

OPEN ACCESS

EDITED BY

Fabio Petrelli,
University of Camerino, Italy

REVIEWED BY

Muzafar Riyaz,
Sher-e-Kashmir University of Agricultural
Sciences & Technology, India

*CORRESPONDENCE

L. N. Kakati
✉ lakhmi.kakati1956@gmail.com

RECEIVED 12 January 2026
REVISED 10 February 2026
ACCEPTED 18 February 2026
PUBLISHED 09 March 2026

CITATION

Mozhui L, Sale K and Kakati LN (2026)
Edible spiders: an unconventional
source of nutrition and therapeutic
agents.
Front. Sustain. Food Syst. 10:1785733.
doi: 10.3389/fsufs.2026.1785733

COPYRIGHT

© 2026 Mozhui, Sale and Kakati. This is
an open-access article distributed under
the terms of the [Creative Commons
Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use,
distribution or reproduction in other
forums is permitted, provided the
original author(s) and the copyright
owner(s) are credited and that the
original publication in this journal is
cited, in accordance with accepted
academic practice. No use, distribution
or reproduction is permitted which does
not comply with these terms.

Edible spiders: an unconventional source of nutrition and therapeutic agents

Lobeno Mozhui¹, Kekhesino Sale¹ and L. N. Kakati^{2*}

¹Department of Zoology, Nagaland University, Lumami, Nagaland, India, ²Faculty of Science, Assam Down Town University, Guwahati, Assam, India

Currently, arthropods are recognized as viable “mini livestock,” offering a sustainable, ecologically efficient, and nutritionally important food source characterized by high protein content, exceptional amino acid profiles, essential micronutrients, and a low environmental footprint. Arachnids, particularly spiders, are one underexplored component of human diets, with documented consumption in several indigenous cultures for both nutritional and traditional medicinal purposes. However, despite their ethnobiological significance, systematic research on their nutritional composition, safety, and potential contribution to food security remains limited. In Nagaland, India, orb-weaver spiders such as *Nephila pilipes* and *Trichonephila clavata* are consumed and highly preferred for their plump abdomens, which yield a creamy, nutty flavor upon cooking. Edible spiders are considered viable meat substitutes, contributing protein and other essential nutrients to local diets. The knowledge and practice of consuming various spiders for food and medicinal purposes amongst indigenous cultures are passed down orally through generations. Hence, emphasizing these practices can foster respect and curiosity among researchers towards indigenous knowledge systems. Despite the urgent need to provide sufficient nutrition for an expanding population, many individuals experience discomfort or aversion to consuming arachnids, frequently attributed to food neophobia or feelings of disgust. The present study, therefore, focuses on the importance of edible spiders as a sustainable food source for future food and nutrition security.

KEYWORDS

arachnophagy, arachnotherapy, edible spiders, food security, *Nephila pilipes*, novel food, *Trichonephila clavata*

1 Introduction

The global population is expected to reach 9.8 billion by 2050 and 11.2 billion in 2100, requiring a near doubling of present food production (UNDESA, 2017). Over 2 billion people experience food insecurity, while demand for animal-based protein continues to grow. However, sustaining this demand is increasingly difficult due to constraints such as limited arable land, resource depletion, climate change, and water scarcity (Denning, 2025). Global hunger is also intensifying—over 811 million people went to bed hungry in 2020, up from 690 million in 2019, largely due to the COVID-19 pandemic (FAO, 2021). Furthermore, conventional livestock production contributes significantly to greenhouse gas emissions, deforestation, and excessive water use (Denning, 2025). In this context, traditional foods, rooted in centuries-old culinary and cultural practices that are derived from local resources and produced through small-scale, low-technology systems with short value chains, represent sustainable alternatives.

These foods are nutrient-rich, eco-friendly, and culturally significant, enhancing food security by providing accessible, locally sourced nutrition (Kapoor et al., 2022).

2 Arachnophagy: the consumption of spiders

Although edible insects are widely studied and frequently discussed in the literature, considerably less attention has been given to the knowledge, consumption, and diverse uses of edible spiders. The presence of painful, venomous, and sometimes fatal bites in several spider species undoubtedly adds to the widespread fear these arachnids evoke. Spiders form an integral part of the small-food traditions of the Alune people of northwest Seram. The Huntsman spider (Heteropodidae), referred to as “*labalilba kuning*” in Ambonese Malay, holds cultural significance for the Alune tribe, serving as a traditional food source. The tribe also consumes species of *Nephila*, which are prepared either by roasting them whole over a fire or steaming them in bamboo tubes, demonstrating the community’s adaptation to locally available resources. Additionally, *Araneus* species (Araneidae), locally called *tasie*, meaning “salty,” are valued for their naturally pleasant flavor. Similar species within the genus are also used as food in New Caledonia (Healey and Florey, 2003).

