



Indigenous language unlocks ecological insights on Hornbills, Purple frog and others, the Western Ghats Kadar experience

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Background: Indigenous languages are crucial for biodiversity knowledge, yet face extinction. This study emphasizes their importance in understanding ecosystems and the necessity of preservation efforts based on the ethnoecological knowledge of Kadar indigenous community endemic to Western Ghats mountains of South West India. Integrating this knowledge into conservation policies is essential for global biodiversity protection.

Methods: This study documented the ecological knowledge of threatened species of the Kadar community in Anamalai, Western Ghats. The knowledge associated with indigenous terminology on threatened species such as Purple Frog, Cochin Forest Cane Turtle, Hornbills etc are used here to demonstrate the depth of associated ecological knowledge. It involved ethnographic engagement to understand their perspectives and practices.

Results: The Kadar language holds vital ecological knowledge, including unique names for species within the Anamalai landscape unit of the Southern Western Ghats. Their lexicon reveals intricate understandings of biodiversity, exemplified by "Karimbudan" (endangered tree) known uniquely to Vazhachal clans, and specific terms for "Koottupambu," "Chirapool," "Thattukottan," "Vatti Ongal," and "Karimbudan" for them alone and "Chirattan" which is shared across other indigenous communities of the Southern Western Ghats are highlighting the interconnected ecological comprehension.

Conclusion: The Kadar ethnic community's knowledge exemplifies deep ecological insights that are useful for the present conservation paradigm. Preserving this linguistic heritage is crucial for safeguarding traditional ecological knowledge and integrating indigenous perspectives into conservation, enriching our understanding of biodiversity and ensuring local community involvement.

Keywords: great hornbill, cane turtle, diospyros, conservation, TEK

Introduction

The knowledge embedded in Indigenous languages is increasingly recognized as essential for global biodiversity conservation strategies, as it offers unique insights into species behavior and ecosystem dynamics (Gafner-Rojas, 2020; Balasubramanian & Sangha, 2023; Rasmussen, 2023a). However, the threat of language extinction poses a significant risk to this invaluable knowledge, necessitating urgent efforts for preservation and revitalization (Zimmer, 2024). This is particularly critical given that approximately half of the world's estimated 7,000 languages are considered endangered, with potential consequences for the loss of associated ecological understanding (UNESCO, 2010). Indigenous languages, such as those spoken by the Kadar community in the Western Ghats, serve as vital repositories of ecological knowledge, reflecting a deep and long-standing connection to local biodiversity (Bachan et al., 2014; Balasubramanian & Sangha, 2023). This relationship is crucial for understanding and preserving unique ecosystems, as these languages encode specific environmental information that is essential for microlevel resource and ecosystem management, especially in the context of climate change. Studies have shown that areas with high linguistic diversity often overlap with regions of high biodiversity, indicating a correlation between cultural and natural heritage (Maffi, 2005). Indigenous languages contain specialized vocabulary that describes local flora and fauna with a high degree of precision, enhancing the community's ability to interact with their environment (Zimmer, 2024). For instance, these languages often possess terms that differentiate between various plant and animal species, including distinctions related to their life cycles, behavior, and ecological roles. This linguistic precision aids in sustainable harvesting practices, targeted conservation efforts, and the monitoring of environmental changes. The cultural practices of Indigenous communities, such as traditional farming and foraging, are often intertwined with their linguistic heritage, promoting biodiversity conservation through sustainable resource use. Furthermore, their oral traditions and songs frequently convey ecological wisdom, reinforcing community norms and practices related to environmental stewardship. While Indigenous languages like those of the Kadar are crucial for biodiversity conservation (Gouthami & Bachan, 2022), the challenge remains in integrating this knowledge into broader environmental policies and management frameworks. Acknowledging and respecting Indigenous perspectives, and incorporating Traditional Ecological Knowledge (TEK), can significantly enhance the effectiveness of global efforts to protect biodiversity. International frameworks, such as the Aichi Biodiversity Targets, have recognized the importance of integrating traditional knowledge, with Target 18 specifically calling for the integration of traditional knowledge into biodiversity conservation policies, the implementation of relevant projects, and the national reporting of such efforts (CBD, 2006). However, the implementation of these targets has been uneven, highlighting the need for more concrete strategies and mechanisms for knowledge integration. Efforts to integrate Indigenous knowledge into modern conservation strategies are essential, as they can provide critical insights that enhance ecological resilience and sustainability. Specifically, Indigenous knowledge can inform the development of more effective conservation strategies by providing data on long-term ecological changes, species interactions, and the impacts of human activities on ecosystems. In light of the threats to both linguistic diversity and biodiversity, this study aims to investigate the ecological knowledge embedded within the Kadar language, focusing on their understanding of four threatened species in the Western Ghats. By documenting and analyzing this knowledge, the research seeks to demonstrate the crucial role of Indigenous languages in biodiversity conservation and to identify pathways for the effective integration of TEK into mainstream conservation practices. This research contributes to the growing body of literature on the link between language, culture, and biodiversity, and underscores the urgency of preserving Indigenous languages and the knowledge they contain for the benefit of both human societies and the natural world.

