UTILIZATION OF THE EDIBLE INSECTS IN FOOD INDUSTRY

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ABSTRACT

The aim of this study is to investigate the factors affecting the chemical composition of edible insects and their potential uses in food industry.

Edible insects have garnered increasing interest in food technology due to their environmental friendliness, economic and sustainable nature, and nutritional qualities (rich in proteins, healthy fats, vitamins, and minerals). The most commonly consumed insects belong to the orders *Coleoptera, Lepidoptera, Hymenoptera, Orthoptera, Hemiptera, Isoptera, Odonata*, and *Diptera*. Edible insects can be classified into two groups based on their life cycle patterns: hemimetabolous and holometabolous insects. Hemimetabolous insects (*Orthoptera, Hemiptera, Isoptera, Odonata, Diptera*, etc.) undergo incomplete metamorphosis, also known as paurometabolism, passing through three stages: egg, nymph, and adult. Holometabolous insects (*Coleoptera, Lepidoptera, Hymenoptera*, etc.), on the other hand, experience a four-stage development process, including egg, larva, pupa, and imago (or adult). The life cycle stage of insects affects their nutritional composition. In general, high fat content is observed in the pupal stage of edible insects, while high protein content is found in the larval stage. Therefore, the developmental stage of insects chosen may vary depending on the valuable component intended for extraction.

The nutritional composition of insects varies depending on the species and diet. The edible insect sector is rapidly growing, producing new products for various applications, including powders, liquids, and oils. In many Asian countries, edible insects are consumed by roasting, frying, or boiling them whole. Studies have shown that, in countries such as Europe and the United States, consumers tend to prefer using valuable components extracted from insects rather than consuming insects directly.

Insect flours/powders can be used in fortified dry foods, protein supplements, high-protein cereals, meat substitutes, chitosan, protein-rich beverages, sports supplements, and various snacks such as burgers, energy bars, and compound feeds.

Keywords: Edible insect, Hemimetabolous, Holometabolous, Larva, Pupa

INTRODUCTION

Edible insects are becoming a focal point in food industry innovation due to their sustainable nature, high nutritional value, and versatile applications. They are particularly valued for their protein content, healthy fats, vitamins, and minerals, making them a viable alternative to traditional animal-based protein sources. As the global population grows and environmental concerns intensify, insects offer a promising solution for the future of food. This poster explores their diverse applications in the food industry, with a focus on their potential to address sustainability challenges, nutritional benefits, and consumer demands.

Nutritional Composition and Benefits

Edible insects provide an excellent source of high-quality proteins, essential fatty acids, vitamins (such as **B12** and **riboflavin**), and minerals (such as **zinc** and **iron**). Their nutritional composition varies across species and life stages, with larval stages typically being richer in protein and pupal stages higher in fats (Rumpold & Schlüter, 2013). The ability to modify insect diets allows producers to optimize their nutrient profiles for specific food applications, making them adaptable to different dietary needs (van Huis, 2013).Compared to conventional livestock, insects have a much lower environmental footprint. For instance, crickets require **12 times less feed** and produce **80 times less methane** than cattle to produce the same amount of protein (Dobermann et al., 2017). These advantages position insects as an environmentally sustainable protein source for the future.

Consumer Acceptance and Challenges

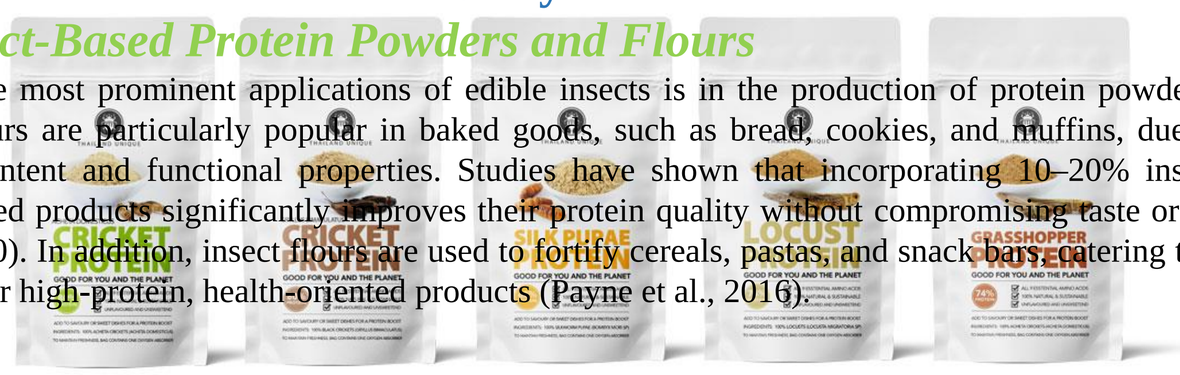
One of the primary challenges facing the edible insect industry is consumer acceptance. Many consumers in Western countries perceive insects as unappetizing or associate them with unhygienic conditions. This “yuck factor” has been a significant barrier to the widespread adoption of insect-based foods (van Huis, 2013).