Among the 53,634 recognized spider species worldwide, only a small fraction is considered harmful, with fewer than 30 species—less than one-tenth of 1%—linked to human fatalities (World Spider Catalog, 2026). Despite the immense diversity of spiders, only 23 species have been documented as food sources in various cultural contexts (Costa-Neto and Grabowski, 2021). Healey and Florey (2003) emphasize the limited attention given to the use of spiders by human societies, suggesting that the scarcity of information may reflect either a substantial underutilization of this resource or a tendency among ethnobiologists to overlook authentic indigenous practices involving spiders. Approximately 80% of the global population intentionally consumes insects, spiders, and other arthropods, while nearly 100% consume them unintentionally (Costa-Neto and Grabowski, 2021). There are sporadic accounts in the literature that point to spiders’ many uses, such as food, medicine, technical components, and positive symbols of social identity (Healey and Florey, 2003). Despite arachnophobia, the use of arachnids and myriapods for food (arachnophagy) and therapeutic (arachnotherapy) purposes is increasingly recognized as an adjunct within the broad field of entomophagy, with the potential to supplement traditional animal protein sources (Gajbe, 2024; Meyer-Rochow, 2017).

Edible spiders are primarily classified within five families: Araneidae, Lycosidae, Salticidae, Sparassidae, and Theraphosidae. They form part of traditional diets in regions of Africa (e.g., South Africa, Gambia, Madagascar), Asia (e.g., Thailand, Cambodia, China, Indonesia, Northeast India, Laos), Oceania (e.g., Papua New Guinea, New Caledonia), and the Americas (e.g., Mexico, Paraguay, Venezuela) (Costa-Neto and Grabowski, 2021). Spider species, namely, *Epeira nigra*, *Nephila naurata*, and *Nephila madagascariensis*, along with other Araneae and Bostrichidae species, were documented as consumed globally by Jongema (2017). In several Melanesian cultures—including the Kapauku, Yopno, Pawaia, Maring, Kilimeri, and communities in New Caledonia—spiders roasted in embers are a popular snack (Healey and Florey, 2003). In Cambodia, spider species

known locally as *a-ping* and likely belonging to the genus *Haplopelma* (Theraphosidae) were originally eaten for medicinal purposes, but their widespread use as food is believed to have emerged during the severe famine under Pol Pot’s Khmer Rouge regime in the 1970s. Species of the genera *Haplopelma* and *Nephila* are particularly regarded as delicacies and are traditionally harvested from the wild. Other species, such as *Heteropoda venatoria* (Sparassidae), are also collected and consumed by indigenous groups like the Yanomami in Venezuela. Typically, spiders are prepared by heating, defanging, and occasionally drying or grinding before consumption (Cardoso et al., 2025).

The goliath bird-eater, *Theraphosa blondi* (Theraphosidae), is considered a nutritious food source and forms part of the traditional diet of the Yanomami and Piara communities in the Amazon. Toasting *T. blondi* over fire is a common way for the Yanomami people of Venezuela to enjoy a tasty snack. Being one of the largest spider species, it contributes significant flavor and texture to any dish (Menzel and d’Aluisio, 1999). *Theraphosa blondi*, along with *H. venatoria*, is also incorporated into local cuisines in Venezuela and Paraguay. Species *Nephila edulis*, known for its plump abdomen, is reported to have a pâté-like flavor when baked, potentially appealing to individuals exploring traditional diets. *Nephila pilipes* is consumed in Thailand, either raw or cooked, and in New Guinea, where it is traditionally fire-roasted (Costa-Neto and Grabowski, 2021). *Nephila pilipes* and *N. clavata* have also been documented as a food source in Manipur, India (Kananbala et al., 2013).

Despite widespread arachnophobia, spiders are vital components of terrestrial ecosystems, providing numerous ecosystem services. In some societies, spiders are consumed as part of long-standing cultural or ritual traditions, while in others, their consumption historically arose from necessity during times of food scarcity (Cardoso et al., 2025). Growing recognition of spiders as edible resources—alongside their ecological importance—highlights their potential contribution to sustainable, diversified, and locally adapted food systems (Costa-Neto and Grabowski, 2021).

3 Arachnotherapy: a historical overview

In the Kamchatka Peninsula in eastern Russia, spiders are thought to confer fertility upon infertile women and facilitate childbirth, highlighting their magical importance. In Brazil, unidentified spiders are used as aphrodisiacs, illustrating their significance in traditional health practices (Bodenheimer, 1951). Many cultures and religions hold spiders in high esteem for their mystical and culturally significant uses, such as improving libido for reproductive purposes, predicting social disaster, and protecting from mythical dangers. Numerous accounts of arachnophagy indicate that these creatures are predominantly perceived as therapeutic agents rather than mere sustenance, underscoring their significance in both medicinal and mystical contexts (Healey and Florey, 2003).

Arachnids have been extensively employed in traditional medical systems and are frequently considered nutraceuticals, valued for their preventive and therapeutic attributes. Scientific research has validated the therapeutic potential of various species of spiders, resulting in the extraction of numerous bioactive compounds with pharmacological uses (Costa-Neto and Grabowski, 2021). Worldwide, spiders and

tarantulas have historically been utilized in ethnomedicine to address respiratory, dermatological, and dental conditions. The tarantula *Brachypelma vagans* based beverage is used in the traditional medicine of the Chol Maya community in Mexico to cure chest pain, coughing, and asthma (Machkour-M'Rabet et al., 2011). Likewise, spider-derived treatments for wounds and asthma are extensively documented in Brazil, India, Mexico, and China (Meyer-Rochow, 2017).

Ethnobiological records highlight species-specific applications among different cultures. The Tzeltales and Tzotziles peoples of Chiapas, Mexico, employ *Tilitocatl vagans* to treat tumours by allowing the spider to bite the affected area; in Brazil, chelicerates from the Goliath bird-eating tarantula have been reported to treat “erysipelas” (or “Holy fire”), fortification of teeth, and asthma; in Bahia, toasted bird-spider (*Mygalomorphs* spp.) are taken for the treatment of asthma (Machkour-M'Rabet et al., 2011; Hunn, 1977). Among the Chol communities, an extract derived from *T. vagans* body is believed to “clean the eyesight”. The Senufo people of Mali are reported to consume fried *Phoneyusa* sp. to relieve stomach ailments, while in Cambodia, fried tarantulas (*Haplopelma* sp.) are eaten to alleviate respiratory disorders (Cardoso et al., 2025). The Char Chapori communities of India use *H. venatoria* to treat skin rashes, asthma, ulcers, and menorrhagia (Ahmed et al., 2013). In other parts of India, powdered or dried spiders are administered to manage haemorrhages, piles, coughs, coryza, congestive headaches, and nasal bleeding (Cardoso et al., 2025). Besides their direct applications as folk medicine, the silk of spiders has also been used for centuries as a therapeutic material due to its antiseptic and regenerative properties. In Madagascar, for instance, spider silk is applied to boils, pustules, and ulcers to promote healing and accelerate sore maturation. In some traditions, spider webs are mixed with kitchen soot and applied to open wounds, including circumcision sites, to facilitate recovery (Guo et al., 2023).

4 Golden orb-weaver spiders

Golden orb-weaver spiders of the genus *Nephila* are distributed globally and particularly abundant in tropical regions. They exhibit extreme sexual size dimorphism, with brightly colored females far larger than males, a trait attributed to either male dwarfism or female

gigantism (Hoebeke et al., 2015; Elgar and Schneider, 2004). Some species, notably *N. pilipes*, have unusually broad geographic ranges across South and Southeast Asia, Australia, and islands extending to Japan and the Pacific (Harvey et al., 2007). *Nephila* species construct large, asymmetrical orb webs measuring up to 1.5 m in diameter and are composed of resilient golden silk capable of capturing insects and, sometimes, small vertebrates (Sakai, 2007; Craig et al., 1996). While some species are habitat specialists, others readily persist in anthropogenically altered environments (Su et al., 2011).

Golden orb-weaver spiders play a critical role in tropical and subtropical ecosystems. Their large webs serve as indicators of environmental chemistry, while their growth and development reflect habitat quality (Dacanay et al., 2014). Genus *Nephila* is a well-established model in ecological biology, silk, and developmental biology studies, and its species have been widely used to study foraging behavior, mating systems, predator-prey interactions, and symbiosis (Kuntner et al., 2012; Harvey et al., 2007; Zschokke et al., 2006). Although most spiders are nocturnal and exhibit cryptic coloration, several diurnal orb-weavers in the families *Araneidae* and *Tetragnathidae* display conspicuous color patterns, which have been shown to augment foraging success by acting as visual attractants to prey (Oxford and Gillespie, 1998; Yaginuma, 1986). Representative images of the orb-weaver spiders *Nephila pilipes* and *Trichonephila clavata* in their natural habitat are shown in Figure 1.

5 Orb-weaver spiders: a culinary delicacy in indigenous Naga culture

Among the indigenous tribes of Nagaland, knowledge of spider consumption for food and medicinal purposes is transmitted orally and embedded in traditional ecological knowledge systems. Earlier ethnographic reports documented the use of *Avansa* sp. and *Nephila clavata* among Naga communities (Meyer-Rochow and Changkija, 1997). In this study, the traditional knowledge on the consumption of *Nephila pilipes* and *Trichonephila clavata* was documented using a semi-structured questionnaire. Informants ($n = 33$; 26 males and 7 females) were selected through purposive sampling (Garcia, 2006), targeting individuals with recognized traditional knowledge (e.g.,

