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EVALUATING GRASSHOPPER-BASED FOODS FROM A *HALALAN TAYYIBAN* PERSPECTIVE

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Abstract

Grasshoppers are increasingly being considered as an alternative food source due to their nutritional value and potential contribution to dietary protein. For Muslim consumers, however, nutritional value alone is insufficient: a grasshopper-based product must also meet halal permissibility and tayyib expectations regarding safety, wholesomeness, and integrity. This narrative review synthesises Islamic sources, halal standards, and scientific evidence on grasshopper identity, nutrition, biological and chemical hazards, allergenicity, sourcing, processing, traceability, and consumer assurance. OIC/SMIIC 1:2019 expressly recognises grasshopper as a halal animal, providing a standards-based basis for general permissibility. Nevertheless, species identification remains necessary to verify the marketed ingredient and support accurate labelling, traceability, nutritional interpretation and risk assessment. Unlike reviews centred mainly on nutrition, sustainability and market potential, this review examines how source permissibility relates to product-level assurance. The evidence indicates that halalan tayyiban evaluation depends on the harvesting environment or feed substrate, microbial and chemical controls, allergen communication, acceptable ingredients and processing aids, validated processing and appropriate storage controls, and truthful consumer disclosure. Seven interconnected areas are synthesised to support product assessment and future research. Further species- and process-specific evidence is required to strengthen risk assessment and halal assurance across jurisdictions.

Keywords: *consumer, safety, grasshopper, halalan, traceability*

INTRODUCTION

Growing pressure on food systems has intensified the search for alternative protein sources to complement conventional livestock production. The global record now encompasses more than 2,000 edible insect species, although their use remains highly dependent on geography, tradition and food culture (Omuse et al., 2024). Grasshoppers have a long history of consumption in parts of Asia, Africa and Latin America and are

increasingly considered in dried, fried, powdered and composite food forms (Tanga & Ekesi, 2024; Riaz et al., 2025).

This development creates opportunities for food diversification, but it also requires careful distinction between traditional familiarity, scientific evidence and commercial claims. Grasshoppers cannot be treated as a uniform food material. Their nutritional composition and potential hazards may vary according to species, source, production conditions and processing method (Meyer-Rochow et al., 2021; Kababu et al., 2023). These variations indicate that nutritional, safety and sustainability claims should be supported by evidence relevant to the particular species and product.

The issue has an additional dimension in halal food systems. OIC/SMIIC 1:2019 explicitly recognises grasshopper as a halal animal, establishing a clear standards-based foundation for permissibility. However, permissibility of the animal source does not automatically establish that a finished grasshopper-based product is halal and *tayyib*. Species identity, collection or farming conditions, added ingredients, processing aids, contamination controls, traceability and consumer information remain relevant to the integrity of the final product.

Existing studies have examined edible insects from nutritional, environmental, safety and consumer perspectives (Aidoo et al., 2023; Lin et al., 2023; Siddiqui et al., 2024; Tanga & Ekesi, 2024). Shamsuddin (2024) examines entomophagy through the Islamic legal concept of *al-khabith*, while Riaz et al. (2025) review the halal position, nutrition, sustainability, certification and market prospects of grasshoppers and locusts.

The present review differs in analytical emphasis and output. Rather than reviewing the benefits and market potential of grasshoppers generally, it distinguishes evidence concerning the animal-source ruling from evidence concerning a defined finished product. It also separates grasshopper-specific findings from broader edible-insect evidence and integrates identity, sourcing, nutritional interpretation, hazard control, processing, traceability and consumer disclosure into seven product-assessment areas.

This source-to-product synthesis constitutes the manuscript's principal contribution. This review focuses specifically on grasshoppers for four reasons. First, grasshoppers have an explicit standards-based basis of permissibility under OIC/SMIIC 1:2019, making them particularly relevant to halal food research. Second, grasshoppers have a documented history of consumption in several societies and continue to be obtained through wild harvesting, farming and small-scale trade in different regions.

Third, published studies indicate their potential as nutrient-dense foods, particularly as sources of protein, fat and minerals. Fourth, their sourcing, species variation, possible exposure to agricultural contaminants, allergenic potential and uneven regulatory treatment raise important *tayyib* questions. Grasshoppers therefore provide a suitable focus for examining how source permissibility, food safety, nutritional suitability, processing integrity and consumer assurance interact within a *halalan tayyiban* assessment.

This focus is also necessary because conclusions drawn from edible insects as a broad category may conceal important differences. Mealworms, crickets, black soldier flies, locusts and non-swarming grasshoppers differ in biology, rearing practices, composition, consumer familiarity and regulatory treatment. Even within grasshoppers, evidence is concentrated in selected species and regions.

The present review therefore uses general edible-insect research only when it clarifies a relevant hazard, process, or consumer issue and identifies where direct evidence on grasshoppers remains limited. This boundary avoids presenting category-level expectations as species-level facts. This review therefore aims to synthesise the religious, scientific, regulatory, and consumer evidence relevant to the evaluation of grasshopper-based foods from a *halalan tayyiban* perspective.

In pursuing this objective, the review examines grasshopper permissibility and species identity together with nutritional suitability, food safety, allergenicity, sourcing, processing, traceability, regulatory requirements and consumer assurance. The discussion

draws on Islamic sources, halal standards, scientific studies and consumer research relevant to grasshopper-based foods.

METHODOLOGY

This study employed a narrative review approach to synthesise Islamic sources, halal standards and scientific literature relevant to grasshopper-based foods. This approach was selected because the review integrates different forms of evidence, including religious texts, juristic explanations, standards, authoritative reports and peer-reviewed studies. The review aimed to compare the available evidence, identify areas of agreement and uncertainty, and examine grasshopper-based foods from a *halalan tayyiban* perspective. It was not designed as a systematic review or meta-analysis.

Relevant sources were identified through iterative searches of Google Scholar and PubMed. These searches were supplemented by searches of publisher websites and reference lists of relevant review articles and authoritative documents. Search terms included combinations of "grasshopper," "locust" and "edible insect" with "halal," "Islamic jurisprudence," "nutrition," "food safety," "microbiological hazard," "chemical contaminant," "pesticide," "heavy metal," "mycotoxin," "allergy," "processing," "traceability," "regulation" and "consumer acceptance."

The final search was conducted in August 2026. Priority was given to English-language peer-reviewed publications published between 2021 and 2026 that directly addressed grasshoppers or locusts. Studies on edible insects more broadly were included when they provided evidence relevant to the assessment of grasshopper-based foods. Earlier publications were retained when they provided primary Islamic evidence or important scientific evidence not adequately covered in recent literature.

Studies focusing exclusively on insects as animal feed were excluded unless their findings had a clear implication for human food safety or quality. As this was a narrative rather than a systematic review, formal record counts and a study-selection flow diagram were not produced. The evidence was organised according to permissibility, species identity, sourcing, nutritional composition, biological and chemical safety, allergenicity, processing, traceability, product disclosure and consumer acceptance.

Evidence was also distinguished as grasshopper-specific, locust-specific or derived from broader edible-insect literature. Findings from the broader literature were applied cautiously and were not presented as species-specific evidence. The evidence was then synthesised into seven interconnected review areas. The relevance and authority of each source, its directness to grasshopper-based foods and its consistency with other evidence were considered during interpretation.

Islamic sources and halal standards were used to discuss permissibility and halal requirements, while scientific publications and authoritative reports were used to assess nutritional, safety and consumer-related considerations.

RESULTS AND DISCUSSION

Halalan Tayyiban as the Basis of Assessment

The Qur'an associates lawful food with that which is *tayyib*, including in *al-Baqarah* 2:168 and *al-Ma'idah* 5:88. Halal primarily concerns permissibility under *Shariah*, whereas *tayyib* encompasses goodness, cleanliness, wholesomeness and freedom from harm.

Therefore, the assessment of grasshopper-based foods involves two related considerations: whether the grasshopper is permissible for consumption and whether the finished product meets relevant requirements concerning halal ingredients, safety, processing, handling and product information (Awang, 2021; Md Dahlal, 2021; Ahmad & Nordin, 2023; Abdul Mokti et al., 2024).

The presence of potential food-safety hazards does not make grasshoppers inherently impermissible, as such hazards may also occur in other food sources. From a *tayyib* perspective, these hazards should be identified and adequately controlled. This

requires verification of the species and source of the grasshoppers, appropriate processing and contamination controls, and accurate information for consumers.

