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# UNCONVENTIONAL DIETARY COMPONENTS IN DIFFERENT CULTURES: INSECTS AS A REALISTIC AND VALUABLE ALTERNATIVE.

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**Abstract**

The perception of certain foods as "strange" or "controversial" is primarily shaped by cultural influences rather than their actual properties. Although insects are not yet widely accepted as food in many Western societies, they are a well-established and valued part of the diet in many countries worldwide. In cultures across Asia, Africa, and South America, insects are appreciated for their nutritional value, taste, and availability. Entomophagy includes over 2,000 insect species and is practiced by more than 2 billion people globally.
This paper aims to present selected dishes and dietary components that are entirely accepted—and in many cases even regarded as delicacies—in various cultures worldwide, despite being perceived by Western consumers as equally, or even more, controversial than insects. Examples include fermented fish, animal brains, and blood-based dishes. Compared to these, insects may be seen as a less controversial food choice in terms of both appearance and taste. They are rich in nutrients, can be farmed efficiently, and are environmentally sustainable, making them a viable alternative to traditional animal protein sources.
Presenting edible insects alongside other unusual yet culturally accepted dishes may help reduce negative associations and facilitate the introduction of entomophagy. Such comparisons offer significant educational value by placing insects in a broader culinary context and demonstrating that unconventional ingredients can, over time, become normalized parts of the diet. This approach may foster greater openness and gradual acceptance of insects among Western consumers.

*Keywords:* edible insects, unconventional food, entomophagy, food acceptance, cultural food perception.

## 1. Introduction

The perception of food as "strange," "controversial," or "difficult to accept" is primarily shaped by cultural, religious, and social factors that influence dietary habits and norms within a given society (Orkusz & Orkusz, 2024). Foods and dishes considered perfectly acceptable in one part of the world may provoke disgust or suspicion in another—despite lacking any objectively adverse sensory qualities (Babji et al., 2015; Magat, 2002; Skåra et al., 2015). This phenomenon is commonly referred to as food neophobia, or the fear of new or unfamiliar foods (Pliner & Hobden, 1992). Cultural discrepancies in food acceptance are especially pronounced regarding products that deviate from a community's culinary "norms." Many such items—such as *surströmming* (fermented herring, Skåra et al., 2015), *hákarl* (fermented shark, Osimani et al., 2019), *shiokara* (fermented marine viscera, Saisithi, 1994), *prahok* (fermented fish paste, Narzary et al., 2021), or *balut* (incubated duck egg, Bondoc et al., 2023; Magat, 2002)—may be perceived as extreme, yet they occupy a well-established place in local culinary traditions and often function as delicacies or even cultural identity symbols (Skåra et al., 2015; De Vergara et al., 2020). Their integration into local food customs stems from historical and environmental factors and their symbolic significance—they may serve as elements of ritual, social initiation, or cultural belonging (Magat, 2002; Ruddle & Ishige, 2005).
In this light, the acceptability of edible insects becomes particularly compelling. While often deemed "unnatural" or "disgusting" in Western cultures, insects are a routine part of the diet in

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many parts of Asia, Africa, and South America (Orkusz & Orkusz, 2024). Importantly, these insects generally exhibit less intense or controversial sensory characteristics than many foods (van Huis et al., 2013). Furthermore, once processed—e.g., in powdered form—they can be easily incorporated into familiar products such as bread, cookies, pasta, and savory and sweet snacks (Orkusz et al., 2020; Carpentieri et al., 2024; Carpentieri et al., 2025). Their neutral taste and smell offer a high potential for integration into Western dietary systems. Additional advantages include their high nutritional value—being rich sources of protein, vitamins, and minerals—as well as their minimal environmental footprint compared to conventional livestock farming (Orkusz, 2021; Orkusz et al., 2024a; Orkusz et al., 2024b).

Placing entomophagy (the consumption of insects) within a broader cultural and comparative framework—alongside examples of unconventional foods consumed in various parts of the world, such as fermented fish, pig brains (Chanted et al., 2021), tuna eyeballs (Renuka et al., 2017; Jeong et al., 2016), bird's nest soup (Babji et al., 2015), fertilized eggs, or guinea pig meat (Echeverría et al., 2023)—may help normalize insect consumption and enhance consumer acceptance. This article aims to review selected traditional food items—such as *surströmming*, *hákarl*, *rakfisk*, *pidan*, *shiokara*, *prahok*, *balut*, bird's nest soup, tuna eyeballs, pig brain, and guinea pig meat—that, despite evoking strong emotional responses among specific audiences, are widely accepted within their respective cultural contexts. Highlighting these examples serves as an exercise in intercultural education and a foundation for advocating entomophagy as a rational, less sensorily intrusive alternative to already accepted "controversial" dishes worldwide.