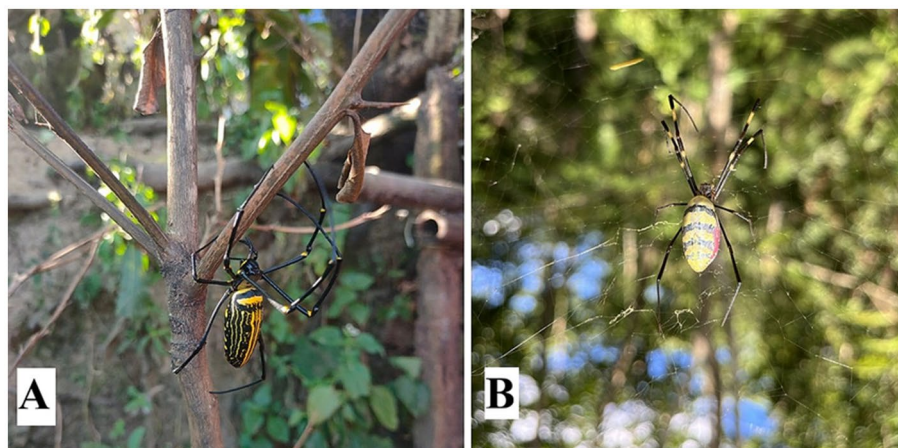


FIGURE 1
Orb-weaver spiders *Nephila pilipes* and *Trichonephila clavata* in their natural habitat, Nagaland, India. Photo credit: (A) Kekhesino Sale, and (B) Lobeno Mozhui.

elders and foragers). The cultural importance of each species was quantified using the use value (UV) index (Phillips et al., 1994): $UV = \sum U/n$, where U is the number of informants' citations per spider species, and n is the total number of informants.

Both species exhibited a high UV value (0.9) and are locally known as *siyankyü* in the Lotha Naga language, indicating their high cultural relevance and perceived nutritional value as alternative protein sources. These species are most abundant during October and November, with limited availability extending into December and January. In November, *N. pilipes* and *T. clavata* are particularly preferred due to their plump abdomens, which develop a creamy, nutty flavor upon cooking.

Preparation involves removing the head and legs (Figure 2A), followed by thorough washing with cold water and repeated soaking in hot water for 3–5 min to ensure proper cleaning. Small incisions are then made in the abdomen to facilitate the absorption of seasonings. The cleaned spiders are placed in a cooking pot with approximately 3–4 teaspoons of cooking oil and salt and cooked over low heat until browned (≈ 5 min). Ginger, chili powder, and/or fresh green chilies, bamboo shoot extract or sumac (4–5 tablespoons), and water are subsequently added, and the mixture is simmered on low heat for approximately 40 min. Fresh garlic paste is added toward the end of cooking and heated until the preparation dries. The final product is consumed as a nutritious meat substitute (Figure 2B).

6 Orb-weaver spiders as dietary protein sources

Although arthropods are increasingly recognized as sustainable alternative protein sources, nutritional studies on spiders remain scarce compared with insects (Nirmal et al., 2025). Research on *Nephila* species has largely focused on silk proteins, fatty acid composition, metabolism, growth, reproduction, and venom biochemistry (Tso et al., 2005; Marhabaie et al., 2007; Wen et al., 2025), while systematic data on proximate composition, amino acid profiles, lipid classes, and mineral content are largely lacking. This represents a major knowledge gap in arthropod-based food research, particularly given spiders' high protein turnover and substantial lipid reserves. Hawley et al. (2014) showed that *Argiope keyserlingi* adjusts lipid and protein storage according to prey macronutrient composition without compensatory nutrient

extraction. Together, these findings highlight the need for comprehensive nutritional studies of *Nephila pilipes* and *Trichonephila clavata* to establish baseline data and evaluate their potential as unconventional protein sources in sustainable food systems.

In the present study, adult *Nephila pilipes* and *Trichonephila clavata* specimens were collected from Nagaland University, Lumami campus, and starved for 24 h to reduce gut content. Specimens were washed with distilled water, legs removed, and body tissues used for thermal processing experiments. Samples were roasted (70 °C, 100 °C, and 130 °C) and boiled in 250 mL distilled water until dryness. After processing, samples were oven-dried at 50 ± 5 °C for 72 h, ground into powder, and stored in airtight containers for biochemical analysis. All treatments were conducted in triplicate.

Total protein content was determined using the Lowry method (Lowry et al., 1951). Protein ranged from 36.03% to 73.65% in *Nephila pilipes* and 34.17%–57.65% in *Trichonephila clavata*. Raw *N. pilipes* showed the highest protein content (73.62%), which decreased to 47.69% after boiling, while roasting at 70 °C and 100 °C yielded 49.97 and 50.51%, respectively, and further declined to 36.03% at 130 °C. In *T. clavata*, raw samples contained 57.65% protein, which dropped to 34.17% after boiling, whereas roasting at 70 °C, 100 °C, and 130 °C yielded 50.40%, 51.32%, and 53.38% protein, respectively. Thermal processing significantly influenced protein content. Moderate heating at 70 °C and 100 °C resulted in partial preservation of protein content in *N. pilipes*, suggesting that these temperatures may maintain protein integrity while improving extractability. In contrast, roasting at 130 °C caused a pronounced reduction in measurable protein, likely due to protein denaturation, aggregation, and degradation reactions such as Maillard browning and thermal hydrolysis. These processes can reduce detectable protein levels by altering amino acid residues or forming insoluble complexes. In *T. clavata*, boiling led to a substantial reduction in protein content, which may be attributed to protein denaturation and leaching into the cooking medium. Interestingly, protein content was relatively higher after processing at 70 °C–130 °C compared with boiling, possibly due to dehydration and concentration effects or improved protein extractability following tissue disruption. The relatively higher thermal stability observed in *T. clavata* compared with *N. pilipes* may reflect species-specific differences in protein structure, tissue composition, and lipid–protein interactions. Overall, the results indicate that processing temperature plays a critical role in determining protein retention in spiders. Moderate heating appears optimal for