Grasshopper Permissibility and Species Identity

The general permissibility of grasshoppers is explicitly recognised in OIC/SMIIC 1:2019, General Requirements for Halal Food, which lists grasshopper among halal animals in Clause 5.1.1.1 (Standards and Metrology Institute for Islamic Countries [SMIIC], 2019). However, the standard also establishes requirements concerning processing, hygiene, traceability, packaging and labelling. These requirements remain applicable when grasshoppers are processed, combined with other ingredients or marketed as finished food products.

Locusts also have a specific basis of permissibility in Islamic sources. A *hadith* narrated by Ibn Umar states that two types of carrion were permitted: fish and locusts (Ibn Majah, n.d., Hadith 3314). The permissibility of locust consumption is also recognised across the four major *Sunni* schools of jurisprudence, namely *Hanafi, Maliki, Shafi'i* and *Hanbali* (Sabri et al., 2023; Riaz et al., 2025).

Although the schools differ in their broader rulings concerning insects and in certain details relating to the manner in which locusts become lawful for consumption, locusts are generally recognised as an exception to the prohibition or restriction applied to many other terrestrial insects. This jurisprudential distinction is important because the permissibility of locusts should not automatically be extended to all insect species.

Official guidance from Malaysian Mufti Departments provides further support for this position. The Federal Territories Mufti Department (2018) concluded that locusts are permissible for consumption based on Prophetic traditions and recognised juristic opinions. The Federal Territories Mufti Department (2020) further discussed whether locusts require ritual slaughter and explained that, according to the *Shafi'i, Hanafi* and *Hanbali* positions and the majority of scholars, locusts may be consumed without conventional ritual slaughter.

The Selangor Mufti Department (2019) similarly distinguished locusts from other insects when discussing the permissibility of insect consumption, recognising locusts as a specific exception supported by Islamic evidence. The Perak State Mufti Department (2021) likewise states that locusts are permissible for consumption, including when found dead, based on the Prophetic tradition identifying fish and locusts as the two lawful types of carrion.

Taken together, these institutional positions provide additional support for the recognised permissibility of locust consumption within the Malaysian context. Nevertheless, "locust" and "grasshopper" should not be treated as interchangeable terms for scientific identification and product labelling. The *hadith* and juristic explanation specifically concern locusts, whereas OIC/SMIIC 1:2019 uses the broader term "grasshopper."

Accordingly, this review bases the general permissibility of grasshoppers on the explicit classification in OIC/SMIIC 1:2019 rather than extending the locust ruling to all grasshopper species. Its application to a particular product remains subject to the requirements of the relevant halal authority.

Species identification remains important despite the general permissibility of grasshoppers. Common names may refer to different insects, while morphological identification becomes difficult after the insects have been milled or incorporated into composite foods. DNA-based methods have therefore been developed to identify insect species in processed food products (Hillinger et al., 2023).

Verified species identity supports accurate labelling and the interpretation of nutritional and safety evidence. Findings obtained from one grasshopper species should not automatically be applied to another. Nutritional and safety evidence should therefore be interpreted in relation to the verified identity and source of the material examined (Ssepuuya et al., 2019; Magara et al., 2025).

Finally, the general permissibility of grasshoppers does not automatically establish the halal and *tayyib* status of every finished product. Fried grasshoppers may contain cooking fats, seasonings or flavourings that require separate halal assessment. Grasshopper snacks may be manufactured using shared equipment, while protein powders may contain carriers, enzymes or processing aids from other sources.

These ingredients and processing conditions remain subject to the applicable halal requirements (SMIIC, 2019). Harvesting, processing and handling may also introduce biological or chemical contaminants that affect food safety (Imathiu, 2020; FAO, 2021). The assessment of a finished grasshopper-based product therefore includes its species identity, source, additional ingredients, processing conditions, contamination controls and applicable regulatory and halal requirements.

