



# **Insects as Food: Relevance for Human Nutrition**

**Short course & Workshop on Insects and Food  
and Feed**

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**Kasetsart University, Bangkok**

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# Outline

1. Context: Insects & Malnutrition & Sustainable Food Systems
2. Nutritional value of insects - nutritional facts of different species
3. Food Risks: Allergies & Other Potential Hazards
4. Conclusions

# Context: Insects & Undernutrition

## Consideration 1: Insects as efficient & appropriate means to address undernutrition

- ▶ 2 billion people worldwide undernourished

FAO (2014):

- ▶ **Undernourishment** = “the result of prolonged low levels of food intake and/or low absorption of food consumed.” (in: Nadeau et al., 2015)
- ▶ **Depth of undernourishment** = “how many calories would be needed to lift the undernourished out of their status” (in: Nadeau et al., 2015)
- ▶ Protein-Energy Deficiencies - most known form of malnutrition
- ▶ “Hidden Hunger” - micronutrient deficiencies - not immediately visible, but longer term impacts on development (especially for children)

# Context: Insects & Sustainable Food Systems

## Consideration 2: Insects as an appropriate means to complement conventional food sources in a sustainable way

*As defined by the High Level Panel of Experts on food security and nutrition (HLPE) “a sustainable food system (SFS) is a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised”.*

(FAO, n.d)

- ▶ Demographic changes, limits of conventional agriculture & growing food demand, especially demand for animal-based proteins
- ▶ Specific nutrition demands for different groups of individuals/individuals at different life stages

# Nutritional Value of Insects

- ▶ Wide recognition of scientists - insects = excellent nutritional properties - comparable/sometimes superior to conventional food sources
- ▶ WHO: insects suitable food for individuals with higher protein needs:
  - ▶ E.g. infants
  - ▶ Pregnant & lactating women
  - ▶ HIV-positive persons
  - ▶ Malnourished people
- ▶ Nutritional varies between different insect species & maturity stage of insects (e.g. pupae vs. adult insects)
- ▶ Influenced by feed

# Nutrition contents of insects, beef, fish & eggs

Table 2. Nutrient contents of commonly eaten insects in Lao PDR in comparison to meat alternatives per 100 grams of blanched insect

Insect/animal	Energy (kcal)	Protein (g)	Carbohydrate (g)	Fat (g)	Calcium (mg)	Iron (mg)
House cricket	134	12.9	8.1	5.5	76	9.5
Grasshopper	96	14.3	2.2	3.3	27.5	3
Silkworm pupae	127	12.2	4	7	42	1.8
Scarab beetle	98	13.4	7.9	1.4	23	6.4
Giant water bug	182	19.8	7.1	8.3	44	13.6
Beef (boiled)	218	27.6	0	12	11.4	3.5
Fish (boiled)	130	19.2	0	5.9	108.5	0.6
Eggs (boiled)	143	12.5	0.3	10.3	57	2.5

Source: Hanboonsong & Durst, 2014

# Nutritional Facts: Protein

- ▶ High quality protein content due to presence of all essential amino acids in recommended ratios
- ▶ Makes insects suitable food for all age groups
- ▶ Average protein contents: up to 50-82% (dry weight)
- ▶ 100 g of caterpillars: 76% of the daily required amount of proteins - >60% of dry are protein
- ▶ Silkworm pupae (dry): contain 50% proteins & 30% lipids  
(3 pupae: as rich in nutrients as 1 chicken egg)
- ▶ termites, grasshoppers, caterpillars: better protein sources by weight than beef, pork, chicken & lamb
- ▶ House cricket: protein superior to soy protein

Sale of caterpillars in Congo



Source: van Huis et al., 2013

# Nutritional Facts: Fat

- ▶ Some insects; good source of fat
- ▶ Fat content: less than 10 to over 30% fat based on fresh weight - higher in larval & pupal stages, less in adult stage
- ▶ Fatty acid composition: ratio between saturated fatty acid (SFA), monounsaturated fatty acid (MUFA) & polyunsaturated fatty acid (PUFA) - within range of dietary recommendations
- ▶ Termites & caterpillars: among the insects with the highest fat contents
- ▶ Termites: provide 350 kcal/100 g (fresh weight) & contain 28% fat
- ▶ Some butterfly larvae: fat content of 77% (dry matter)
- ▶ Palm weevil larvae: 52.4-62.1% (dry matter)

Bamboo worms for sale in Thailand



Source: van Huis et al., 2013

# Nutritional Facts: Micronutrients

- ▶ Insects: good source of minerals & vitamins
- ▶ Most insects: high contents of potassium, calcium, iron, magnesium & selenium
- ▶ Termites: especially high in iron
- ▶ Some insects: significantly more iron & calcium than beef, pork & chicken 100
  - ▶ Caterpillars: 100g provide 335% of minimum daily required amount of iron g of caterpillars on average
- ▶ Insects rich in zinc - good means to address zinc deficiencies
- ▶ Insects good source of some vitamins:
  - ▶ bee brood high in vitamin A & D,
  - ▶ Caterpillars: very high levels of Vit B1, B2 & B6 - 100g = almost 100% of the daily required amount of vitamins for humans

Shield bugs snack



Source: van Huis et al., 2013

# Allergic Reactions

## Food allergy:

- ▶ Range from mild symptoms to severe life-threatening reactions
- ▶ Any food can potentially cause allergies - but shellfish (mainly shrimp, lobster, crayfish) more common source of allergies
- ▶ Likely cause of allergy: specific type of protein (tropomyosin)
- ▶ People with allergic reactions to shellfish, may also react allergic to insects
  
- ▶ General advice:
  - ▶ People with known serious allergies to shellfish, should avoid eating insects
  - ▶ People with mild allergies & people who have never consumed insects before, should try carefully - e.g. small amounts first
  - ▶ Special attention: children

# Other Potential Hazards

- ