Edible insects: scope

2.1 Microbiology and antimicrobial resistance

Various factors, including the presence of microorganisms in ingredients, their introduction via cross- contamination during harvesting or preparation, inadequate cooking of the food and/or the improper treatment and storage of products, affect the number and type of microorganisms present in food products at the point of purchase. Such microorganisms may themselves be pathogenic to consumers or they can cause faster spoilage, increasing food waste.

Following the Novel Food authorisation process, levels of microbiological contaminants must be tested and then stated as part of the specification of the Novel Food (EFSA, 2016). The most common indicators of microbiological contamination of food include, amongst others, counts of mesophilic aerobes, Enterobacteriaceae, Escherichia coli and Listeria monocytogenes (HPA, 2009). Maximum microorganism count levels for different types of insect product have not been yet specified in legislation. In the UK, guidelines from the Health Protection Agency (HPA) and Public Health England (PHE) are used to interpret the enumeration of pathogens and hygiene indicators in ready to eat food (HPA, 2009).

Other than bacterial contamination, The EFSA Risk Profile from 2015 (EFSA, 2015) concluded that, based on the information available at the time, infection with viruses, parasites and prions from edible insects would not constitute a risk unless inadequate rearing practices allowed for external contamination. This was primarily due to the lack of presence of such pathogens in insects with the ability to infect humans, and the evidence showing the incapability of prions to multiply within insects. This evidence was re-evaluated as part of this literature review to incorporate new scientific evidence published from 2015 to 2019.

Antimicrobial resistance is a global growing problem that poses a risk to the capability of treating infectious diseases. As a consequence of antibiotic use in several sectors, including animal husbandry and agriculture, infectious agents become resistant to the action of antibiotics, sometimes at a higher rate than new antibiotics can be produced (WHO, 2020). It is therefore necessary to consider the impact on AMR from using antibiotics in insect-rearing.

No specific pathogenic agents or AMR genes were identified or excluded prior to the execution of the review, in order to allow for a wider research scope. During the search and analysis process, those agents non-pathogenic to humans and those not capable of altering the hygienic quality of the food were not compiled as part of the results.

2.2 Toxicology

Toxicological safety evaluation is a requirement of the Novel Food authorisation process, including genotoxicity, subchronic and chronic toxicity, carcinogenicity, and reproductive and developmental toxicity (EFSA, 2016). Toxic chemicals may accumulate in edible insects from the substrate they feed on or by direct contact with contaminants during rearing. These chemicals can also form through the processing of the insects after harvesting, although there is a significant knowledge gap in the literature concerning this topic.

The guidance for the authorisation of Novel Foods specifies that for insects, consideration must be given to the hazards identified in the EFSA risk profile for edible insects of 2015, which

includes heavy metals, toxins, pesticides, and toxic by-products of the processing (EFSA, 2015).

The literature review included a wide search to avoid the exclusion of relevant toxic compounds or potentially new risks discovered, given the lack of studies identified by the 2015 EFSA document. The scope of the review does not cover toxins produced by the insects themselves. This review is not a full evaluation of toxicological risk to human health, as it does not include additional information currently unavailable, such as exposure and consumption data, as well as referring those to health-based guidance values.

2.3 Allergenicity

One of the main characteristics of the average insect-based food is their high content in protein, and hence, the risk that some of these proteins act as allergens for the consumer. Historically there have been reports of allergic reactions to the consumption of insects and the cross-reactivity between mealworm and crustaceans has been repeatedly confirmed. However, the exact mechanism and potential for both cross-reactivity and de novo sensitisation to insect proteins is still an area with a lot of unknowns (EFSA, 2015).

Both cross-reactivity and de-novo sensitisation were considered for the scope of the review.

2.4 Composition variability

As part of the Novel Food authorisation process, applicants must specify the nutritional values that characterise their product. The final product must meet these specifications in order for it to be commercialised (EFSA, 2016). Therefore, a high variability in composition within samples of the same type of product may cause it to fail to comply with the specifications and not be able to be commercialised. Furthermore, if edible insect composition variability is not taken into account, the product could mislead customers by believing they are consuming a food with a proportion of nutrients that cannot actually be guaranteed to be the way it is described.

The scope of the review aims to identify potential hazards to misleading consumers or placing them at a nutritional disadvantage. No other nutritional considerations were taken into account for this review.

2.5 Exclusions

Physical hazards that are part of the structure of the edible insect, such as spines or stingers, were not considered as part of the scope of this review. No nutritional considerations other than those previously mentioned were taking into account in the review. Other than microbiological contamination and toxic compound accumulation, the scope of the review does not include further packaging, storage, or transport considerations. Risk related to feed, food for pets, insects captured in the wild or reared under uncontrolled conditions were not evaluated, as these are considered irrelevant or unacceptable for human consumption.

2.6 Other legitimate factors

The ‘other legitimate factors’ described in the next section are not within the remit of this report, which aims to identify hazards to humans from consumption of insects as food. However, they are important to consider within wider strategic work on regulating edible insects and their impact on food safety. These factors could form the basis to future complementary pieces of work to be undertaken.

Term	Definition
Consumer acceptance	Social acceptance of insects as food should be considered to support risk management decisions. Questions include whether the public will react positively to the inclusion of insect products in the market, and what the overall consumer perception will be like.
Environmental impact	The industry claims that insect farming has a significantly lower negative impact on the environment than other farmed animals. The aim of this review is not to identify this evidence, but it should be considered as a potential future line of work in order to inform risk management decisions.
Animal welfare	Currently there is no legislation defining or covering welfare of farmed insect populations, and it is not likely to be developed in the near future. Risk managers will take these factors into consideration.
Impact of trade	Introduction on the market of edible insects and, particularly, products derived from animal protein, could have a positive impact in trade relationships with other nations that already trade with insect products, but could also pose a risk to the introduction of products with lower standards of hygiene and safety, as well as competing with other products as a source of protein for human diets.