Nutritional Suitability

Grasshoppers may provide protein, fats, amino acids, minerals and vitamins, although their nutritional composition is not uniform (Tanga & Ekesi, 2024; Riaz et al., 2025). Kababu et al. (2023) reported geographical variation in the proximate composition, fatty acids, amino acids, minerals and vitamins of Ruspolia differens, while Lu et al. (2024) demonstrated considerable variation in mineral content among edible insects. Nutrient composition may also be influenced by species, developmental stage, sex, season, diet and processing method (Meyer-Rochow et al., 2021).

Nutritional findings and product claims should be interpreted in relation to the species, analytical method, processing condition and reporting basis. Comparisons among whole insects, dried powders, defatted flours and composite foods require caution because moisture removal and fractionation alter reported nutrient concentrations (Meyer-Rochow et al., 2021).

The European Food Safety Authority's assessment of Locusta migratoria similarly considered product composition together with its proposed uses, use levels and anticipated intake (EFSA NDA Panel, 2021). Nutritional claims should therefore reflect the composition, product form and expected amount of consumption of the actual product rather than values obtained from another species or product form.

Protein measurement presents an additional methodological consideration. The conventional nitrogen-to-protein conversion factor of 6.25 may overestimate insect protein because chitin and other non-protein compounds also contribute nitrogen (Janssen et al., 2017; Boulos et al., 2020). In an analysis that included Locusta migratoria, Boulos et al. (2020) reported a conversion factor of 5.33 for locusts.

Studies should therefore report the analytical method and conversion factor used and, where possible, support crude-protein estimates with amino-acid analysis. Protein quality should also be evaluated according to amino-acid composition and digestibility rather than total protein concentration alone (Ochiai et al., 2022). The nutritional effects of processing should be evaluated using the product form offered to consumers, as discussed further in Section 3.5.

Food-Safety and Allergenicity

The Food and Agriculture Organization of the United Nations (2021) groups hazards associated with edible insects into biological, chemical, physical and allergenic categories. Their occurrence depends on the species, production system, environment, handling and intended use. Grasshoppers may carry microorganisms on external surfaces and within the digestive tract, and contamination may also arise from collectors, containers, water, equipment and storage conditions.

The relevant question is not whether microorganisms can be detected, but whether pathogenic or spoilage organisms are present at levels that compromise safety or shelf life and whether processing controls are capable of reducing them. Reviews identify bacteria, yeasts, moulds and parasites as potential biological hazards in insects used as food and feed (Vandeweyer et al., 2021).

Grasshopper-specific literature likewise emphasises microbial loads, handling and storage within Ruspolia differens supply chains (Nabikolo et al., 2023; Ng'ang'a et al., 2021). Cooking may reduce vegetative microorganisms, but contamination can recur during handling, display or humid storage. The evidence therefore supports hygienic collection, an effective heat step, controlled drying and protection from recontamination, with controls adapted to the actual product.

Chemical hazards are strongly influenced by the substrate or collection location. Wild grasshoppers from agricultural landscapes may encounter pesticide applications, contaminated soil or water and atmospheric deposition. Farmed insects may be exposed through feed ingredients, bedding or equipment. Studies and reviews identify heavy metals, pesticide residues and other pollutants as contaminants requiring attention (Kolakowski et al., 2021; Meyer et al., 2021; Amorello et al., 2024).

Species may differ in uptake, metabolism and excretion, so absence of contaminant in one insect cannot be generalised. Source mapping and risk-based analytical testing are especially important when collection occurs near intensively managed crops. Mycotoxins introduce another substrate-related issue. Mould-contaminated feed or plant material can expose farmed or wild insects to multiple toxins.

Insects may metabolise, excrete or retain these compounds differently, and disappearance from a substrate does not necessarily establish that all metabolites are harmless (Evans & Shao, 2022; Bisconsin-Junior et al., 2023). Research should therefore examine both parent compounds and relevant transformation products. For practical control, sourcing specifications should exclude visibly spoiled materials, establish suitable storage conditions and use testing when the hazard analysis indicates a credible risk.

Claims that insects can safely convert any organic side stream into food are not justified without evidence on the substrate and resulting insect biomass. Allergenicity requires explicit attention because edible-insect proteins may cause primary sensitisation or cross-react with allergens from other arthropods. Shared proteins, including tropomyosin and arginine kinase, may contribute to cross-recognition between insects and crustaceans (De Marchi et al., 2021; Ribeiro et al., 2021).