## 2. Materials and methods

This article is a narrative literature review focusing on analyzing food products perceived as unconventional across different cultural contexts. It includes both traditional dishes that, despite their intense sensory characteristics, are socially accepted (e.g., fermented fish, pig brain, *balut*), as well as edible insects, which—despite being a traditional dietary component in many cultures—are regarded in Western countries as an innovative yet still controversial food alternative.

The study draws on examples from countries representing distinct cultural systems—such as Japan, Iceland, the Philippines, Cambodia, and Peru—to illustrate how deeply cultural conditioning influences the acceptability of foods with firm sensory profiles. This intercultural approach identifies shared and divergent mechanisms shaping the perception of so-called controversial foods.

The literature review was conducted between January and March 2025 using the following databases: Science Direct, Scopus, PubMed, Google Scholar, and Web of Science. The search used keywords and combinations, including *unconventional food*, *extreme cuisine*, *entomophagy*, *fermented foods*, *edible insects*, *food neophobia*, *food disgust*, *cultural food practices*, *traditional food*, and *symbolic food*. Literature was selected based on relevance and currency to the review's objective. A comparative and contextual approach was employed to juxtapose diverse examples from various cultural spheres.

Only peer-reviewed publications written in English were included in the review. These comprised empirical studies, systematic reviews, or theoretical analyses related to the social perception, cultural embedding, or regulatory frameworks of unconventional food. Non-peer-reviewed works and publications in languages other than English were excluded.

## 3. Entomophagy

Or the consumption of insects by humans, is a practice that dates back thousands of years and occurs on nearly every continent. Although it remains controversial in industrialized countries, it constitutes a significant part of the daily diet in many regions of the world. The Food and Agriculture Organization of the United Nations (FAO) estimates that over 2 billion people regularly consume more than 2,000 insect species, which continues to grow. The most commonly consumed orders include Coleoptera (beetles, 31.2%), Lepidoptera (butterflies and moths, 17.1%), Hymenoptera (bees, wasps, ants, 15.2%), Orthoptera (locusts, crickets, grasshoppers, 13.2%), and Hemiptera (true bugs, 11.2%). In Africa, insects play a crucial role as a source of protein and micronutrients, particularly in regions with limited access to other food resources. In Asia and South America, insects are not only a food source but also part of culinary traditions and folk medicine (Orkusz & Orkusz, 2024).

Despite their numerous advantages, entomophagy still encounters resistance in Western countries. Reluctance toward insect consumption is multidimensional and stems from the interaction of psychological, cultural, and perceptual factors. Disgust plays a key role—it is rooted in evolutionary defense mechanisms against potential biological contamination. Insects, commonly associated with dirt, decay, and pathogens, evoke aversion regardless of nutritional value. This phenomenon is driven by deeply embedded cultural prejudices and a general lack of dietary awareness (Orkusz & Orkusz, 2024). In Western societies, insects are not perceived as “food” in the traditional sense but rather as exotic curiosities—or worse, associated with parasites. Insect morphology is another significant barrier—a chitinous exoskeleton, segmented limbs, and antennae provoke strong aversion, particularly when insects are consumed in unprocessed forms. Food neophobia prevalent in Western societies further intensifies these reactions, limiting openness to unfamiliar foods, especially animal-based ones.

Overcoming psychological barriers and promoting insects as “normal” food requires appropriate educational efforts, awareness campaigns, and innovative technological solutions—for instance, incorporating insect powder into widely accepted food products such as bread, pasta, cookies, and snack bars (Orkusz et al., 2020; Orkusz, 2021; Carpentieri et al., 2024; Carpentieri et al., 2025).