Materials and methods

The ethnographic engagement with the Kadar indigenous people over the past few decades has yielded significant insights into their intricate knowledge systems and ecological interpretations. These have highlighted the profound umbilical relationships that exist between the Kadar community and their surrounding environment, underscoring the importance of Traditional Ecological Knowledge (TEK) in contemporary sustainability discourse (Balasubramanian & Sangha, 2023; Muringatheri, 2023; Berkes, 2018). Furthermore, the documentation of these indigenous practices enhanced sustainable livelihood options for the Kadar people and emphasized the critical role of community-preserving conservation efforts.

In this context, we take insights from Kadar's knowledge of four important and threatened species of the forest to gain a deeper understanding of how indigenous knowledge, which was preserved, passed on, and evolved over time through the oral dialect, can inform and enrich modern conservation strategies, ultimately fostering a more sustainable coexistence between humanity and nature (Rasmussen, 2023b; Centre for Communication Rights, 2023).

a. The tribe

The Kadar are an old ethnic group indigenous to Anamalai in the Western Ghats of Southern India. The literary references go back to Deniker (1900); Thurston (1909) classifies the Kadar as a primitive hill tribe in the Cochin and Travancore hills and designates them as the "King of Anamalai Hills," highlighting their proficiency as trackers and botanists. Lawson's publication, Caste and Tribes of Southern India. The Kadar are part of India's 75 Primitive Vulnerable Tribal Groups (PVTGs), five of which are located in Kerala. Gouthami & Bachan (2022) acknowledge them as the indigenous population of the Anamalai highlands and their genetic connections to the first settlers of the Indian subcontinent. Ehrenfels (1952) asserts that the Kadar are part of the Negroid tribal group, practice nomadism, and converse in a blend of Tamil and Malayalam. An in-depth understanding of the Kadar vocabulary for the preparation of an inclusive tribal language-based multilingual pedagogy (Bachan et al., 2012; Bachan et al., 2014) revealed their unique identity compared to the Malayalam and Tamil, scripted languages.

b. The species

The Kadars, endemic to the Anamalai region of the Southern Western Ghats, are considered tribes of the rainforests, renowned for their richness in flora and fauna. The Anamalai are considered the stronghold of the flagship bird of the rainforest and the state of Kerala, the Great Hornbills (*Buceros bicornis*) (Bachan 2006; Datta et al., 2022). The area is well known for the once thought extinct, now endangered Cochin Forest cane turtle (*Vijayachelys silvatica*) and the recently famous Indian Purple Frog (*Nasikabatrachus sahyadrensis*). One of the lesser-known trees, *Diospyros crumenata*, known only from a few locations in the Western Ghats, was recently evaluated as Critically Endangered by the IUCN (Bachan & Devika, 2024) and is known to the Kadar clans in the Vazhachal region alone. We discuss these four species, the Kadar indigenous community's knowledge, and its conservation implications here, along with other published evidence.

Results

Our exploration with the Kadar indigenous community commenced with investigations into the riparian flora situated along the lower elevations of the Vazhachal forests within the Anamalai landscape, specifically in the Chalakkudy river basin. Their expertise and profound understanding of the terrain, as well as the local wildlife, proved to be invaluable for our explorations into the wilderness. Each plant species, bird, and animal we encountered daily possessed a designated name and a narrative to convey. They maintained a complex relationship with the riparian forests, as their ancestral hamlets were located within the Valley forests of the Anamalais, particularly within the Chalakkudy River basins. They were compelled to relocate from the Poringalkuthu area, the Parambikulam Valley, and the Sholayar Valley, especially during the construction of the dams in these tributaries.

