 and November 2024. The informants comprised both females and males, and they played a significant role in collecting and applying conventional animal-based compositions. The current study reveals that indigenous populations predominantly

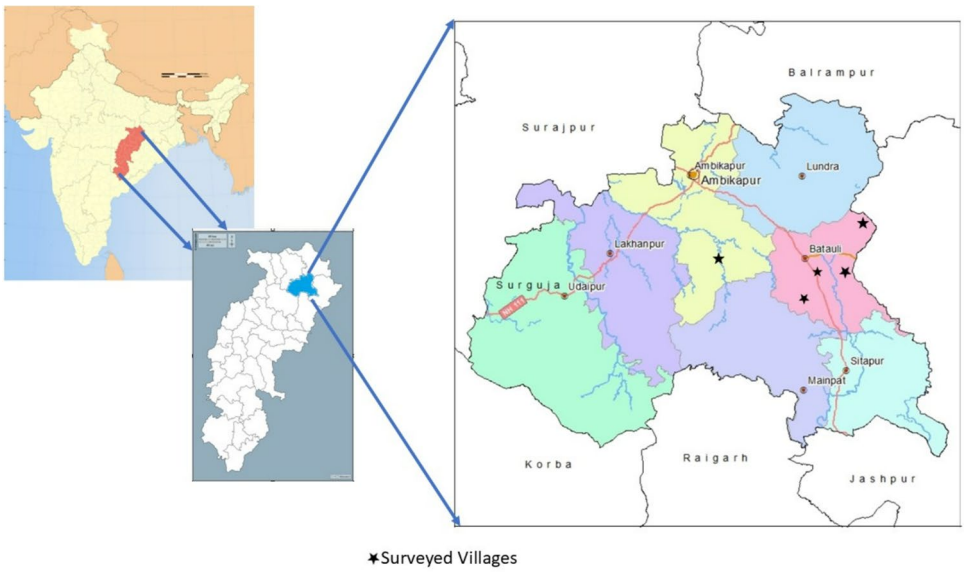

Fig. 3 Location map indicating the Study sites

prefer customary medical systems, primarily due to their lack of access to Western medicine, which is hindered by poverty and the exorbitant expenses of allopathic treatments, as noted by Mahato (2022, 2023). Out of the total 33 responders, the majority were males (69.69%) and older than 35 years (87.8%) (Table 1). Most traditional healers completed their formal education (75%).

Regarding gaining conventional knowledge, 15 (45.45%) of respondents obtain their traditional medicinal understanding from their family, 10 (30.30%) from the neighboring societies, and the remaining eight (24.25%) from their own experience. Based on a questionnaire conducted, the grounds that drove the people to use animals as medicine were their (i) consideration of better curative capacity than modern medicine, 20; 60.60% respondents. Out of 20 respondents 60% agree/strongly agreed that zootherapy helped them recover from their illness, 25% reported partial improvement, while 15% stated no noticeable changes), (ii) lack of income to acquire modern medicine (6; 18.18%) and (iii) the lack of access to modern treatment (hospitalization) (7; 21.21%). The data indicate that ethnomedicine remains a preferred choice among ethnic communities due to its cultural significance, ease of access, and perceived safety. The survey also found that the majority of respondents believed

Table 1 Demographic characteristics of informants in the study area

Baseline characteristics		Total number	Percentage
Gender	Male	23	69.69
	Female	10	30.30
Age	22–25	1	3.03
	26–35	3	9.09
	36–45	12	36.36
	46–55	7	21.21
	56–65	8	24.24
	66–75	1	3.03
	76 above	1	3.03
Religion	Hindu	17	51.51
	Christian	12	36.36
	Sarna	4	12.12
Education level	Illiterate	6	18.18
	Primary	12	36.36
	Secondary school level	5	15.15
	Intermediate	8	24.24
	Bachelor and master's degree	2	6.06

