Entomophagy: a literature review of sustainable and nutritional properties

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Introduction

By the year 2050, the human population is estimated to reach 9 billion people (Van Huis 2013). The UNFAO believes that the available resources to continue producing conventional livestock are quickly dwindling (UNFAO 2009). Entomophagy, or the eating of insects, has been offered up as a viable protein source for current and future generations (Van Huis 2013, Kinyuru et al. 2015, Van Huis et al. 2015).
Insects make up 75% of all animals (Bamaiyi and Aniesona 2012).

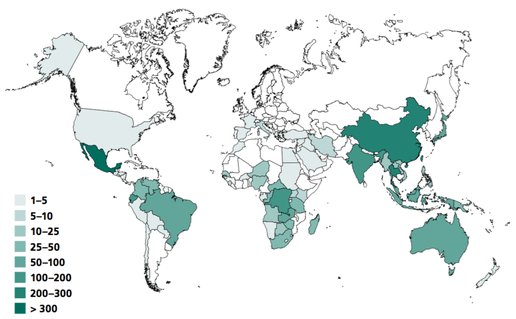

Figure 1. Recorded number of edible insect species, by country (Huis and Food and Agriculture Organization of the United Nations 2013a). Insects are still commonly eaten in many countries around the tropics (Center for Invasive Species Research 2014).

Health Benefits

Studies from Kinyuru et al. (2015) and Meyer-Rochow and Chakravorty (2013) have shown that edible insects are teeming with the necessary proteins, fats, fibers, vitamins and minerals required for human health, although the specific impacts of entomophagy when incorporated into the diet have not been evaluated. Ashiru (1989), Ramos-Elorduy and Pino (1990), and Bukkens (2005) found that when comparing protein rich vegetables and meats to insects, on average, insects had similar or greater caloric content and percentages of protein.

- 50% more protein than soybeans
- ≥ iron content compared to beef (Bukkens 2005)
- Many insects are high in zinc and other micronutrients

Crude protein content, by insect order

Insect order	Stage	Range (% protein)
Coleoptera	Adults and larvae	23 – 66
Lepidoptera	Pupae and larvae	14 – 68
Hemiptera	Adults and larvae	42 – 74
Homoptera	Adults, larvae and eggs	45 – 57
Hymenoptera	Adults, pupae, larvae and eggs	13 – 77
Odonata	Adults and naiad	46 – 65
Orthoptera	Adults and nymph	23 – 65

Table 1. Seven insect orders and the comparison of their protein content (Van Huis et al., 2013).

Sustainability

Insect rearing or “minilivestocking”, as Raubenheimer and Rothman call it, holds great potential for reducing environmental impacts of conventional livestock production. Insect rearing creates significantly lower levels of green house gas emission compared to conventional livestock. It also requires less water and space (figure 3, Van Huis et al. 2015). Van Huis et al. explains how insects can easily be fed on biowaste, providing a disposal method for byproducts and a natural repurposing.

Figure 4. Commercially reared crickets during feeding (Kinyuru, 2015).

Figure 3. Insects, like these fried locusts on display in a market, are a popular snack in a number of countries (Holl et al. 2013).

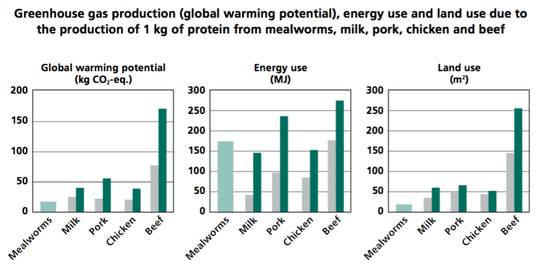

Figure 2. The global warming potential, energy use, and land use are compared for mealworms are compared with milk, pork, chicken, and beef. Mealworms were found to have significantly lower greenhouse gas missions along with a smaller production footprint (Van Huis et al. 2015).

Entomophagy Considerations

Although there are many edible insects, Cohen et al. (2009) discussed the potential for contamination with heavy metals, such as lead. Van Huis et al. (2015), mentioned how some insects have dangerous toxins that could be harmful to humans. The use of biowaste has the potential risk of chemical, bacteria, fungal, and disease related contamination. These risks only increase the need for greater regulation of insects for food production..

Insects are diverse and can often look similar to non-edible species, so it is important to have careful consideration when harvesting in the wild or choosing insects for rearing.

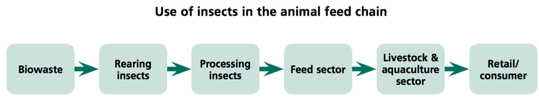

Figure 5. Change of insect production to market (Van Huis et al, 2015).

Figure 6. Bee larvae granola with bee larvae yogurt (Huis and Food and Agriculture Organization of the United Nations 2013a).

Conclusion

Entomophagy is another tool that could be useful in dealing with global hunger. It is a sustainable, healthy option that requires further research into methods for rearing, preparing, marketing and consumption insects. Insects appear to be excellent sources of many vital nutrients.

To date, insect flours and other forms of edible insects are not readily available in the marketplace. Most edible insect products are produced abroad and imported into the US. Future research should focus on heavy metal content and sustainable rearing practices.

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