According to Mylamany, the former Chief of the Malakkappara settlement,

"We are the Anamalai Kadar who resided in the Parambikulam Valley. My father and siblings were compelled to relocate to our current positions in the Parambikulam Kadar hamlet and the Earth Dam hamlet following the construction of the Parambikulam group of dams. We migrated to the Sholayar Valley in the present Chandanthodu region and were subsequently forced to move to our current position at Malakkappara due to the construction of the Lower Sholayar dam."

This forced displacement not only disrupted their traditional way of life but also instigated significant cultural and social upheaval within the community, as they endeavored to acclimatize to new environments and circumstances.

a. The "Thattukottan" - Indian Purple Frog

During 2002, while living alongside the temporary sheds of the Kadars in the Sholayar riverside and responding to a particular call from a frog, the Ganeshan of Malakkappara village referred to it as "Thattukottan" in their local language (Fig.1). Surprisingly, on the way back through the Sholayar hamlet, the children were taking a particular frog just like a purple balloon into their hands. A few years later, the species came into the limelight after it was first described as the Indian Purple Frog (*Nasikabatrachus sahyadrensis*) (Das, 2006).

This unique amphibian, known for its distinct purple hue and burrowing habits, quickly captured the attention of researchers and conservationists alike. As studies emerged, they highlighted the critical role of the Western Ghats ecosystem and the urgent need to protect such rare species from habitat loss and environmental changes. The wonderful

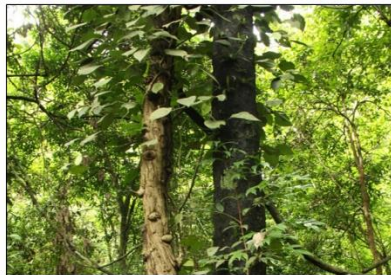
species exhibits a remarkable life cycle, with tadpoles adapted to cling to rocks in fast-flowing streams, utilizing a ventral oral sucker. Upon metamorphosis, the frogs transition to a fossorial lifestyle, employing specialized morphological adaptations for burrowing (Radhakrishnan et al., 2007) showcases unique adaptations and behaviours, its cryptic nature and limited distribution raise concerns regarding conservation and habitat preservation in the Western Ghats.

According to Ganeshan, Kadar from the Malakkappara Village “Thattukottan “means a person making a rhythmic sound using some local drums or sticks. Pipe, drum, and dance are integral parts of Kadar life and cultural practices. They also know the lifecycle and ecology of the species.

"Thattukottan emerges from its deep mud slumber only during the breeding season." Their young ones are in the rocky streams and go for sleep in the earth, feet down, and will be like "Dead." We have known them for generations, observing them in excavations as they dig for tubers or construct huts near riverbanks in the forest. The Thattukottan come again to life from the "Dead" if we keep them in some water. Our kids used to play with it."



Purple Frog
Nasikabatrachus sahyadrensis



Karimbudan
Diospyros crumenata



Cochin Cane Turtle
Vijayachelys silvatica

Figure 1. Purple Frog, Karimbudan and Cochin Cane Turtle

b. The “Karimbudan” - the Critically Endangered Ebony tree

Few individuals of the tree of *Diospyros crumenata* (Figure 1), a rare species of the ebony tree family known only from a few locations of the low-elevation tropical rainforest endemic to the Western Ghats Biodiversity hotspot, were located in the Vazhachal region. The species was known to the tribal communities of Vazhachal. Kochuvelayi of Vazhachal pronounced the species as “Karimbudan” (Bachan, 2010). Sasidharan (2003) identified the tree as "Karimaram," indicating a lack of specific local names and the general use of this name for common ebony trees in Malayalam. This illustrates the rich cultural connection between the local communities and their natural environment, where names like "Karimbudan" and "Karimaram" reflect both ecological knowledge and linguistic diversity.