Table 2 Use value of animal species for treating various diseases

S. No.	English Name	Local Name	Scientific Name	Components/ Parts used	Indication	Mode of administration	Use value (UV)*	Use report (U)
1	River snail	Ghonagha	*Filopaludina bengalensis*	Smooth body part	Weakness	Oral	0.09	3
2	Red ant	Demta chentee, Mata, Bemta	*Oecophylla smoragdina*	Whole body Egg	Chronic Cough Heat stroke	Oral	0.18	6
3	Gypsy moth	Chemda	*Lymantria dispar*	Whole body	Protein source for Weakness	Oral	0.06	2
4	Beetle	Kokerra	*Cybister lateralimarginalis*	Whole Body	Malaria	Oral	0.09	3
5	Mussel	Goleya, Chumakharo	*Lamellidens corrianus*	Meat	Fever and Weakness	Oral	0.06	2
6	Tortoise	Kachua	*Testudo graeca*	Shell	Bruises and burnt areas on the body	Topical	0.09	3
7	Earthworm	Ketua, Lenda	*Aporrectodea* sp.	Whole body	Improve lactation	Oral	0.24	8
8	Millipede	Gomi	*Apheloria virginiesis*	Whole body	Inflammatory skin condition	Topical	0.12	4
9	Scorpion	Khekhar bichhu	*Hottentotta tamulus*	Stinger (Tip of tail)	Ear infection	Topical	0.06	2
10	Spider	Makadi	*Hogna stictopyga*	Egg sac	Bleeding Cuts & Wounds	Topical	0.15	5

*UV = ∑ U/N {U is the number of use reports for a particular animal species and N is the total no. of informants interviewed (N = 33)}

zootherapy was equally effective as modern medicine, while a small fraction preferred allopathy for faster recovery. These beliefs align with previous studies (Abebe et al., 2022; Efa, 2023), highlighting the reliance on traditional healing practices in rural and indigenous populations. However, scientific validation and integration with modern medicine could enhance its credibility and usage.

The study involves some healers who are traditional orthopedists specializing in alleviating severe back pain through their indigenous medicinal expertise. They also administer the principal treatment for patients afflicted with skin disorders, burns, rashes, and similar conditions. Healers typically administer treatment for several ailments, including chronic cough, fever, weakness, skin rashes, asthma, arthritis, rheumatism, tuberculosis, abdominal pain, back pain, malaria, oral ulcers, visual impairments, ear infections, and women's health issues (post-delivery cases). The tribal healers utilize diverse traditional medicinal methods based on their cultural and ecological surroundings. Their therapeutic approaches predominantly utilize native flora and fauna, which are essential to their medical framework, tackling a broad spectrum of maladies from general illnesses to particular disorders.

During the mid-twentieth century, Oraon tribal groups of Chhattisgarh adopted the *ojha* system, a traditional healing practice influenced by Hindu rituals. This integration illustrates a wider trend of cultural interchange between the Oraons and adjacent Hindu populations, wherein aspects of Hinduism have been incorporated into tribal customs. The Oraons uphold a profound heritage of totemism that mirrors a common cultural ethos with Hindu practices toward environment and conservation (Tirkey & Jain, 2006). Adopting the *ojha* system exemplifies cultural absorption; nonetheless, it is crucial to acknowledge that the Oraons preserve distinctive elements of their identity and behaviours, which may resist complete merger into Hindu customs. This dynamic interaction between tradition and adaptation underscores the intricacy of cultural identity within tribal societies. The Oraons of Chhattisgarh possess a profound legacy of clan names intricately linked to their conservation actions. The clan names, originating from local flora and wildlife, signify the community's respect for nature and emphasize their dedication to biodiversity preservation. The Oraons designate their clans using names derived from plants, animals, and objects that hold significance in their environment, cultivating identity and accountability towards these creatures (Tirkey & Jain, 2006). The Baiga tribe generally employs two techniques for persons to attain "Baiga" status. The initial process is divine selection, wherein the tribe's deities bestow mantras, thoughts, and power upon an individual through their dreams. The second technique entails training, wherein individuals acquire abilities through knowledge transmitted by their predecessors, educators, and the natural world.