In light of the above, entomophagy should not be viewed as foreign but as culturally unfamiliar. Its future integration does not hinge on the physicochemical properties of insects but on societies’ ability to redefine the boundaries of what is considered acceptable food. In this sense, insects represent an ideal case study—a product that, despite rational benefits, remains a victim of irrational responses, much like many other controversial but culturally sanctioned ingredients in global cuisine.

Within the European edible insect market context, the most commonly used species are the larvae of the yellow mealworm (*Tenebrio molitor*) and the house cricket (*Acheta domesticus*). Both species are available in either whole (dried) or in-ground (powdered) form and used as ingredients in various food products (van Huis et al., 2013).

*Tenebrio molitor*, a member of the Tenebrionidae family, was initially considered a storage pest. Today, it is one of the most widely farmed insect species for human consumption. Its larvae can be sold dried, frozen, or powdered and approved by the European Union under Regulation (EU) 2015/2283 (Noyens et al., 2024). *Acheta domesticus*, from the family Gryllidae and the order Orthoptera, originates from Southeast Asia but is now bred in many regions worldwide, including Europe, North America, and Australia (Yeerong et al., 2024). In Thailand alone, more than 20,000 cricket farms were operating in 2022, predominantly raising this species. The house cricket has a short life cycle (~45 days) and high farming efficiency, making it an economically and environmentally attractive protein source (Yeerong et al., 2024). Both species are rich in protein (*T. molitor*: 36–60% of dry matter; *A. domesticus*: up to 70% of dry matter), fat, vitamins, minerals, and bioactive compounds with beneficial health effects (Orkusz, 2021; Volek et al., 2023; Draszanowska et al., 2024; Noyens et al., 2024; Yeerong et al., 2024).

## 4. Examples of Unconventional Foods in Different Cultures

*4.1. Fermented Fish Products:* Fermented fish products form a staple of many traditional cuisines in Asia and Northern Europe. In Scandinavia (Sweden, Norway, Iceland), East Asia (Japan, Korea), Southeast Asia (Thailand, Cambodia), and parts of Africa, fish fermentation is not only a method of preservation but also a part of culinary heritage and national identity.
Products such as *surströmming* (Sweden), *hákarl* (Iceland), *rakfisk* (Norway), *shiokara* (Japan), and *prahok* (Cambodia) are deeply rooted in local traditions, often associated with periods of limited access to fresh food (e.g., winter, dry season, or remote areas).

*4.1.1. Surströmming* is a traditional Swedish fermented fish product made by lightly salting Baltic herring (*Clupea harengus membras*). It is one of Northern Europe's most iconic examples of fermented foods. The fermentation process starts with a salt concentration of only 6–8%, which inhibits spoilage bacteria while allowing the growth of fermentative microbes (Skåra et al., 2015). The initial phase involves autolytic reactions driven by endogenous fish enzymes such as cathepsins (e.g., B and D) and calpains, breaking down muscle proteins into peptides and amino acids. Concurrently, lipases release free fatty acids, contributing to the product's soft texture and unique aroma. Lactic acid bacteria, especially *Lactobacillus* species, further stabilize the product by acidifying the environment and producing organic acids that inhibit pathogens (Narzary et al., 2021).
After several weeks of maturation in wooden barrels, the fish is canned, where fermentation continues anaerobically. Anaerobic halophilic bacteria such as *Haloanaerobium* play a key role in this phase, producing characteristic metabolites like butyric, acetic, propionic acids, and hydrogen sulfide. The final product has a strong aroma, high pH (7.5–8.5), biogenic amines, and locally appreciated sensory traits. Thanks to organic acids, LAB activity, and low water activity, *surströmming* is microbiologically safe despite being unheated (Narzary et al., 2021; Skåra et al., 2015).
Traditionally eaten in summer during family or social gatherings, *surströmming* is consumed outdoors due to its pungent odor, often likened to rotten eggs, sewage, or ammonia. If opened indoors, doing so underwater or near an open window is recommended to minimize odor spread. Despite its divisive character, many Swedes regard it as a delicacy and a key aspect of national identity. Based on low salinity and extended maturation, the fermentation method reflects a Nordic pragmatism born of necessity in regions with limited salt, refrigeration, and transport infrastructure.