Later, a detailed investigation (Devika & Bachan, 2021) revealed the species' rarity and its threatened nature. Few mature individuals of the charismatic large tree, with its characteristic black bark, are known to the scientific community and lack a specific local name. The Kadar refers to these trees as "Karimbudan," emphasising their black-coloured bark and edible fruits. The knowledge was new to us, even though we have observed that the Great Hornbills, Civets, and Lion-Tailed Macaques feed on the fruits. Surprisingly, a detailed investigation indicated that the species and the tribal name "Karimbudan" are known only to the Kadar clans within the Vazhachal-Poringal region.

The Kadar people's support played a crucial role in the subsequent comprehensive survey, which classified the species as Critically Endangered due to its limited distribution to six subpopulations, a low number of mature individuals, and the degradation of the surrounding forests. The Kadar people, known as "Karimbudan," have now retained the vernacular name of the species at the international level at the IUCN official red list by Bachan & Devika (2024).

c. The “Chirapool” - the Endangered Cochin Forest Cane Turtle

In 2002, while conducting research on riparian forests, I inquired about the existence of the Cochin Forest Cane Turtle (*Vijayachelys silvatica*), a small turtle native to the Anamalais that was once thought to be extinct but is now endangered (Fig.1). While reaching his hut in the hamlet, the Kochuvelayi of the Vazhachal Kadar village showed me a small turtle with red eyes, a beaked snout, and a greenish-brown shell that was kept in their home for the children to play with. Since then, I've learned that most elderly people who roam the forests are familiar with the Cochin cane turtle, also known as "Chooralama" in Malayalam. The Kadar people pronounce turtles as "Nama" in their language and give each turtle and tortoise a unique name.

According to Manikyaraj of the Kadar community, “*The Cochin Forest Cane turtle is small and entirely different from the large Travancore tortoise, which they used to consume. We call the Cochin Forest Cane Turtle “Chirapool.” We have a deep affection for this species, and children often play with them. Sometimes we keep them, but they are usually not eaten due to their small size.*” “*They hold a special place in our hearts, representing a connection to nature and our childhood memories. The gentle nature of the Chirapool makes it a beloved companion for the younger generation as they explore the forests around us.*” He continued.

These names often reflect the turtle's characteristics or the stories associated with it, fostering a deep connection between the villagers and these creatures. This cultural bond highlights the importance of biodiversity in their ecosystems and emphasizes the respect the Kadar people have for all living beings. The traditional story of the Hornbill and the Cane turtle, used to tell their kids to make them understand how compassionate and generous are the Great Hornbill to carry the small “Chirapool” to attend a meeting held by the God of the forest.

Seeing that the tribal folk “Patt-ali,” the singer sang, “Karimb-ali,” the piper played, and the “Chenda-yali,” the drummer, drummed for the “Attam-ali,” the dancers....

“*Ongalum namem varado, thathakkam pithakkam chadikkali*”

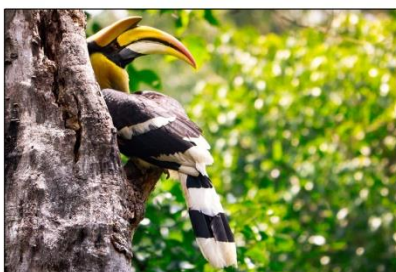
“The Great hornbill and the turtle are coming let us splay and dance”

d. The “Ongal, Vatti Ongal and Cherattan” - the three Hornbills and the Kadar

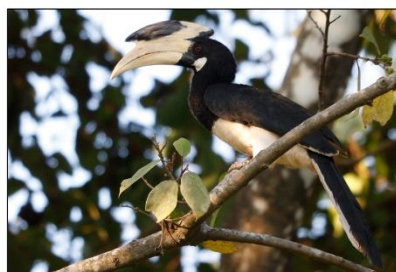
During the empirical investigation conducted in the riparian ecosystems of Vazhachal in the early 2000s, I was frequently accompanied by Kochuvelai, a Kadar tribal associate serving in the capacity of a tracker; it was during this time that I became acutely aware of the distinctive diversity of endangered flora and fauna, encompassing both avian and terrestrial species, thriving within the low-elevation patches of forest. The flagship avian species of the state, the Great Hornbill (Malamuzhaki Vazhambal), along with the medium-sized, low-elevation-preferred Malabar Pied Hornbills (Pandan Vezhambal) and the Malabar Grey Hornbill (Kozhi Vezhambal), exhibit both sympatric distributions and nesting habitats (Figure 2).