Sushila Lakra (60 +),[1] a female Oraon healer, informed us about the procedure for preparing medicine to treat

[1] Sushila Lakra: Village- Santipara, P.O.- Batauli, P.S.- Batauli, Distt- Surguja, Chhattisgarh.

insufficient lactation in breastfeeding mothers using a combination of earthworms (*Aporrectodea* sp. and *Lumbricus* sp.), black gram, and jaggery (Table 2). After washing the collected ingredients, the healer grinds them on a flat stone (*śila*) with the help of a cylindrical stone (*loḍha*, a Sargujia word). A fine paste is prepared by grinding and then given to breastfeeding mothers to consume. She also added the earthworms collected from agricultural fields on either Sunday/Tuesday and ground the ingredients by chanting a mantra. This therapeutic knowledge of the Oraon population was validated using various search engines, such as Google Scholar and PubMed, to substantiate their assertions. A similar kind of study reported by Dandotiya et al. (2013) claimed comparable use of *Pheretima posthuman* (*kenchua*) by the Sahariya tribe. They stated that even a single dose of dried earthworm in powdered form, along with milk or fresh as a paste (3–6 earthworms), is highly effective in inducing lactation. A patent also filed by Li (2007) reported the utilization of earthworm extract to develop galactagogue that improves milk output in cows. The procedure entails combining earthworms with water, followed by other stages to manufacture the final product for lactation assistance. In the present study, earthworm were the most frequently used animal species (24%) to treat ailments in the study area, followed by red ants (18%). The other most used species next to earthworm and red ants were spider and millipede, which accounted for 15 and 12 percent of the use value (Table 2).

Another female Nagesia healer, Kameshwari,[2] aged 40 or above, apprised us of the protocol for compounding medication to treat situations where there is a cut on the head, and no hospital is accessible nearby. In such cases, prolonged bleeding may occur, and if it is not controlled in time, it can lead to severe blood loss. She said the application of spider egg sac to the cut area, helped to stop the bleeding. This claim is unrecorded in any literature and may be considered original. This traditional belief may be based on the antimicrobial properties of silk from spider egg sacs, which can prevent infections in wounds, thereby enhancing the healing process. Dhanita Prajapati (age 42 +),[3] a Kumhar female traditional therapist, informed us about the procedure for compounding medication for the treatment of *bemchi* (an inflammatory skin condition that can result in itchy patches on an individual's skin) using a combination of millipede and coconut shell. After the ingredients are collected from forests, the millipede is burned and converted into ash. The coconut shell is burned, releasing a small amount of oil. This oil is then mixed with the ash of the millipede and used as an ointment. She also added that there are food restrictions imposed during therapy time, and the patient should consume vegetarian meals to avoid any kind of allergic conditions.

Vijay Kumar (47 +),[4] a renowned Nagesia healer, also prepares formulations to treat skin lesions (boils, pimples, etc.) using a combination of a tortoise skull and coconut shell. After collecting the ingredients, the coconut shell and tortoise skull are mixed with a little water and heated in an earthen pot. The combination is boiled till it is reduced to an amount of 1/10 th of its original. After some time, oil is extracted, which is used as an ointment for skin lesions. During the extraction of oil, a mantra is chanted thrice (Appendix A). Vijay Kumar acquired this mantra from his father, who was working as a farmer in the fields of a Brahmin Panda (Manabodhan Panda), where he learned the mantras. The patients were instructed to apply the oil extract twice (morning and evening) for one week. The medication is administered to the patient following its dedication to the tribal Goddess. Devnath (65 +),[5] a male Panika healer, informed us about the procedure for preparing medicine to treat burnt skin. A combination of tortoise skull and mustard oil is used (Table 2). The hard top shell of the tortoise is burnt to make a paste or ash, which is then mixed with mustard oil. This mixture is used to heal bruises, sprains, and burnt areas on the body.

Another well-known Korwa healer, Kalpnath (80 +),[6] prepares formulations to treat chronic cough using a combination of red ants and their eggs. He prepared juice from freshly collected red ants and their eggs, mixed with a little water, and heated it in an earthen pot. The mixture is boiled until the water boils. He gave decoction to patients by chanting a mantra as incarnations (Appendix B), which was believed to cure chronic cough. He also prepared a medicine to treat tuberculosis using crab juice. After washing the freshly harvested crabs from forests, the healer grinds them on a flat stone (Sil) with the help of a cylindrical stone (*lodha*). The crab juice is extracted by grinding, and the juice is used for drinking.

A cross-cultural assessment of the recorded fauna revealed that the tortoise species (*Testudo graeca*) was used only by Nagesia community, whereas the Oraon (*Ekka*) does not kill or harm tortoises. This can be elucidated by the fact

[2] Kameshwari, Village- Bansajhal, P.O.- Batauli, P.S.- Batauli, Dist.- Surguja, Chhattisgarh.