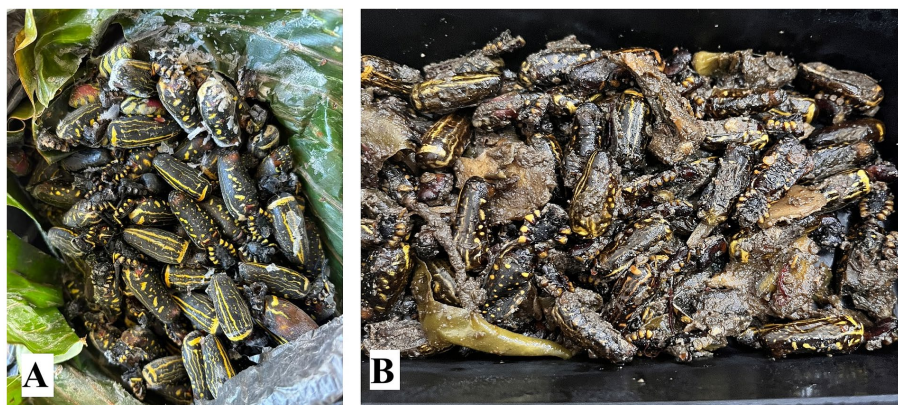


FIGURE 2

(A) *Nephila pilipes* and *Trichonephila clavata* (legs removed); (B) cooked spiders (as mentioned in the text). Photo credit: (A) Etsoshan Y. Ovung, and (B) Lobeno Mozhui.

preserving protein content, whereas extreme thermal treatments may compromise protein integrity and nutritional quality. These findings provide the first baseline data on the effect of thermal processing on protein content in *Nephila* spiders and highlight their potential as alternative protein sources for future sustainable food systems.

7 Current scientific investigations in arachnology

The majority of current spider research has largely focused on biological characteristics such as silk properties, web architecture, morphology, and genetics. *Nephila pilipes* exhibits adaptive plasticity in the synthesis of silk, altering the amino acid content of dragline silk in response to the availability of prey (Tso et al., 2005). Additionally, its dragline silk exhibits antibacterial action against major wound pathogens like *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*, highlighting potential biomedical applications such as clinical masks and wound dressings (Bergmann et al., 2022). The potential of spider silk in regenerative medicine is highlighted by numerous *in vitro* studies, which have demonstrated that spider silk is biocompatible, supporting adhesion, migration, and proliferation of diverse mammalian cells while eliciting minimal immunogenic responses *in vivo* (Amaley et al., 2014). Furthermore, a variety of bioactive substances found in silk, hemolymph, and spider venom are the primary focus of bioprospecting initiatives. This potential is supported by ethnomedical traditions, such as the Sukuma tribe of Tanzania using spider webs to heal wounds and ancient arachnid-based therapies recorded in Europe and Africa (Cardoso et al., 2025).

A wide variety of peptides and bioactive compounds that interact with neuronal sodium, calcium, and potassium channels as well as glutamate and acetylcholine receptors, are present in spider venoms, which have remarkable biochemical complexity and significant therapeutic potential (Guo et al., 2023). These peptides have therapeutic potential, but they are also effective pharmacological tools for understanding ion channel function and disease causes. Notably, guanxi-toxin-1E has been instrumental in defining the role of KV2 delayed-rectifier potassium channels in neuronal excitability, PcTx1 in advancing understanding of acid-sensing ion channels and related disorders, and α - and ω -agatoxins in studies of mammalian glutamate receptors and calcium channels (Saez and Herzig, 2019).

Spider-derived neurotoxins exhibit strong translational potential, with applications extending beyond medicine to industrial processes, food technologies, and waste management. Several compounds have shown promise in treating neurodegenerative disorders, chronic pain, skeletal muscle and vascular diseases, dermatological and urinary disorders, metabolic dysfunctions, cancer, microbial infections, and malaria, owing to their potent analgesic, antimicrobial, and neuroprotective properties. Among the most advanced drug candidates is a peptide derived from the venom of the Australian funnel-web spider *Hadronyche infensa* (Saez and Herzig, 2019).

Furthermore, spider silk has emerged as a sustainable biomaterial for regenerative medicine and tissue engineering due to its high biocompatibility, biodegradability, and exceptional mechanical strength. It serves as an effective scaffold for musculoskeletal repair, including skin regeneration and the reconstruction of bone, cartilage, ligaments, muscle, peripheral nerves, and vascular tissues, and shows promise for applications such as wound dressings, surgical sutures, antibacterial textiles, drug

encapsulation and targeted delivery, biodegradable artificial silks, and nerve regeneration scaffolds (Branković et al., 2024). While these advances underscore the biomedical and technological potential of spiders, they also highlight a critical research gap: the limited nutritional profiling of edible spider species. Addressing this gap would expand our understanding of spiders not only as sources of novel bioactive compounds but also as sustainable and nutritionally valuable food resources.