*4.1.2. Hákarl* is a traditional Icelandic fermented product made from Greenland shark (*Somniosus microcephalus*). In its raw form, the meat is toxic due to high levels of urea and trimethylamine oxide (TMAO), which convert into toxic trimethylamine (TMA) in the human body (Skåra et al., 2015; Anthoni et al., 1991).
Historically, the shark meat was gutted and buried in shallow gravel pits near the coast, where tidal seawater would create anaerobic fermentation conditions. Covered with stones, turf, and seaweed, it would ferment for weeks or months. Today, fermentation occurs in closed drainage containers, followed by air-drying in wooden sheds (*hjallar*) for several weeks or months (Reynisson et al., 2018; Osimani et al., 2019).
Fermentation relies on endogenous enzymes (ureases, cathepsins, proteases) and natural microflora. Bacterial urease breaks down urea into ammonia, raising the pH from 6 to 9. TMAO

is converted into TMA, yielding a sharp ammonia odor. Microbiological studies reveal the presence of *Tissierella*, *Pseudomonas*, *Lactococcus*, *Oceanobacillus*, *Abyssivirga*, and yeasts like *Candida*, *Debaryomyces*, and *Saccharomyces*, all influencing the sensory profile (Osimani et al., 2019).

The final product has a semi-firm, fibrous texture and a strong ammonia smell. Despite these traits, it is safe to eat due to its high ammonia content, low water activity, and high pH. *Hákarl* is typically consumed during the winter festival *Þorrablót*, in honor of old Norse traditions. Though often perceived as extreme by foreigners, Icelanders view it as a culinary heritage item and a symbol of national pride. Like *surströmming*, it embodies resilience and adaptation to harsh northern climates. The fermentation and preservation method reflects Icelandic pragmatism and innovation amid scarce wood, salt, and refrigeration.

*4.1.3. Rakfisk* is a traditional Norwegian fermented product, usually made from trout (*Salmo trutta* or *Oncorhynchus mykiss*), and is neither cooked nor smoked. The process relies solely on cold fermentation without the use of heat. Gutted fish fillets are lightly salted (4–6% NaCl) and fermented in wooden or plastic barrels at 4–8°C for 2 to 3 months or longer (Skåra et al., 2015). It is consumed cold after fermentation, typically with rye bread, onion, sour cream, or traditional potato flatbread (*lefse*).

The fermentation begins with autolytic enzymes like cathepsins and calpains breaking down muscle proteins. Lactic acid bacteria (LAB) such as *Lactobacillus sake*, *L. curvatus*, and *Leuconostoc mesenteroides* acidify the environment and stabilize the product. The microbial profile varies by season, region, fish source, salt content, and storage conditions. Studies have identified psychrotrophic and potentially undesirable microbes such as *Enterobacteriaceae*, *Pseudomonas*, and occasionally *Listeria monocytogenes*, particularly in poorly stored batches. Nowadays, *rakfisk* is produced under strict sanitary control and must meet microbiological safety standards.

The final product has a pronounced, spicy flavor, tender flesh, and a strong but not repellent fermented aroma. Unlike *hákarl* or *surströmming*, its smell is generally more acceptable to non-Scandinavian consumers, though its consumption still requires cultural openness and appreciation of traditional processing methods.

*4.1.4. Shiokara* is a traditional Japanese dish classified as fermented seafood (*gyosho*) made from the viscera of marine animals, most commonly squid (*Todarodes pacificus*). The innards are mixed with salt (10–15%) and a small amount of starch or fermented rice and fermented under refrigeration for several days to weeks, depending on flavor preference and temperature (Narzary et al., 2021; Saisithi, 1994).

Fermentation is spontaneous, relying on naturally occurring microflora in marine guts, including halophilic and lactic acid bacteria. Dominant strains include *Lactobacillus plantarum*, *Tetragenococcus halophilus*, *Staphylococcus*, and *Micrococcus*, which produce organic acids, biogenic amines, and aroma compounds such as aldehydes, esters, and amines. Endogenous enzymes (proteases, lipases) further intensify protein and fat breakdown, contributing to the bold flavor profile.

The final product has high salinity, moderately low pH (~5–5.5), and a strong fishy smell. Its texture is thick, sticky, and often described as "slimy," making it one of the more extreme examples of Japanese fermented cuisine (Saisithi, 1994). Despite its challenging sensory characteristics, *shiokara* is established in Japanese culinary culture, often served as a snack with alcohol, especially sake. In this role, it functions as *otsumami* – small, flavorful side dishes meant to complement drinks. Its consumption is often seen as a sign of culinary bravery and respect for traditional preservation techniques (Ruddle & Ishige, 2005).

*4.1.5. Prahok* is a traditional fermented fish paste from Cambodia that is central to local cuisine and serves as a primary protein source for many Cambodians. It is typically made from small freshwater fish, especially *Trey riel* (Cyprinidae family), which are crushed, salted (15–20%), and fermented anaerobically for several weeks to months, depending on the desired maturity level (Narzary et al., 2021).

The fermentation relies on halotolerant and lactic acid bacteria such as *Lactobacillus*, *Staphylococcus, Bacillus*, and *Micrococcus*. These microbes break down proteins and lipids into aroma compounds, biogenic amines, and organic acids. Endogenous fish enzymes like cathepsins and lipases also contribute to the paste's characteristic dark grey color, pungent aroma, and thick texture.

The finished product has an intense fermented odor, strong umami taste, and dense, paste-like consistency. Prahok is used as a seasoning or base for soups, stews, and meat dishes in Cambodian cuisine. It can be fried, simmered, or eaten raw with rice and vegetables. Due to its pungency, *prahok* is often called the "cheese of Cambodia" and is sometimes used as a meat substitute.

*Prahok* consumption carries deep cultural and economic significance. In rural Cambodian communities, fish fermentation helps ensure food security during dry seasons when fresh fish is scarce. As such, it is seen as a cornerstone of Cambodian culinary identity. In 2016, the Cambodian government established quality standards for *prahok* production, underscoring its importance as both an export good and a national heritage product (Narzary et al., 2021).

*4.2. Balut* is a distinctive dish originating from the Philippines, made from fertilized duck eggs (*Anas platyrhynchos*) that are incubated for 15 to 18 days and then boiled in water for approximately 30 minutes (Bondoc et al., 2023) before being consumed whole. At this stage, the embryo is partially developed—with visible bones, beaks, and often feather buds—giving the dish its unique and frequently controversial character (Magat, 2002).

There are two main types of the product: *balut sa puti*, in which the embryo is less visible and encased in an albumen membrane, and *mamatong*, where the embryo floats freely within the egg. Balut is typically eaten warm, often seasoned with salt, vinegar, ginger, or soy sauce. An everyday consumption ritual involves drinking the liquid (“soup”) inside the egg before eating the remaining contents.

Balut is a rich source of protein and fat, especially in the yolk, where fat content can reach up to 30%. Eggs incubated for 18 days have shown a more favorable lipid profile than those incubated for 15 days (Bondoc et al., 2023).

Although often labeled as an “exotic” or “extreme” culinary item—particularly by Western consumers—balut is a popular street delicacy in the Philippines, valued for its high nutritional content and strong cultural significance. Its consumption is traditionally associated with beliefs in its strengthening, restorative, and—especially among men—aphrodisiac properties. As such, balut is often eaten at night as a social snack, commonly paired with alcohol, and is sometimes regarded as a symbol of masculinity and vitality (Magat, 2002; De Vergara et al., 2020). Despite its controversial appearance due to the visible embryo, many consumers regard it as part of the national heritage and an example of resourceful use of available protein sources in a context of scarcity.

*4.3. Pidan*, also known as “century eggs” or “thousand-year-old eggs,” is a traditional Chinese product made by preserving duck (and occasionally chicken) eggs in a highly alkaline environment. The classic preparation method involves coating the eggs in lime (CaO), wood ash, salt, and tea paste and storing them at room temperature for two to three months. Modern methods often use high-pH solutions (e.g., 0.9 M NaOH + 0.5 M NaCl) to accelerate the physicochemical transformation of the egg white proteins (Eiser et al., 2009). Under high pH

and sodium or potassium ions, key proteins—primarily ovalbumin, about 54% of egg white proteins—undergo significant modification. Unlike thermal denaturation, which results in a cloudy, brittle mass, alkaline processing produces a transparent, elastic gel. The gelation process begins rapidly at pH levels above 12—taking just minutes in laboratory conditions—but in the enclosed environment of the eggshell, it takes about 14 to 21 days.
The finished product is characterized by an amber, translucent white and a yolk that ranges from creamy to semi-liquid, with colors from gray-green to black. The flavor is intense, marked by mineral notes and hints of hydrogen sulfide and ammonia. While these sensory traits may be challenging for many Western consumers, *pidan* is highly valued in China as a component of breakfasts, snacks, and congee-based dishes. It is also used in banquet cuisine (Eiser et al., 2009).