[3] Dhanita Prajapati: Village- Bhatko, P.O.- Batauli, P.S.- Batauli, Distt- Surguja, Chhattisgarh.

[4] Vijay Kumar, Village- Bansajhal, P.O.- Batauli, P.S.- Batauli, Dist.- Surguja, Chhattisgarh.

[5] Devnath: Village- Chainpur, P.O.-Lakhanpur, P.S. Lakhanpur, Distt- Surguja, Chhattisgarh.

[6] Kalpnath, Village- Bansajhal, P.O.- Batauli, P.S.- Batauli, Dist.- Surguja, Chhattisgarh.

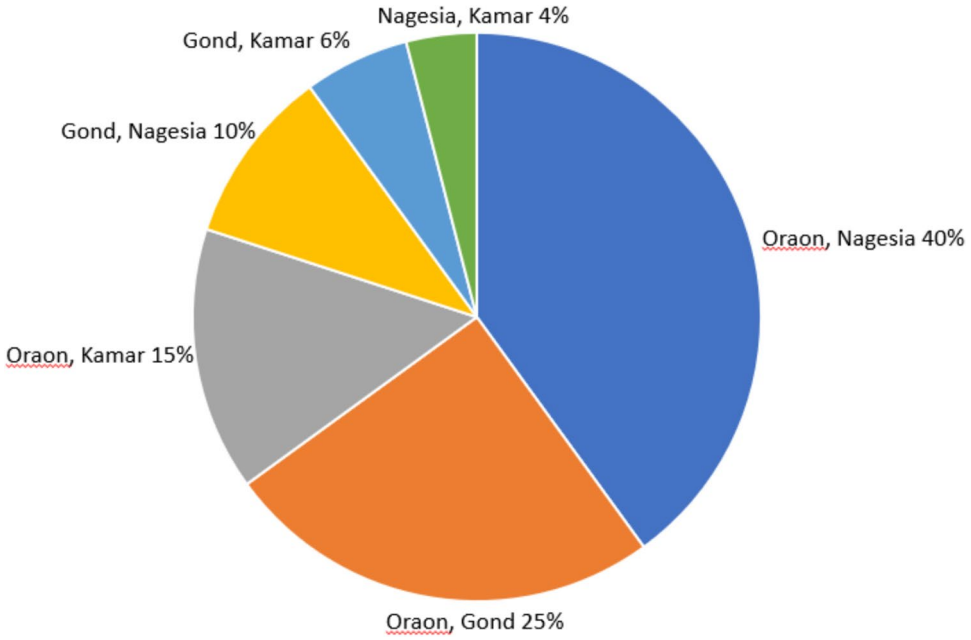

Fig. 4 Percentage of similarity between ethnic groups

that the Oraon clan maintains a special affinity with animals on which their clan name is based. The present study revealed that two animal species *i.e*., red ant (*Oecophylla smoragdina*) and earthworm (*Aporrectodea sp*.), overlapped among all four ethnic communities. The study shows that two species (*Filopaludina bengalensis* and *Lamellidens corrianus*) were idiosyncratic to Oraon and Gond communities, followed by three species (*Apheloria virginiesis, Hottentotta tamulus,* and *Scolopendra sp.*) that were unique to Nagesia. The highest similarity (40%) is observed between Oraon and Nagesia, suggesting a strong cultural overlap in their utilization of animal species which could be due to the same geographical location, intermarriage or shared ancestral traditions (Fig. 4). Oraon and Gond also share a considerable percentage (25%), indicating a moderate level of common traditional knowledge. The lowest similarity (4%) was found between Nagesia and Kamar, suggesting that these groups have distinct cultural practices in using animal species, which might be attributed to differences in ecosystems, religious beliefs, or economic practices.

The present study also observed a decline in exorcism among traditional healers in favor of Eclectic, Ceremonial, and Green witchcraft practices. The decline of exorcism is evident as traditional healers increasingly abandon this technique, acknowledging the rising understanding and skepticism regarding witchcraft (Mahato, 2023). The transition in traditional healing practices in post-independence India signifies a notable change from exorcism to more diverse, ceremonial, and herbal methods. Socio-cultural transformations, ecological consciousness, and the demand for affordable healthcare within ethnic communities shape this evolution. The present survey aligns with similar reports by Reddy (2023) that healers increasingly integrate many methods, combining nature-based medicines with rituals that align with local beliefs, thereby establishing a more comprehensive approach to healing. Rituals, including mantras and sacred artifacts, have become significant, offering psychological solace and fostering community solidarity (Nair & Kumar, 2010). These actions not only fulfill health requirements but also contribute to the preservation of cultural identity and traditional ecological knowledge (Mahato, 2023). The emphasis on inclusive, nature-based healing approaches and accessible healing procedures diminished the prevalence of exorcism in influencing the healing landscape in post-independence India.