8 Future outlook on arachnology

Food security is emerging as a critical global challenge as a result of rapid population growth, rising consumption patterns, and the looming risk of declining food availability. Agricultural productivity has shown signs of stagnation, while chronic malnutrition persists across many low-income regions. Both natural factors—such as climate change, energy shortages, declining soil fertility, and increasing pest and disease pressures—and human-induced factors, including rising food prices, limited food availability, unequal distribution systems, and reduced purchasing power, contribute significantly to food insecurity (Kumar and Chand, 2010; Gahukar, 2009). For at least the next 40 years, it is projected that the demand for food will increase globally. For example, by 2030, for instance, with the human population increasing by approximately 6 million people per month and global food reserves at their lowest levels in 50 years, overall food demand is expected to grow by nearly 50% (Beddington, 2010). Under these conditions, finding sustainable and alternative food sources is now crucial rather than optional in these circumstances.

As population growth continues, the pressure on environmental resources such as freshwater systems and arable land will intensify, further constraining conventional food production. In this context, traditional food systems—particularly those rooted in indigenous knowledge—offer valuable insights, as they rely on locally available and culturally accepted resources (Kuhnlein, 2003; Mintz and Du Bois, 2002). Many indigenous communities have long incorporated invertebrates into their diets as part of survival strategies (Wahlqvist, 2007; Kuhnlein, 2003). Among these, spiders represent a largely overlooked but promising food resource.

Given the widespread degradation of ecosystems and the limits of traditional agriculture, the use of invertebrates such as spiders for human consumption presents a sustainable and ecologically efficient pathway to enhance food security. Preserving and revitalizing indigenous knowledge systems that include the harvesting and consumption of spiders is, therefore, crucial, not only for cultural continuity but also for developing resilient food systems capable of meeting future global nutritional demands.

9 Conclusion

Despite their nutritional and cultural potential, widespread acceptance of arachnid and myriapod consumption remains limited due to deep-rooted cultural barriers. In many societies, the idea of eating spiders evokes fear or disgust, particularly among populations unfamiliar with such practices. Nonetheless, interest in these species as novel foods is growing, and they have become increasingly accessible through online retailers and culinary tourism in regions where arachnophagy is a traditional practice. As cultural perceptions gradually evolve, the consumption of these arthropods may become more

normalized among curious consumers and those seeking sustainable, nutritious food alternatives. Although the notion of consuming spiders may appear unconventional in many cultures, their promising nutritional profile and potential environmental benefits render them a compelling subject for scientific investigation. Within the broader context of edible invertebrates, spiders should be given greater recognition as sustainable and viable sources of protein. In addition to improving future food and feed security, their use could help achieve several Sustainable Development Goals (SDGs) of the United Nations, including those of life on land, zero hunger, and responsible consumerism. As the global community seeks to develop resilient, inclusive, and sustainable food systems, exploring such unconventional yet ecologically efficient alternatives becomes increasingly vital.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/[Supplementary material](#).

Ethics statement

The manuscript presents research on animals that do not require ethical approval for their study.

Author contributions

LM: Formal analysis, Visualization, Funding acquisition, Writing – original draft, Project administration, Data curation, Resources, Methodology, Conceptualization, Investigation, Validation, Supervision, Writing – review & editing. KS: Data curation, Writing – original draft, Investigation, Resources. LK: Validation, Conceptualization, Writing – review & editing, Supervision, Formal analysis, Methodology, Visualization.

Funding

The author(s) declared that financial support was received for this work and/or its publication. This research is funded by Nagaland University, Lumami grant no. F. No. NUL/RDC/SUPYF/PF-18/2024.

