Bugged Out: Entomophagy Safety Risks and Legislative Review

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Introduction

- The act of eating insects is called "entomophagy"[1].
- Once considered taboo in Western culture, it is becoming more common. But the practice is becoming more common in the West due to travel, trade and immigration.
- Globally, approximately 2 billion people eat insects regularly[1].
- The most commonly eaten insects include the house cricket (*Acheta domesticus*) and mealworms (*Tenebrio molitor*)[2].
- Of the species currently eaten 1-1.4 million species only 5000 are dangerous to plants, animals or humans[1].
- Hence, 200 times more species are safe for human consumption, as opposed to posing a health risk.
- With an increase in entomophagy, there is a need to research potential health risk associated with consuming insects because policies and procedures may need to be created or updated in Ontario. This review of policy was done to create baseline knowledge of what other countries have done to regulate insects intended for human consumption.

Mealworm (*Tenebrio molitor*)

(https://www.google.ca/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwip9tzW54rTAhVrxoMKHFFNDuIQjRwIBw&url=http%3A%2F%2ftheworrlady.ca%2Feootic-pet-nutritional-info.php&psig=AFQjCNEfaeebQ9KZvSWUpTnXthfJm4bGxw&ust=1491395565441081)

Methodology

- This study reviewed current literature on the safety risks surrounding entomophagy and current policies and regulations in Canada, the US, the EU, and Australia and New Zealand.
- The literature was systematically searched by key terms, to identify specific entomophagy subject matter. The literature was organized by key terms used, ways in which they were found, and the key information drawn from the literature.
- Gaps in literature were also recorded.
- Canadian legislation was identified with the assistance of CFIA, Health Canada, and a local Public Health Unit.

Safety Risks

Microbial Risks on Raw Insects:

- The pathogens that may adversely affect human health are ones the insect acquired from its environment and reside on or in (the gut) the insect[3]. These microbial hazards include bacteria, viruses, fungi[3], protozoa and parasites[4], in insects. In addition, environmental pathogens, such as spore-forming bacteria, can be found on wild gathered insects[4] insects.
- Common environmental pathogens are *Salmonella spp., Campylobacter, and Escherichia coli O157:H7*[5]

Physical Hazards of Edible Insects:

- Physical hazards include any parts of the insect that may not be digestible and could cause perforation or constipation in the human intestine[6]. Physical hazards can include, but are not limited to, insect's jaws, legs, spines, wings, and chitin content[6].

Chemical Hazards of Edible Insects:

- Chemical hazards are in two main categories; (1) the insect itself may carry a toxin (e.g. scorpions), and/or (2) toxic substances and residues may be found on or in the insect (e.g. pesticides)[5].
- Insect toxicity is further divided into two categories, insects that are phanerotoxic, that have organs that produce poisons, and those that are cryptotoxic that are poisonous through bioaccumulation of noxious substances[4].

Allergens:

- Allergies similar to house dust mites and crustacean (shell-fish) are found in insects[5]. There is also a possibility of repeated exposure creating allergic sensitivities[3].

Processing and Handling:

- Crushing insects, boiling, roasting, stir-frying, temperature handling, storage, and fermentation can change the microbial levels on these edible insects[2].

Figure 1: Example of a Hazard Analysis

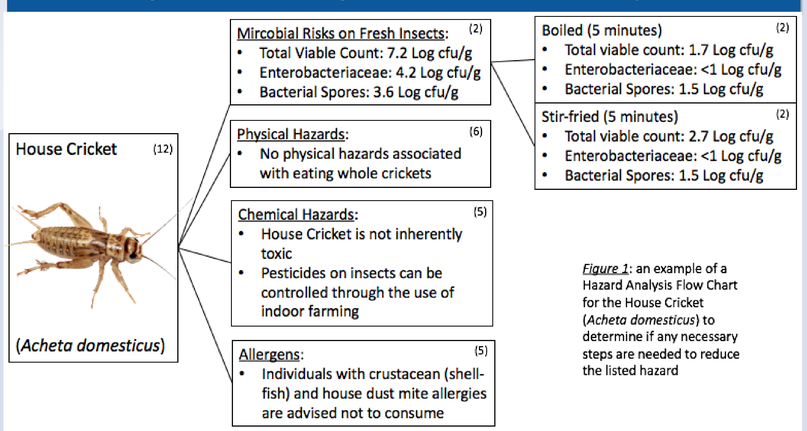

Figure 1: an example of a Hazard Analysis Flow Chart for the House Cricket (*Acheta domesticus*) to determine if any necessary steps are needed to reduce the listed hazard

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Government Policies and Regulations

Canada:

- Insects that do not have a "history of safe use" are classified as Novel Foods under Division 28 of the *Food and Drug Regulations*[7].
- Producers of "Novel Foods" must submit information to Health Canada regarding their safe use. Health Canada determines if it is safe for human consumption[7].
- Insects with a long history of safe use (e.g. house crickets, and mealworms), not considered "Novel Foods", are classified as "non-federally regulated" (NFR) commodities[7].
- NFR commodities are covered under the *Imported and Manufactured Food Program* of the Canadian Food Inspection Agency (CFIA)[7].
- All insect foods for human consumption must also comply with sections 4,5 and 7 of the *Food and Drugs Act*[7].
- CFIA uses the General Principles of Food Hygiene, Composition and Labelling Guidance Document for inspecting NFR premises[7].

US:

- In the United Sates, two bodies oversee federal food commodities. The Department of Agriculture (USDA) regulates meat, poultry and eggs, and The Food and Drug Administration (FDA) regulates food, drugs, and cosmetics outside the USDA scope[8].
- Under the *Food, Drug and Cosmetic Act*, edible insects are classified as food "(f) The term "food" means (1) articles used for food or drink for man or other animals, (2) chewing gum, and (3) articles used for components of any such article" under FDCA Section 201(f)[8].
- Insects raised for human consumption must follow current good manufacturing processes (cGMP)[8].

European Union:

- Regulation (EC) Nr 178/2002 of the European Union 2002, requires that new foods with potential health risks must complete a premarket risk assessment[4] .
- Since 2015 edible insects have been declared "Novel Food", under EU Regulation 2015/2283[5].
- Under the new *Novel Food Regulation*, insects with historically safe use (25+ years), after review are allowed for distribution[9].
- The new *Novel Food Regulation*, January 1st 2016, will not be enforced until January 1st 2018, meaning that during the transition, producers can follow the old less permissive EU Regulation 258/1997[9].

Australia and New Zealand:

- The regulatory body is the Food Standards of Australia and New Zealand (FSANZ)[10].
- "a food that does not have a history of human consumption in Australia or New Zealand" (Australia New Zealand Food Standards Code – Standard 1.5.1) requires a risk assessment[1].
- According FSANZ, edible insects are considered "New Non-Traditional" foods, and have been identified as posing no safety concerns after a preliminary risk profiling and would meet the permission criteria[11].

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