

## Edible Insects through the Food Safety Lens

Keya Mukherjee Ph.D. and Vittorio Fattori Ph.D.

### *Why is there an interest in edible insects?*

As the global population rises there is an increased need to find solutions to adequately feed the world. This is in the context of growing awareness about the impacts of conventional agriculture on the environment, effects of climate change and drive for healthier living. All this has prompted a heightened interest in exploring sources of food that are both nutritious and environmentally sustainable. Some of these new food sources are explored in a recent FAO publication entitled, [Thinking about the future of food safety - a foresight report](#). One food source that has garnered steady attention recently – from media, consumers, national agencies to private sector – is edible insects.

While largely absent from western diets to date, consumption of insects is not new. In fact, entomophagy (or consumption of insects as food) has been traditionally practiced in several regions of the world for generations and is deeply rooted in numerous cultural customs and religious beliefs. The nutritional value of insects is species dependent. Overall, insects tend to be rich in protein, dietary fibre, beneficial fatty acids and various micronutrients. Apart from improving food and nutrition security, selling insects, gathered from the wild or reared, can be a source of livelihood diversification with economic benefits, especially for rural communities ([FAO, 2013](#)).

Fast growth, high fecundity, efficient conversion of feed into body mass, lower land and water use, and carbon footprint compared to conventional livestock, and year-around production are some of the factors that can make insect farming attractive, in both rural and urban settings. And indeed, the edible insects sector is fast expanding, with global production ranging from small-scale farms with minimal infrastructure producing a few tonnes a year to large scale, automated farms that produce a few thousand tonnes a year. The market for this sector is projected by some to grow to approximately USD 5.5 billion by 2026 ([Businesswire, 2021](#)). However, it must be noted that farmed insects also have other applications, such as feed for animals (including for pets), and waste (plant and animal-derived side streams) management. But these applications are not discussed in this article. Some of the commercially important insects for food-based applications are yellow mealworms, crickets and grasshoppers.

While there is no denying the different opportunities and benefits that the edible insects sector brings, there are also some challenges that must be acknowledged and addressed. A recent FAO publication, [Looking at edible insects from a food safety perspective. Challenges and opportunities for the sector](#) (2021) described the challenges related to the potential food safety risks associated with the production or farming, processing, and consumption of insects. This article draws on that work to outline some of the food safety issues to consider with respect to edible insects.

### *What are the various food safety implications associated with edible insects?*

Like other foods, edible insects are also associated with some food safety hazards which must be taken into consideration to drive further development in this sector. Potential food safety risks associated with edible insects highly depend on the species of insects, the environment they are reared in or collected from, what they eat, and the production and processing methods used. Some of the food safety hazards are discussed in brief:

Biological hazards: The microbiota of insects, found in the gut as well as other anatomical parts, is complex. While the microbiota of some commercially important insects has been analyzed, more work in this area remains to be done. This is important, as insects tend to be consumed in their entirety, with a few exceptions. Though most pathogenic microbes that infect insects are harmless to humans due to phylogenetic differences, insects can be vectors or carriers of microbes that are harmful to humans, especially when insects are reared under poorly controlled hygienic conditions. Several bacterial species have been associated with edible insects, both farm-reared and wild-caught, and some of these are not only pathogenic and opportunistic bacteria, they can also be responsible for reducing the shelf-life of edible insects. The presence of endospore-forming bacteria in edible insects is a major food safety concern as the spores, being heat-resistant, may withstand the common processing methods adopted for edible insects, like drying, boiling and deep-frying.

So far, risks associated with foodborne viruses, like hepatitis A, hepatitis E and norovirus, from consuming edible insects are low, but care must be taken not to introduce the viruses in insect production units through their feed, and unsafe handling practices. Insect species deemed fit for mass production may be vectors for parasites, however this particular risk may not be particularly high and is poorly documented.

Contamination of edible insects post-processing is also an area of consideration. For instance, edible insects sun-dried in humid areas may be susceptible to microbial growth due to moisture. Air-drying of insects where they may come in contact with soil also pose potential food safety issues.

Chemical hazards: Insects that are reared on agricultural products may be exposed to various agrochemicals (such as pesticides and veterinary drugs), and other chemical hazards (such as mycotoxins and heavy metals). These chemicals can accumulate in insects and pose food safety concerns when the insects are consumed.

Research to determine the allergenic potential of insects and insect-based food products need to be broadened to gain a better understanding. Insects and crustaceans (shrimp, prawns, etc.) belong to the arthropod family. According to published literature individuals allergic to crustaceans may be particularly vulnerable to allergic reactions to edible insects, due to allergen cross-reactivity. In addition to this, there is also a risk associated with developing *de-novo* sensitization to yet unidentified allergens from insects. Processing of insects may also play a role in increasing or decreasing the allergenicity of insects.

*What can be the way forward?*

A thorough assessment of food safety hazards will help to establish appropriate hygiene and manufacturing practices for the edible insect sector. While insect farming is gaining interest, most regulatory frameworks to govern this sector are highly fragmented posing a major barrier for the development of the sector. Food safety risk assessments will pave the way to facilitate the development of appropriate regulatory frameworks (legislation, standards, and other regulatory instruments) that pertain to the production, consumption and trade of edible insects and insect-based food products. For instance, a recent risk assessment, carried out by the European Food Safety Authority (EFSA), found that thermally dried yellow mealworm larvae (both in its whole form and as a powder) were safe for human

consumption ([EFSA NDA Panel et al., 2021](#)), paving the way for the European Union to approve it for EU-wide human consumption.

The insect farming sector has an opportunity to learn from other food sectors and cautiously consider how to sustainably integrate insects into our agrifood systems. This includes educating producers on the implications of using agrochemicals in insect production, producing evidence-based policies to regulate the sector, establishing and enforcing good manufacturing practices, fostering close collaboration among all stakeholders involved to build a multidisciplinary platform from the get-go, and investing in research efforts to improve quality standards and advance innovation ([FAO, 2021](#)).

**About the authors:**

Keya Mukherjee, Food Safety Specialist, and Vittorio Fattori, Food Safety Officer, work at the Food and Agriculture Organization of the United Nations (FAO), within the Food Systems and Food Safety Division.

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