4 Conclusion

The transmission of traditional knowledge among tribes is essential for preserving cultural traditions and ecological wisdom. Oral traditions, rituals, and daily practices predominantly transmit this information. The present study demonstrates that information is conveyed vertically (from parents to offspring), horizontally (among peers), and obliquely (from elders) among tribal communities of Surguja, Chhattisgarh. In the present study, 10 animal species belonging to insects, molluscs and reptiles were used to manage nine types of ailments. Insects were the

most frequently used. As per the informant's viewpoint, this ethnozoological practice gained popularity due to its efficacy in treating ailments, and the effectiveness mainly depends on the patient's belief in the system, the healer's expertise in the drug preparation, and the application of mantras. Nonetheless, these traditions' interest in and practice have experienced considerable transformations over time, especially during the pre-Independence period and thereafter. The advent of modern medicine has led to a reduction in the practice of traditional medicine among the indigenous populations in the studied area. However, multidisciplinary research is essential to examine these practices with a critical and evidence-based perspective that reestablishes trust among younger generations.

Appendix A

devee dishaen haath pairage manabodhan panda
ek haathe khadag le ek haathe araj kare
maata jug jug naam rah jae,
baranau guru budharaam guru bhamha guru khelaavan guru aae thaad,
aaika sur baika sur lanka sur banka sur
bheesha sur khopa ke daanav pahunchal chaahee.

With a sword in one hand Manabodhan Panda,
I am praying to the Divine Mother with folded hands,
requesting her that this medicine cures the illness of the patient.
May my wish be fulfilled, O Mother, and your name be remembered for ages for this grace.
I bow to all my gurus: Barnao Guru, Budhram Guru, Brahma Guru, and Khelawan Guru.
I also call upon the demons from the Danav lineage—the Aika Sur, Baika Sur, and the demons of the Khopa—to assist me in this endeavor. (Translation).

Appendix B

kaalee kaalee chatur kaalee bhadur kaalee indr kaalee
brahm kaalee mohan kaalee chandee kaalee jay kaalee
aay thaad araj kare maata jug jug naam rah jaay
arjun laane bheem chhudae kavaroo bede gaay
khanapoka dhamaraaj sarve jhaad the
dohaee krshn nakul sahadev indr raaja.

"O Mother, we praise you. Our prayer is that your name remains immortal for ages.
Arjuna achieved victory with your grace, and Bhima overcame difficulties with your strength.
You defeated the army of the Kauravas.
Dharmaraj (Yudhishthira) sought your help.
Krishna, Nakula, Sahadeva, and even King Indra came to your refuge.
Everyone who sought your refuge was blessed and prospered. This patient, too, has come under your protection; please relieve them from their suffering." (Translation).

Acknowledgements This document is the result of a Research Project funded by the Indian National Science Academy (INSA), New Delhi. I am grateful to Mr. Madhvendra Narayan, Assistant Executive Director of INSA, all members of the Research Council, History of Science, INSA, and expert groups who offered valuable recommendations. I express gratitude for the assistance of traditional healers and tribal heads for imparting significant information. I am also grateful to Dr. Pankaj Sarup Bhatnagar, Central Zone Regional Centre, Zoological Survey of India, Jabalpur, Madhya Pradesh, for ensuring the accuracy of the scientific names of therapeutic animals.

Author contributions Conceptualization, A.K.P. and B. D.; methodology, B.D.; writing—original draft preparation, A.K.P., B.D., S.K.; writing—review and editing, A.K.P. and S.S.B. All authors have read and agreed to the published version of the manuscript.

Funding This work is supported by the Indian National Science Academy (Grant No. HS/RC/342).

Data availability Not applicable.

Declarations

Conflict of interests The authors declare no conflicts of interest.