Pali-Schöll et al. (2019) demonstrated IgE cross-recognition involving desert locust and migratory locust proteins among individuals allergic to crustaceans or house dust mites. However, IgE recognition does not necessarily establish clinical food allergy in every sensitised individual, as the outcome may depend on the insect species, protein profile, dose, processing method and individual susceptibility.

Physical hazards such as stones, plant fragments, metal or packaging material may enter during collection and processing (FAO, 2021). Cleaning, sorting, sieving and equipment maintenance may reduce these hazards. Storage must then preserve earlier controls: packaging integrity and moisture or water activity are particularly relevant to dried whole insects and powders, while hygienic handling is necessary to prevent post-process contamination.

Sourcing, Processing and Traceability

Sourcing controls should reflect the production system and hazards identified in Section 3.4. For wild-harvested grasshoppers, relevant information includes the collection location, season, nearby agricultural activity, collection method and temporary storage conditions (Ng'ang'a et al., 2021; Amorello et al., 2024). For farmed grasshoppers, relevant controls include feed or substrate specifications, water quality, hygiene, stocking conditions and production records (Imathiu, 2020; FAO, 2021).

Neither system should be considered inherently safe or unsafe without evidence from its actual operating conditions. For wild harvests, the reviewed evidence indicates the relevance of collection location, season, nearby agricultural activity, collection method and temporary storage. Sites exposed to pesticide application, contaminated water or waste may present greater chemical or microbiological risks (Ng'ang'a et al., 2021;

Amorello et al., 2024). Ecological effects are less well documented; consequently, sustainability should not be assumed from seasonal abundance alone.

For farmed grasshoppers, feed or substrate quality may influence both safety and nutritional composition. Agricultural side streams may improve resource efficiency but can also introduce pesticides, mycotoxins, heavy metals or physical contaminants (Meyer et al., 2021; Evans & Shao, 2022; Bisconsin-Junior et al., 2023). Feed materials should therefore be assessed separately for food-safety hazards and, where relevant, Shariah concerns.

Najis is a religious classification, whereas pathogenic microorganisms, pesticide residues and heavy metals are hazards evaluated using scientific criteria. Scientific analysis may determine the presence and level of a contaminant, but it does not by itself determine its religious classification. Clear documentation of both aspects enables appropriate safety controls and, where necessary, consideration by the relevant halal authority.

Processing may include receiving, sorting, washing, blanching, roasting, frying, drying, defatting, milling and incorporation into other foods. Washing can remove surface debris and may reduce some surface contamination, while the effectiveness of heating and drying in controlling microorganisms and moisture depends on the processing conditions applied (FAO, 2021; Mugo-Kamiri et al., 2024).

Milling makes grasshoppers easier to incorporate into food products but removes visible characteristics used for species identification. It may also increase exposure to oxygen and moisture, affecting product stability if storage and packaging are inadequate (Yang et al., 2024). Processing controls should therefore be determined according to the species, product form, intended use and identified hazards.

Additional ingredients and processing aids require separate halal and safety assessment. Cooking oils, coatings, seasonings, flavourings, enzymes, carriers and anti-caking agents may affect the status of the finished product even when the grasshopper itself is permissible. Shared equipment may also introduce residues from non-compliant materials or unintended allergen cross-contact. Segregation, cleaning and production-changeover procedures should therefore be applied and documented according to the identified risks (SMIIC, 2019; FAO, 2021).

Heat treatment should be validated for the specific species and product form to achieve the intended microbial reduction without causing unnecessary deterioration in product quality. Dry products also require suitable packaging and storage conditions to control moisture uptake, mould growth and oxidative deterioration. Shelf-life studies should therefore evaluate the actual product, packaging system, storage temperature and anticipated handling conditions rather than relying on findings from a different insect or product form (Kozlu et al., 2024; Yang et al., 2024).

Traceability connects information concerning species identity, source, processing and distribution. Relevant records may include the scientific name, collection location or farm, harvest or production date, feed or habitat information, receiving checks, processing treatments, additional ingredients, packaging and distribution details (SMIIC, 2019).