It was Kochuvelai who elucidated the nesting locations within the riparian forests, some of which had been traditionally utilized for sustenance by the Kadar community. They refer to the Great Hornbill as “Ongal,” the Malabar Pied Hornbill as “Vatti-ongal,” and the Malabar Grey Hornbill as “Chirattan” (Bachan, 2006; Bachan et al., 2019). The Kadar community and their customary hunting practices were depicted as contributing factors to the decline of the hornbill population in several widely circulated articles and news reports during that period. In the meantime, Ganeshan, another Kadar acquaintance, posed several inquiries to me.

“*Would you consider imposing incarceration on the tiger if it were to pursue an endangered species of deer?*” he inquired with profound melancholy. “*We do not engage in hunting; our existence and sustenance have historically been reliant on forest ecosystems. Our primary source of sustenance is fish, with occasional recourse to bushmeat during periods of food scarcity,*” he elaborated. “*We cannot be held accountable for the extensive environmental degradation that has transpired in the forest, including the establishment of plantations, tea estates, teak, dams, and reservoirs; all alterations within this ecological landscape have been orchestrated not by the Kadar. Our presence in this region extends back to time immemorial.*”



Great Hornbill
Buceros bicornis



Malabar Pied Hornbill
Anthracoceros coronatus



Malabar Grey Hornbill
Ocyeros griseus

Figure 2. Great Hornbill, Malabar Pied Hornbill and Malabar Grey Hornbill

This inquiry was selected as a focal research question to investigate and have developed a program aimed at the protection and monitoring of Hornbill nests and their associated habitats within the Vazhachal Forest Division, in collaboration with the Forest Department and the Kadar community (Bachan 2006). This initiative has led to the documentation of 23 nests of Great Hornbills and 3 nests of Malabar Pied Hornbills at that juncture (Prabhu et al., 2005), which was subsequently expanded to facilitate the effective conservation of 62 Hornbill nesting trees. The research empirically substantiated that the degradation of forest ecosystems occurred as a consequence of extensive land conversions, with its persistent repercussions identified as the primary factor contributing to the decline of the hornbill population (Bachan et al., 2011).

According to Senthilkumar, one of the hornbill monitoring guards, "the Kadar possess profound knowledge regarding the complex interdependencies among organisms and their rainforest habitats. The forest constitutes our domicile; we do not exist as separate entities from it. We have been engaged in the monitoring of Hornbills regardless of our employment status, as this endeavor has conferred upon us dignity and recognition. Moreover, the extensive knowledge we have accumulated concerning this terrain has been documented and has subsequently served as a basis for the affirmation of our forest rights." The Kadar community's involvement in the collective conservation efforts pertaining to the hornbill is extensively recognized as one of the unique societal groups, having garnered significant attention in various international media outlets (Thomas, 2015; Shaji, 2019). This community played a crucial role in enhancing biodiversity conservation and forest management within the region through an inclusive framework. Furthermore, this initiative facilitated the accumulation of long-term data regarding the alterations occurring within the forest amid the challenges posed by climate change, as well as the ramifications of the 2018 flood on the local biota, hornbill nesting trees and the riparian forests

Discussion

The intellectual repository of the Kadar community has played a pivotal role in the establishment of the community-based Hornbills conservation and monitoring initiative (Bachan, 2006; Bachan et al., 2011) as well as the oversight of other threatened resources (Amitha Bachan, 2011). Investigations into their ethnobotanical knowledge (Sabeena & Bachan, 2006) cataloged 44 plant species, each accompanied by distinct terminologies. The analysis of their ethnoecological knowledge (Vineesha & Bachan, 2016) elucidated their comprehensive understanding of various forest types, wherein they differentiate between Tropical Rainforests or Wet Evergreen forests, referred to in their dialect as 'Adavi,' and the standard evergreen forests, designated as "Pachakkadu." A multilingual pedagogical framework was developed, grounded in the Kadar language, which serves to facilitate the integration of indigenous children into formal educational systems (Bachan et al., 2012). This initiative has revealed that 60-70 percent of the vocabulary in their dialect is distinctive and divergent from Tamil and Malayalam. The ethnic nomenclature and knowledge on the lesser known and Critically Endangered low elevation rainforest tree *Diospyros crumenata* indicate need of in-depth enquiry into each and every taxon known to the community.