References

- Ahmed, M., Anam, J., Saikia, M. K., and Saikia, P. K. (2013). Spider species *Heteropoda venatoria* Linnaeus 1767 (family: *Sparassidae*): a commonly used traditional medicine of char Chapori people of Assam, India. *Indian Soc. Arachnol.* 2, 1–15.
- Amaley, A., Gawali, A., and Akarte, S. (2014). Antibacterial nature of dragline silk of *Nephila pilipes* (Fabricius, 1793). *Indian J. Arachnol.* 3, 8–11.
- Beddington, J. (2010). Global food and farming futures. *Phil. Trans. R. Soc. B Biol. Sci.* 365, 2767–2767. doi: 10.1098/rstb.2010.0181
- Bergmann, F., Stadlmayr, S., Millesi, F., Zeitlinger, M., Naghilou, A., and Radtke, C. (2022). The properties of native *Trichonephila* dragline silk and its biomedical applications. *Biomater. Adv.* 140:213089. doi: 10.1016/j.bioadv.2022.213089
- Bodenheimer, F. S. (1951). "Insects as human food" in *Insects as human food: a chapter of the ecology of man* (Dordrecht: Springer Netherlands). doi: 10.1007/978-94-017-6159-8
- Branković, M., Zivic, F., Grujovic, N., Stojadinovic, I., Milenkovic, S., and Kotorcevic, N. (2024). Review of spider silk applications in biomedical and tissue engineering. *Biomimetics* 9:169. doi: 10.3390/biomimetics9030169
- Cardoso, P., Pekár, S., Birkhofer, K., Chuang, A., Fukushima, C. S., Hebets, E. A., et al. (2025). Ecosystem services provided by spiders. *Biol. Rev.* 100, 2217–2236. doi: 10.1111/brv.70044
- Costa-Neto, E. M., and Grabowski, N. T. (2021). Edible arachnids and myriapods worldwide—updated list, nutritional profile and food hygiene implications. *J. Insects Food Feed* 7, 261–280. doi: 10.3920/JIFF2020.0046
- Craig, C. L., Weber, R. S., and Bernard, G. D. (1996). Evolution of predator-prey systems: spider foraging plasticity in response to the visual ecology of prey. *Am. Nat.* 147, 205–229. doi: 10.1086/285847
- Dacanay, C. C., Barrion-Dupo, A. L., and Nuñez, O. M. (2014). Rapid assessment of spider fauna of Pulacan falls, Zamboanga del Sur, Philippines. *J. Bio. Env. Sci.* 5, 455–464.

Acknowledgments

LM would like to thank Dr. Etsoshan Y. Oving for sharing the culinary recipe and the DBT NER Project No. BT/PR53947/NER/95/2200/2024 for providing laboratory facilities to facilitate the completion of the work.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was not used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2026.1785733/full#supplementary-material>