These records support product investigation, withdrawal or recall and verification of species and ingredient claims, particularly when milling or formulation prevents visual identification (Hillinger et al., 2023). A batch code or digital interface is effective only when the information linked to it is complete, accurate and maintained throughout the supply chain.

Regulatory, Halal and Consumer Assurance

A general ruling of permissibility does not automatically establish that a product may be marketed or certified in every jurisdiction. Edible-insect regulation varies, and requirements may depend on species, product form, hygiene, labelling and permitted claims (FAO, 2021; Riaz et al., 2025). This review does not undertake a jurisdiction-by-jurisdiction legal analysis.

Its regulatory conclusion is therefore limited to the need for manufacturers to confirm the requirements of the competent food and halal authorities for the intended market. Halal certification, where applicable, provides independent assurance that a product or facility has been assessed against specified halal requirements. However, certification does not necessarily mean that a product is nutritionally superior, environmentally sustainable or entirely free from food-safety risks. Similarly, the absence of a halal certification logo does not automatically mean that grasshoppers are *haram*.

A clear distinction should therefore be made between the general permissibility of grasshoppers, the halal certification status of a particular product or facility, and a halal claim made by the manufacturer. Beyond certification, halal integrity also depends on measures that prevent adulteration, intentional contamination and other forms of food-related misconduct within the supply chain (Abd Razak & Ramli, 2022). These distinctions should be communicated accurately to avoid misleading consumers.

Consumer acceptance of grasshopper-based foods depends on factors beyond their halal status. Previous studies have identified unfamiliarity, disgust, reluctance to try new foods, sensory characteristics and food-safety concerns as important barriers to the consumption of edible insects (Doğan & Çekal, 2022; Ros-Baró et al., 2022). In Malaysia, Lim et al. (2022) reported low acceptance among adults surveyed in the Klang Valley and Kuching.

The main barriers were texture, food-safety concerns and disgust, with no significant difference in acceptance between the two locations. Sabri et al. (2023) further identified religious considerations and clear regulatory requirements as factors that may influence the future acceptance of edible insects in Malaysia and Indonesia. Product form may influence consumer acceptance.

Whole insects make the ingredient immediately visible but may intensify disgust among unfamiliar consumers, while incorporating grasshopper flour or protein concentrate into familiar foods may improve willingness to try the product (Bisconsin-Junior et al., 2022). However, processing should not obscure the identity of the ingredient. Product information should clearly identify the grasshopper ingredient, relevant halal or certification status, allergen information and any necessary storage or preparation instructions.

Communication should be based on verified product information and applicable labelling requirements rather than broad claims such as “completely safe,” “pure” or “naturally halal.” Environmental sustainability is another area in which product claims require appropriate evidence. Edible insects may require less feed and land than conventional livestock; however, environmental performance varies according to the insect species, production system, feed substrate, energy requirements and processing method.

Life-cycle assessment results are also affected by the selected system boundaries and functional units (Vinci et al., 2022; Lange & Nakamura, 2023). Environmental claims should therefore relate to the specific species, product, and production system. Sustainability may be a benefit, but it does not determine a product's halal status.

Integrated *Halalan Tayyiban* Considerations for Grasshopper-Based Foods

Taken together, the findings indicate that the *halalan tayyiban* suitability of grasshopper-based foods depends on more than the general permissibility of grasshoppers. It also requires consideration of species identity, sourcing conditions, nutritional suitability, food-safety and allergenic risks, processing controls, traceability, regulatory requirements and consumer information.

These considerations are interconnected because weaknesses in one area may affect the halal integrity, safety or acceptability of the finished product. Table 1 synthesises the principal findings across the seven interconnected assessment areas and identifies the references that support them.

Table 1. Synthesised *Halalan Tayyiban* Considerations for Grasshopper-Based Foods