The designation of the King Cobra as "Koottupambu," interpreted as the Nest Making Snake, underscores their ecological cognizance, particularly when juxtaposed with its appellation in Malayalam, "Raja Vembala." The language has exhibited gradual evolution over time, exemplified by the incorporation of new lexicon. For instance, the term they ascribed to the Giraffe, a species familiar to them through illustrations, is "Gopura Kazhutha" (Bachan et al., 2014). A recent comprehensive study (Gouthami & Bachan, 2022) identified 253 plant names that are unique to this community. This profound linguistic diversity not only emphasizes their intrinsic relationship with the environment but also mirrors the cultural importance ascribed to flora and fauna within their societal framework. The earlier inclusion of the ethnic knowledge has contributed well establishing indigenous community-based conservation of Hornbills and their nesting habitat (Bachan et al., 2011). These finding on threatened species such as Purple frog, Cochin Forest Cane Turtle and the *Diospyros crumenata* has similar potential, we ascertain that this knowledge, if harnessed appropriately, can be integrated into an inclusive framework aimed at achieving sustainability and conservation objectives.

The Kadar language, along with its lexicon, serves as fundamental components for the enhancement of ecological understanding, which may be elucidated through a natural history framework that encompasses time-honored and essential information pertinent to contemporary conservation efforts in our current paradigm climate change indicated insurgency of the anthropocene. Their role in conservation is significant, as they contribute to the preservation of genetic resources within the Anamalai Tiger Reserve (Sawant & Shivaa, 2019). Kadar songs and dances serve as vital cultural expressions, reflecting their daily lives, emotions, and connection to nature. These artistic forms are crucial for maintaining their identity, even as modern influences threaten their traditional practices. The Kadar are changing with the times, but their songs show how hard it is for them to stay true to who they are. It is believed that recording their traditional songs will help them close the gap between the past and the present (Therdyllo, 2022).

Conclusion

The Kadar community's deep-rooted knowledge of their environment showcases how indigenous languages encapsulate vital ecological insights, offering perspectives on species interactions and conservation practices that are often overlooked in mainstream scientific discourse. The linguistic proficiency exhibited by these individuals demonstrates considerable diversity across their respective clans, as illustrated by the case of the endangered tree “Karimbudan,” which remains exclusively known to the Vazhachal clans. Their vocabulary exhibits distinctiveness, interwoven with complex ecological insights related to the biology and life cycle of “Koottupambu,” ecological behaviors and adaptations such as “Chirapool” and “Thattukottan,” as well as specialized knowledge concerning “Vatti Ongal” and “Karimbudan.” Notably, the designation for the Malabar Grey Hornbill, “Chirattan,” along with its derivatives, is frequently utilized by various ethnic groups throughout the Southern Western Ghats. This shared nomenclature underscores the interrelation of these communities and their collective comprehension of local biodiversity, thereby emphasizing the critical necessity of safeguarding both linguistic heritage and ecological knowledge for subsequent generations. This rich linguistic heritage not only preserves traditional ecological knowledge but also highlights the importance of integrating indigenous perspectives into contemporary conservation efforts, fostering a more holistic understanding of biodiversity. By valuing and incorporating these indigenous languages, conservationists can enhance their strategies, ensuring that the voices of local communities are heard and respected in the quest to protect our planet's diverse ecosystems. The Kadar unwritten linguistic system, still employed in their communicative exchanges, has undergone an evolutionary process, preserving an extensive compendium of ecological knowledge within the lexicon they utilize, akin to seeds poised for germination. However, it is imperative to possess the cultural sagacity necessary to cultivate a conducive environment that facilitates their sprouting and sustenance.

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Author contributions

Amitha Bachan KH: Conceptualization, Writing, Methodology, Review & Editing, Image contributions- Purple frog, Cochin cane turtle & Malabar Grey Hornbill.

Devika M Anilkumar: Formal analysis, data collection, Writing, Data curation & Editing, Image contributions- Karimbudan.

Aswin KB: data collection, Writing, Data curation, Image contributions- Great Hornbill & Malabar Pied Hornbill.

Conflict of interests

The authors declare no conflict of interest.

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Ethics approval

No experiments based on animals during the study. Pre informed consent sought from the Kadar ethnic community.

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