References

Abebe, D., Molla, Y., Belayneh, A., Kebede, B., Getachew, M., & Alimaw, Y. (2022). Ethnozoological study of medicinal animals and animals' products used by traditional medicinal practitioners and indigenous people in Motta city administration and Hulet Eju Enessie District, East Gojjam, Northwest Ethiopia. *Heliyon*. https://doi.org/10.1016/j.heliyon.2022.e08829

Arnold, D. (2000). *Science, technology and medicine in colonial India* (Vol. 5). Cambridge University Press.

Birkle, C. (2013). Communicating disease: An introduction. In C. Birkle (Ed.), *Communicating disease: Cultural representations of American medicine* (pp. ix–xxxiv). Heidelberg: Winter.

Dandotiya, H., Singh, G., & Kashaw, S. K. (2013). The galactagogues used by Indian tribal communities to overcome poor lactation. *International Journal of Biotechnology and Bioengineering Research, 4*(3), 243–248.

Efa, D. A. (2023). Animal and their products used for treatment and prevention of disease practiced by traditional healers in Jimma Arjo district, East Wollega Zone, Western Ethiopia. *Veterinary Medicine and Science, 9*(6), 2660–2675.

Goldsworthy, C. (2019). The effect of dynamic social material conditions on cognition in the biomedical research laboratory. *Phenomenology and the Cognitive Sciences, 18*(1), 241–257.

Grasseni, C. (2007). Introduction. In C. Gasseni (Ed.), *Skilled vision: Between apprenticeship and standards.* Bergham.

Haq, S. M., Calixto, E. S., Yaqoob, U., Ahmed, R., Mahmoud, A. H., Bussmann, R. W., & Abbasi, A. M. (2020). Traditional usage of wild fauna among the local inhabitants of Ladakh, Trans-Himalayan region. *Animals, 10*(12), Article 2317.

Li, C. (2007). Utilize earthworm extractive as raw material to produce the processing technology of fodder for increasing milk agent. China Patent CN100548145C.

Mahato, N. K. (2022). The status of tribal medical system and practices in the Jungle Mahals, Eastern India, 1947–2000. *Indian Journal of History of Science, 57*(4), 344–347.

Mahato, N. K. (2023). Revisiting the traditional medicine of the tribals in the Jungle Mahals, 1947–2000. *Indian Journal of History of Science, 58*(2), 119–128.

Mahawar, M. M., & Jaroli, D. P. (2008). Traditional zootherapeutic studies in India: A review. *Journal of Ethnobiology and Ethnomedicine, 4*, 1–12.

Nair, B., & Kumar, H. (2010). Marunnum Mantravum-an ethnographic enquiry into the patterns of affliction and therapeutics in a traditional healing practice in Malabar, north Kerala (Doctoral dissertation, Masterarbeit, Heidelberg, Universität Heidelberg).

Nolan, R., Morasae, E. K., & Michael, M. (2024). From schools of thought to an ecology of practices: Categorizing circular economy's futures. *Journal of Industrial Ecology, 28*(6), 1730–1742.

Prasad, L. V. (2002). Indian system of medicine and homoeopathy traditional medicine in Asia. WHO-Regional Office for South East Asia-New Delhi (pp. 283–286).

Ravishankar, B., & Shukla, V. J. (2007). Indian systems of medicine: A brief profile. *African Journal of Traditional, Complementary and Alternative Medicines, 4*(3), 319–337.

Reddy, S. (2023). Revival of local health traditions from healers' perspectives: Urgency of recognition and state support. *Ethnomedicine and tribal healing practices in India: Challenges and possibilities of recognition and integration* (pp. 347–368). Springer.

Singh, R., Gajendra, & Tirkey, S. (2020). Ethnozoological remedial practices by the Madia tribe and indigenous inhabitants of Dantewada district, Chhattisgarh, India. *Journal of Life Sciences, 17*(1), 57–62. https://doi.org/10.51365/NJLS.2020.V17I01.010

Smith, D. E. (2022). Look to the ravens: Reconceptualizing communities of practice into ecosystems of practice. *Environmental Education Research, 28*(9), 1348–1358.

Tirkey, A., & Jain, S. K. (2006). Tradition of clan names and conservation among the Oraons of Chhattishgarh. *Indian Journal of Traditional Knowledge, 5*(2), 224–226.