No.	Assessment area	Synthesised finding	References
1.	Permissibility and identity	OIC/SMIIC 1:2019 recognises grasshopper as a halal animal, while the hadith and juristic explanation provide a specific basis for the permissibility of locusts. Verified species identity supports accurate product identification, labelling and interpretation of nutritional and safety evidence.	Ibn Majah (n.d.); SMIIC (2019); Jabatan Mufti Wilayah Persekutuan (2020); Hillinger et al. (2023)
2.	Sourcing and contamination control	Wild-harvested and farmed grasshoppers may be exposed to microbial contamination, pesticide residues, heavy metals and mycotoxins through their environment, feed substrate, harvesting and handling conditions. Controls should therefore reflect the actual production system and identified hazards.	Meyer et al. (2021); Ng'ang'a et al. (2021); Bisconsin-Junior et al. (2023); Amorello et al. (2024)
3.	Nutritional suitability	Grasshoppers have nutritional potential, particularly as sources of protein and other nutrients. However, their composition varies according to species, life stage, geographical origin, diet and processing method. Nutritional claims should therefore reflect the composition, product form and intended amount of consumption of the actual product.	Meyer-Rochow et al. (2021); EFSA NDA Panel (2021); Kababu et al. (2023); Lu et al. (2024); Tanga & Ekesi (2024)
4.	Food safety and allergenicity	Biological, chemical, physical and allergenic hazards require product-specific assessment and control. Locust and other edible-insect proteins may cross-react with crustacean allergens, while the clinical significance of cross-recognition involving house dust mites remains uncertain.	FAO (2021); Pali-Schöll et al. (2019); De Marchi et al. (2021); Ribeiro et al. (2021); EFSA NDA Panel (2021)
5.	Processing integrity	Processing methods such as heating, drying and milling may improve microbial safety, shelf stability and usability but can also affect nutritional composition, protein functionality, oxidation and allergenic properties. Additional ingredients, processing aids and shared equipment also require halal and safety assessment.	SMIIC (2019); Kozlu et al. (2024); Yang et al. (2024)
6.	Traceability and disclosure	Records should connect the scientific name, source, production or harvesting batch, processing history, additional ingredients, packaging and distribution. Clear information concerning ingredients, halal status and allergens is particularly important when milling or formulation prevents visual	SMIIC (2019); FAO (2021); EFSA NDA Panel (2021); Hillinger et al. (2023)

		identification of the grasshopper ingredient.	
7.	Regulatory and consumer assurance	General permissibility does not automatically establish regulatory authorisation, halal certification or the safety of a finished product. Consumer acceptance is influenced by familiarity, disgust, food neophobia, sensory characteristics, product form and safety concerns. Consumer-facing halal, safety and environmental claims should be specific, verifiable and supported by evidence relevant to the particular product and production system.	Lim et al. (2022); Ros-Baró et al. (2022); Sabri et al. (2023); Vinci et al. (2022); Lange & Nakamura (2023)

The assessment areas are interconnected rather than independent. Species identity and sourcing information support the interpretation of nutritional and safety evidence, while processing and traceability connect the raw material with the finished product. Regulatory and consumer assurance depends on clear evidence concerning product identity, halal status, safety controls and disclosure. The relevance of each area may vary according to the species, product form, production system, intended consumer group and applicable jurisdiction.

The synthesis also identifies priorities for further research. Species-level taxonomic and compositional studies are needed because findings from one grasshopper species should not be applied directly to another (Magara et al., 2025). Research on wild-harvested grasshoppers should consider geographical source, seasonal variation, habitat and possible agricultural exposure (Ssepuuya et al., 2019; Ishara et al., 2025).

Processing studies should examine microbial reduction, moisture control, nutrient retention, shelf life and allergenicity in clearly defined products (Pali-Schöll et al., 2019; Imathiu, 2020). Consumer studies should use realistic products and labels to determine how halal information, allergen disclosure, product form and transparent labelling influence acceptance, particularly within Muslim consumer markets (Lim et al., 2022; Sabri et al., 2023).

CONCLUSION

This review establishes that grasshoppers have a clear general basis of permissibility under OIC/SMIIC 1:2019, while Islamic evidence concerning locusts provides a related but more specific religious basis. Nevertheless, source permissibility alone does not establish the *halalan tayyiban* suitability of every finished grasshopper-based product. Such suitability depends on verified species identity and source, acceptable ingredients and processing, appropriate hazard controls, traceability and accurate consumer information.

The evidence remains uneven across grasshopper species, production systems and geographical settings, with some conclusions derived from locusts or the broader edible-insect literature. Further species- and process-specific research is therefore needed, particularly concerning composition, contaminants, allergenicity, processing effectiveness and consumer acceptance in halal markets.

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