



On the Nutritional Value of Edible Insects



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Submission: 📅 March 18, 2018; Published: 📅 May 16, 2018

Letter to the Editor

The practice of consuming insects is called entomophily, may help to meet the growing protein demand by humans worldwide. Recently consumption of insects by humans is traditionally practiced in many countries around the world. Over 2000 insect species are edible and has a high nutritional value. Among these species are beetles, caterpillars, bees, ants and flies and other species [1]. The maximum consumption of insects is in Asia, Africa and Latin America [1]. Based on the fact that the nutritional value of insects are comparable to commonly eaten meats. Considering the growing population in the world and the increasing demand for production of traditional beef and chicken meat, edible insects should be seriously considered as a source of animal protein [2]. The most applicable strategy to promote insect consumption is to incorporate the insects unrecognizably into familiar products [3].

Considering the amino acid composition of edible insects, they contain a number of amino acids such as phenylalanine, tyrosine, lysine, tryptophan and threonine which are of great nutritional value especially because some of which are deficient in certain cereal proteins.

Tenebrio molitor, *Schistocerca gregaria*, *Gryllobates sigillatus* as three species of insects easily to be breed in Europe were found to have the biggest potential to be used as food and feed [4]. Zielińska et al. [5] reported that these insects could be used as alternative source of protein. Their proteins are highly soluble under a wide pH range, high emulsion activity and moderate foaming capacity and foam stability which increase the chances to be used as food additives in acid and alkaline food. Moreover, protein hydrolysates or peptides from edible insects was found to have similar or higher nutritional value than that of plants and animals dietary proteins.

The poly unsaturated to saturated fatty acid (P/S) ratio is one of the most significant markers of lipid composition in a healthy diet. It is recommended to consume diet with a P/S ratio close to 1. A high P/S ratio (≥ 3) in diet may promote tumor formation, while a low P/S ratio (≤ 0.33) in the diet could be atherogenic [6]. Interestingly, some insects contain lipids with P/S ratio (close to one, indicating the strong nutritional potential of their lipids.

The omega 6 to omega 3 fatty acids (n6/n3) ratio is another commonly used index to access healthy diets. Studies have suggested that a high n6/n3 ratio in diet is possibly linked to the development of a variety of physiological disorders (such as cancer, coronary heart disease etc.) [7,8].

Artificial diets with high content of linoleic, α -linolenic, eicosapentaenoic or docosahexaenoic acids increased the content of these fatty acids in the insect tenfold. To achieve required ω -6/ ω -3 ratio for human consumption, diverse diets with a source of ω -3 fatty acids and protein should be used when rearing edible insects. This can help to suggest the potential role of optimizing ω -6/ ω -3 ratio for improving human nutrition through the production of edible insects with designed nutritional content [9].

Application of this concept is very attractive and innovation is kept improving in this regard. Most recently, 3D printing technology was employed to obtain snacks with a designed cylindrical geometry from wheat flour dough enriched by ground larvae of yellow mealworms (*Tenebrio molitor*) as novel source of proteins [9,10].

In addition to their high nutritional values, edible insects have also been found beneficial in treating many diseases such as anemia, respiratory disorder, gastrointestinal diseases and [1,4]. Few edible insects namely mealworm (*Tenebrio molitor* Linnaeus), superworm (*Zophobas atratus* (Fabricius)) and cricket (*Gryllus assimilis* (Fabricius)) can be used as complementary medicine in treating people suffering with hyper uricemia or gout as these insects are the sources of low-purine and protein-rich diet [5]. Reports have also suggested that aqueous extract of *Vespa affinis* may be used as therapeutics against oxidative stress-associated health disorders [6]. Recently it has been found that consumption of insects like Grasshoppers, Crickets and Mealworms species could be exceptional sources of bio available iron and it could increase the minerals (Ca, Cu, Mg, Mn, Zn etc.) intake in the human diets [7].

The interest of further more detailed research in the area of

nutritional value of edible insects may lead to discovery of novel peptide sequences, PUFAs which may be more potent and/or more bio available than those present in conventional diet. In accordance, Entomophagy may become a “norm” around the world in the future especially in the third world poor country. Therefore, further scientific evaluation of understudied edible insects is critically needed in order to better understand the potential of edible insects in human health.

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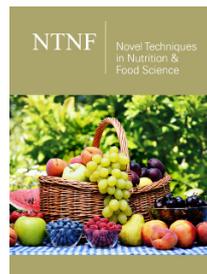
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