Educational campaigns, targeted marketing, and innovative product development are essential to overcoming these barriers. For example, disguising insects in processed forms, such as powders or protein isolates, can make them more appealing to hesitant consumers. In addition, emphasizing the environmental and health benefits of insect-based products can help shift consumer perceptions (Dobermann et al., 2017).

Applications in the Food Industry

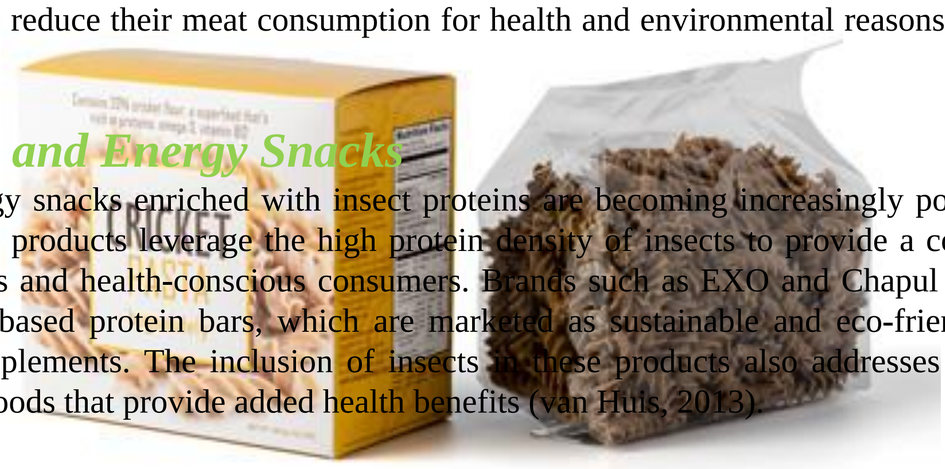
1. Insect-Based Protein Powders and Flours

One of the most prominent applications of edible insects is in the production of protein powders and flours. Insect flours are particularly popular in baked goods, such as bread, cookies, and muffins, due to their high protein content and functional properties. Studies have shown that incorporating 10–20% insect flour into wheat-based products significantly improves their protein quality without compromising taste or texture (Feng et al., 2020). In addition, insect flours are used to fortify cereals, pastas, and snack bars, catering to the growing demand for high-protein, health-oriented products (Payne et al., 2016).



2. Meat Substitutes and Burgers

Insect-based products are also gaining traction as alternatives to traditional meat products. Insect proteins are used to create plant-insect hybrid burgers, sausages, and nuggets that mimic the taste, texture, and nutritional profile of meat. For example, cricket protein is particularly effective in producing meat-like textures due to its gel-forming and emulsifying properties (Rumpold & Schlüter, 2013).These products cater to flexitarian consumers who aim to reduce their meat consumption for health and environmental reasons (Dobermann et al., 2017).



3. Protein Bars and Energy Snacks

Protein bars and energy snacks enriched with insect proteins are becoming increasingly popular in health and fitness markets. These products leverage the high protein density of insects to provide a convenient, nutrient-rich option for athletes and health-conscious consumers. Brands such as EXO and Chapul have pioneered the production of cricket-based protein bars, which are marketed as sustainable and eco-friendly alternatives to traditional protein supplements. The inclusion of insects in these products also addresses growing consumer interest in functional foods that provide added health benefits (van Huis, 2013).

4. Beverages and Protein Shakes

Insect proteins are also being incorporated into beverages, such as protein shakes, smoothies, and fortified juices. These applications utilize insect protein isolates, which are odorless and tasteless, making them suitable for blending into liquid formulations. Insect-based beverages are marketed as a sustainable alternative to dairy- and soy-based protein drinks, targeting vegan and lactose-intolerant consumers (Payne et al., 2016).

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