- Denning, G. (2025). Sustainable intensification of agriculture: the foundation for universal food security. *NPJ Sustain. Agric.* 3:7. doi: 10.1038/s44264-025-00047-3
- Elgar, M. A., and Schneider, J. M. (2004). "Evolutionary significance of sexual cannibalism" in *Advances in the study of behavior*. eds. P. J. B. Slater, J. S. Rosenblatt, C. T. Snowdon, T. J. Roper, H. J. Brockmann and M. Naguib (Amsterdam: Elsevier Inc.).
- FAO (2021). *The state of food and agriculture*. Rome: FAO.
- Gahukar, R. T. (2009). Food security: the challenges of climate change and bioenergy. *Curr. Sci.*, 96, 26–28.
- Gajbe, P. U. (2024). Edible arachnids: a short review. *Art* 13, 1–6.
- Garcia, G. S. C. (2006). The mother–child nexus: knowledge and valuation of wild food plants in Wayanad, Western Ghats, India. *J. Ethnobiol. Ethnomed.* 2:39. doi: 10.1186/1746-4269-2-39
- Guo, R., Guo, G., Wang, A., Xu, G., Lai, R., and Jin, H. (2023). Spider-venom peptides: structure, bioactivity, strategy, and research applications. *Molecules* 29:35. doi: 10.3390/molecules29010035
- Harvey, M. S., Austin, A. D., and Adams, M. (2007). The systematics and biology of the spider genus *Nephila* (Araneae: Nephilidae) in the Australasian region. *Invertebr. Syst.* 21, 407–451. doi: 10.1071/IS05016
- Hawley, J. A., Simpson, S. J., and Wilder, S. M. (2014). Effects of prey macronutrient content on body composition and nutrient intake in a web-building spider. *PLoS One* 9:e99165. doi: 10.1371/journal.pone.0099165
- Healey, C., and Florey, M. (2003). Arachnophagy and approaches to spiders among an eastern Indonesian people. *J. Ethnobiol.* 23, 1–22.
- Hoebeke, E. R., Huffmaster, W., and Freeman, B. J. (2015). *Nephila clavata* L. koch, the Joro spider of East Asia, newly recorded from North America (Araneae: Nephilidae). *PeerJ* 3:e763. doi: 10.7717/peerj.763
- Hunn, E. S. (1977). *Tzeltal folk zoology: the classification of discontinuities in nature*. New York, NY: Academic Press.
- Jongema, Y. (2017). *List of edible insects of the world*. Wageningen: Wageningen University.
- Kananbala, A., Bhubaneshwari, M., and Siliwal, M. (2013). Study on two edible spiders of the genus: *Nephila* (fam. Nephilidae) of Manipur, India. *Biosci. Trends* 6, 154–157.
- Kapoor, R., Sabharwal, M., and Ghosh-Jerath, S. (2022). Indigenous foods of India: a comprehensive narrative review of nutritive values, antinutrient content and mineral bioavailability of traditional foods consumed by indigenous communities of India. *Front. Sustain. Food Syst.* 6:696228. doi: 10.3389/fsufs.2022.696228
- Kuhnlein, H. V. (2003). Micronutrient nutrition and traditional food systems of indigenous peoples. *Food Nutr. Agric.* 32, 33–39.
- Kumar, P., and Chand, R. (2010). Food security, research priorities and resource allocation in South Asia. *Agric. Econ. Res. Rev.* 23, 209–226. doi: 10.22004/ag.econ.97153
- Kuntner, M., Zhang, S., Gregorič, M., and Li, D. (2012). *Nephila* female gigantism attained through post-maturity molting. *J. Arachnol.* 40, 345–347. doi: 10.1636/B12-03.1
- Lowry, O. H., Rosebrough, N. J., Farr, A. L., and Randall, R. J. (1951). Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193, 265–275. doi: 10.1016/s0021-9258(19)52451-6
- Machkour-M'Rabet, S., Hénaut, Y., Winterton, P., and Rojo, R. (2011). A case of zoo-therapy with the tarantula *Brachypelma vagans* Ausserer, 1875 in traditional medicine of the Chol Mayan ethnic group in Mexico. *J. Ethnobiol. Ethnomed.* 7:12. doi: 10.1186/1746-4269-7-12
- Marhabaie, M., Leeper, T. C., and Blackledge, T. A. (2007). Protein composition correlates with the mechanical properties of spider (*Argiope trifasciata*) dragline silk. *Biomacromolecules* 8, 2611–2618. doi: 10.1021/bm070450x
- Menzel, P., and d'Aluisio, F. (1999). *Man eating bugs: the art and science of eating insects*. Emeryville, CA: Ten Speed Press.
- Meyer-Rochow, V. B. (2017). Therapeutic arthropods and other, largely terrestrial, folk-medicinally important invertebrates: a comparative survey and review. *J. Ethnobiol. Ethnomed.* 13:9. doi: 10.1186/s13002-017-0136-0
- Meyer-Rochow, V. B., and Changkija, S. (1997). Uses of insects as human food in Papua New Guinea, Australia, and north-East India: cross-cultural considerations and cautious conclusions. *Ecol. Food Nutr.* 36, 159–185. doi: 10.1080/03670244.1997.9991513
- Mintz, S. W., and Du Bois, C. M. (2002). The anthropology of food and eating. *Annu. Rev. Anthropol.* 31, 99–119. doi: 10.1146/annurev.anthro.32.032702.131011
- Nirmal, N., Anyimadu, C. E., Khanashyam, A. C., Bekhit, A. E. D. A., and Dhar, B. K. (2025). Alternative protein sources: addressing global food security and environmental sustainability. *Sustain. Dev.* 33, 3958–3969. doi: 10.1002/sd.3338
- Oxford, G. S., and Gillespie, R. G. (1998). Evolution and ecology of spider coloration. *Annu. Rev. Entomol.* 43, 619–643. doi: 10.1146/annurev.ento.43.1.619
- Phillips, O., Gentry, A. H., Reynel, C., Wilkin, P., and Gálvez-Durand, C. B. (1994). Quantitative ethnobotany and Amazonian conservation. *Conserv. Biol.* 8, 225–248. doi: 10.1046/j.1523-1739.1994.08010225.x
- Saez, N. J., and Herzig, V. (2019). Versatile spider venom peptides and their medical and agricultural applications. *Toxicon* 158, 109–126. doi: 10.1016/j.toxicon.2018.11.298
- Sakai, W. H. (2007). Long-billed hermit (*Phaethornis superciliosus*) caught in golden orb-spider (*Nephila clavipes*) web. *Ornitol. Neotrop.* 18, 117–119.
- Su, Y. C., Chang, Y. H., Smith, D., Zhu, M. S., Kuntner, M., and Tso, I. M. (2011). Biogeography and speciation patterns of the golden orb spider genus *Nephila* (Araneae: Nephilidae) in Asia. *Zool. Sci.* 28, 47–55. doi: 10.2108/zsj.28.47
- Tso, I. M., Wu, H. C., and Hwang, I. R. (2005). Giant wood spider *Nephila pilipes* alters silk protein in response to prey variation. *J. Exp. Biol.* 208, 1053–1061. doi: 10.1242/jeb.01437
- UNDESA. (2017) World population prospects New York, NY: United Nations Department of Economic and Social Affairs
- Wahlqvist, M. L. (2007). Regional food culture and development. *Asia Pac. J. Clin. Nutr.* 16:2
- Wen, L., Wang, L., Wang, Z., Zhang, H., Hu, L., Peng, B., et al. (2025). The critical role of arachidonic acid on molting in spiders. *Curr. Zool.* 71, 373–380. doi: 10.1093/cz/zoae056
- World Spider Catalog. (2026). World spider catalog. Version 26. Natural History Museum Bern. Available online at: <http://wsc.nmbe.ch> (Accessed January 2, 2026)
- Yaginuma, T. (1986). *Spiders of Japan in color-new edition*. Osaka: Hoikusha Publishing Company.
- Zschokke, S., Henaut, Y., Benjamin, S. P., and García-Ballinas, J. A. (2006). Prey-capture strategies in sympatric web-building spiders. *Can. J. Zool.* 84, 964–973. doi: 10.1139/Z06-074