Chapter 61
Nutritional Properties of Edible Insects

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ABSTRACT

Insects are the biggest animal group on earth. They constitute as much as 80% of the animal kingdom. Over 2000 species of insects are consumed in Central and South America, Africa, Asia, Australia, and New Zealand. Currently almost 1 billion people on this planet suffer from hunger, and we must strive to increase the efficiency of food production. One of the possible solutions is to use insects as a source of food. An important advantage of insect production is the high environmental safety compared to conventional livestock. Conventional animal husbandry is responsible for at least 18% of total greenhouse gas emissions and large consumption of drinking water. A much smaller amount of water is used to produce insect meat and insects require far less feed. Production of insect protein requires much less land and energy than the more widely consumed forms of animal protein. The nutritional usefulness of edible insects varies depending on the species, on the stage of development of the insect and the method of breeding and feeding. Insects have a high nutritional value. They are a rich source of protein which includes all eight essential amino acids (phenylalanine, isoleucine, leucine, lysine, methionine, threonine, tryptophan, and valine). Edible insects contain on average 10-30% of fat in dry matter and they are good source of edible oil which contains more than 50% of polyunsaturated fatty acids (PUFA) desirable for nutritional and health reasons. The average energy value of edible insects is about 400-500 kcal/100g of dry matter. Insects also contain a variety of water soluble or lipophilic vitamins and minerals. Their consumption can build a well-balanced diet. Insects can be regarded as safe, if properly managed and consumed, but international food regulations are needed.

INTRODUCTION

From the beginning of human existence on the Earth, most of the protein supplied with food was taken by hunting or fishing, but in many places collection of insects was necessary to allow to supplement nutritional deficiencies (Tosi & Daccordi, 1983). Insects are the biggest animal group on earth, they

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constitute as much as 80% of the animal kingdom. It is estimated that over 2000 species of insects are consumed in almost 80% of the countries in the world (Wageningen University and Research, 2017). Eggs, larvae and adult forms of insects (Figure 1) are eaten as food in Central and South America, Africa, Asia, Australia and New Zealand.

Figure 1. Larvae of the mealworms Tenebrio molitor (left) and the adult form of the Jamaican field cricket Gryllus assimilis (right)
Photo credit: Tomasz Lewandowski

The taste and flavour of insects are very diverse (Payne, 2018). We can compare them to the ingredients we know and the ways of cooking are no different from the traditional ones. Also, insects can absorb the taste of the chosen seasoning with which they are fed. The total number of ethnic groups practicing entomophagy (from the Greek words ἔντομον éntomon meaning "insect" and φᾰ́γεῖν phagein meaning "to eat") exceeds 3000 (Ramos-Elorduy, 1998; MacEvilly, 2000). Entomophagy is not well accepted in western European populations but it is common in the world.

It is considered that eating insects may reduce the environmental risks (FAO, 2016). Insect breeding compared to livestock farms (pigs, cattle and poultry) releases six to ten times less ammonia (Oonincx, Kgomotso, & Letswiti, 2010). Conventional animal husbandry is responsible for at least 18% of greenhouse gas emissions and massive consumption of drinking water. Much smaller amounts of water are used to produce insect meat. Insects are able to derive their moisture demand from food. Also they require far less feed. For example, the production of 1 kg of live animal weight of crickets requires as little as 1.7 kg of feed (Collavo, Glew, Huang, Chuang, Bosse, & Paoletti, 2005). Typically, 1 kg of live animal weight in a conventional production system demands 2.5 kg of feed for chicken, 5 kg for pork and 10 kg for beef (Smil, 2002). Moreover, the production of insect protein takes much less land and energy than the more widely consumed forms of animal protein (Halloran, Hanboonsong, Roos, & Bruun, 2017; Oonincx & de Boer, 2012; Premalatha, Abbasi, Abbasi, & Abbasi, 2011). Edible insects can be grown at home, on small farms or large industrial facilities anywhere in the world. The interest in using insects for nutritional purposes is justified because (apart from nutritional qualities) insects are characterized by high survival capacity in various ecological conditions, short life cycle and high reproductive ability (DeFoliart, 1999; Illgner & Nel, 2000; Renault, Laparie, McCauley, & Bonte, 2018). However, it is first necessary to establish international food regulations regarding the safety of insect food products (Rumpold & Schluter, 2013a). Also, in countries where there is no tradition of eating insects, it takes time for people to get used to new possibilities.

The science of edible insects is a relatively new field of scientific research. Large-scale breeding is also a small percentage of the sources from which edible insects are obtained – for the most part they