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Edible crickets as a possible way to curb protein-energy malnutrition: Nutritional status, food applications, and safety concerns

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ABSTRACT

Protein malnutrition is a major public health concern in the developing world. The livestock products are a good source of high-quality protein, but the livestock industry is a source of pollution and one of the leading causes of climate change because the slaughtering of animals results in the accumulation of waste, offals, and several inedible body portions. The rapid increase in the human population and inadequate supply of traditional protein sources have driven a search for novel and alternative protein sources such as edible insects. This review extensively explores the nutritional value, allergenicity, and safety considerations associated with consuming common house crickets and other related insect species. A wide range of cricket protein-based products are currently available and provide some attractive options to the consumers such as protein-enriched bakery products and gluten-free bread for celiac patients. The cricket protein hydrolysates are used as preservatives to improve the stability of cheddar cheese and goat meat emulsions during storage. The risks associated with edible crickets and their products are bacteria, mycotoxins, polychlorinated dibenzodioxins, pesticide residues, heavy metals, and the presence of allergenic proteins.

1. Introduction

Malnutrition, unsustainable energy, and contaminated water are some of the major challenges faced by the world in the present days (Awual et al., 2023; Awual et al., 2024; Kubra et al., 2021; Rasee et al., 2023; Salman et al., 2023). The demand for protein-rich foods is likely to increase with the increasing human population which is expected to reach 9.1 billion by 2050 and will make it difficult to supply protein in a sustainable way (Henry et al., 2018). Supply of dietary proteins in such a big quantity without affecting the environment and with a low carbon footprint will be extremely challenging and will require additional measures such as a shift in the diet towards other non-traditional and alternative protein sources (Ahmad, Rizwan, & Saeed, 2022; Khan, Nawaz, Saeed, & Khan, 2022; Mubashir, Ghani, & Mubashar, 2022;

Mehnaz et al., 2023; Anjum et al., 2023; Fonkem et al., 2022; Bastamy, Raheel, Ellakany, & Orabi, 2022; Raza et al., 2022). Animal and chicken-based meat products may have microbial hazards like bacteria (*Campylobacter*, *Escherichia coli*, *Staphylococcus*, and *Salmonella*), protozoa (*Sarcocystis* and *Toxoplasma*), viruses (Norovirus, Hepatitis A virus, and Hepatitis E virus) associated with them (Utari, Warly, & Hermon, 2023; Husmaini, 2023; Aini et al., 2023; Mahmood et al., 2022; Zia, Shah, & Habib, 2022; Elsayed et al., 2022; Rehan, Qureshi, Kausar, & Saleemi, 2023; Dik et al., 2023; Degla et al., 2022; Raza, Hussain, & Khan, 2023). Entomophagy (the practice of consuming insects as a source of nutrition by humans) or eating insects as food is an old-age practice that is believed to provide essential nutrients to more than two billion people worldwide (Barsics et al., 2017). The people in Asia, Central America, Africa, and South America have a long history of eating

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