*4.4. Edible bird's nest soup (EBN)* is a traditional delicacy of Southeast Asia, made from the dried nests of edible-nest swiftlets (*Aerodramus fuciphagus*, *A. maximus*)—birds from the Apodidae (swift) family that construct their nests exclusively from a glycoprotein-rich mucus secreted by the males' salivary glands. Once the nests are built and the breeding cycle is complete, they are harvested—historically from caves, but now more commonly from specially adapted buildings—and meticulously cleaned (Babji et al., 2015), then dried. Before consumption, the nests are soaked and boiled (typically for around 2 hours) to achieve a gelatinous consistency. Traditional EBN soup is prepared using a double-boiling method with rock sugar (*yan wo*).
The dish is considered a luxury delicacy in countries such as China, Vietnam, Malaysia, and Singapore. It is often served during significant festive occasions (e.g., Lunar New Year) as a symbol of health, prosperity, and longevity. Edible bird's nests are rich in glycoproteins—containing 62–63% protein, 25–28% carbohydrates, trace amounts of fat (0.1–1.3%), and minerals such as calcium, sodium, and potassium (Babji et al., 2015; Kathan & Weeks, 1969). A particularly valuable component of EBN is sialic acid (N-acetylneuraminic acid), which is associated with immunomodulatory and antioxidant properties. The amino acid profile of EBN is dominated by serine, threonine, aspartic acid, glutamic acid, and valine.
The unique gel-like structure formed by proteins and polysaccharides lends the product high stability and bioactive qualities—particularly antioxidant activity, which has been shown to surpass that of common meat-based soups (Norhayati et al., 2010). Consumption of edible bird's nest soup carries nutritional, cultural, and symbolic significance. In traditional Chinese medicine, EBN is considered a tonic that strengthens the lungs, aids digestion, enhances focus, and boost virility. In addition, modern processing techniques have led to the development of cosmetic products and health supplements based on enzymatically hydrolyzed EBN.
Production is concentrated mainly in Malaysia, Indonesia, and Thailand, with China, Hong Kong, and Taiwan being the primary consumer markets. Due to its high market value—reaching up to USD 4,000 per kilogram—EBN ranks among the most luxurious and expensive ingredients in Asian cuisine (Babji et al., 2015).

*4.5. Tuna eyes* (*Thunnus albacares*, *Katsuwonus pelamis*) are an unconventional yet traditionally utilized part of the fish in Japanese, Korean, and Filipino cuisines. They are often served cooked delicately or used as an ingredient in soups and broths. Tuna eyes are a rich source of omega-3 fatty acids, amino acids, and minerals while also representing a by-product of the fish processing industry that has, until recently, been underutilized (Renuka et al., 2017). The dominant lipid component is docosahexaenoic acid (DHA), which accounts for 36–37% of the total fatty acids—twice the amount found in the fish's muscle tissue. Also notable is the presence of eicosapentaenoic acid (EPA – 7%) and arachidonic acid (3.6%), as well as a favorable n-3 to n-6 ratio of 9.17, making tuna eyes a promising raw material for the production

of high-value dietary supplements (Renuka et al., 2017). Regarding amino acid profile, tuna eyes are particularly high in glycine, glutamate, alanine, and aspartic acid. The high glycine content is associated with abundant collagen, suggesting potential applications in the cosmetic and biomedical industries (Renuka et al., 2017). The mineral content includes substantial amounts of sodium, calcium, and potassium. Beyond nutritional value, tuna eyeball oil (TEO) exhibits significant bioactive properties (Jeong et al., 2016).
Culturally, tuna eyes are mainly consumed in East Asian countries, where they are considered nutritionally beneficial and prestigious culinary items. Cooked or braised, they are typically served as an addition to soups or consumed whole, with the soft, fatty core of the eye considered particularly prized. While the appearance of an eyeball on the plate may be unpalatable to many Western consumers, from a technological standpoint, it represents a raw material with substantial potential for developing functional foods and nutraceuticals.

*4.6. Pig brain*, although considered a controversial culinary ingredient in many cultures, has long been part of traditional dishes in Southeast Asia and certain regions of Europe. As a by-product of the meat industry, pig brain is notable for its high content of lipids, phospholipids, and functional amino acids, making it an interesting raw material from both nutritional and industrial perspectives (Chanted et al., 2021). The chemical composition of fresh pig brains consists of approximately 80% water, 9.25% fat, and 7.25% protein. The most significant lipid fractions are phospholipids (0.86 g/100 g) and cholesterol (0.30 g/100 g), with a ratio of roughly 3:1. Pig brain is rich in long-chain unsaturated fatty acids, including docosahexaenoic acid (DHA)—one of the brain's most crucial lipid components, essential for neuronal function and nervous system development (Chanted et al., 2021). Regarding amino acids, the pig brain contains about 44% essential amino acids, with leucine, threonine, valine, and lysine being the most abundant (Chanted et al., 2021).
Despite its high nutritional value, pig brain consumption is often controversial due to its distinctive appearance and texture. In some countries, it is considered a delicacy served fried, stewed, in curries, or as an ingredient in soups. In Asia, it is part of traditional medicine and is believed to possess strengthening properties and support nervous system health. At the same time, its use aligns with the principles of sustainable meat processing, promoting a "zero waste" philosophy and the full utilization of slaughter by-products (Chanted et al., 2021).

*4.7. Guinea pig* (*Cavia porcellus*), locally known as *cuy*, has been an essential part of the traditional Andean diet for centuries, particularly in Peru, Bolivia, and Ecuador. Domesticated over 3,000 years ago, it was initially bred for ritual and culinary purposes. It continues to be a valuable source of meat, especially in family farming and subsistence agriculture (Echeverría et al., 2023).
*Cavia porcellus* meat is appreciated for its high nutritional value, containing 19–21% protein and 3–7% fat. Research has shown that dietary modifications (e.g., supplementation with *Euphorbia heterophylla*) can increase the omega-3 fatty acid content in the animals' tissues, thereby enhancing the health value of the meat (Echeverría et al., 2023).
From a culinary standpoint, *cuy* is considered a tender meat with a subtle flavor reminiscent of rabbit or chicken thigh and is prepared in various ways—from spit-roasting (*cuy al palo*) and frying (*cuy chactado*), to baking and boiling. Its consumption has everyday and ceremonial significance, prominently during religious holidays, weddings, and family celebrations. In Andean culture, *cuy* also serves as a symbol of fertility, good fortune, and health.

## 5. Conclusions

This study aimed to demonstrate that edible insects, although still controversial in Western culture, are not inherently more off-putting than other food ingredients widely accepted in many countries' culinary traditions.

The literature review and case analysis confirmed that, on a global scale, the human diet includes numerous items that can be considered far more extreme in terms of sensory properties and biological origin. Fermented fish with putrid odors, ammonia-rich shark meat, duck embryos with visible embryonic features, fermented fish viscera, bird nests made of saliva, animal brains and eyes, and even cheeses containing live larvae are just some of the culturally embedded foods that may elicit strong aversion in other cultural contexts.

Against this backdrop, edible insects appear relatively neutral, especially in processed forms that eliminate distinct morphological features. Their high nutritional value, low environmental production cost, and wide-ranging technological applications make them a realistic and practical alternative to conventional animal protein sources.

This study highlights that the barrier to the acceptance of entomophagy lies not in the intrinsic nature of insects but in cultural and psychological factors, such as food neophobia and lack of prior exposure. Comparing insects to other controversial food items reveals the relativity of what is considered "normal" in a diet. It serves as a cognitive tool that can help challenge and overcome biases.

The implementation of entomophagy in Western countries thus requires coordinated educational efforts, culturally adapted presentation formats, narrative strategies that normalize the concept, and institutional support. Ultimately, if other, more extreme food products have found a place within national culinary heritages, insects too—given the right narrative and strategic framing—can become an accepted and valuable component of the modern diet.

**Compliance with Ethical Standards**

Conflict of Interest

**The authors declare that they have no conflict of interest.**

Authors' Contributions

Conceptualization methodology, validation, resources: **AO**; data curation, writing—original draft preparation: **AO** and **MO**; visualization, supervision, writing—review and editing: **AO**. All authors have read and agreed to the published version of the manuscript.

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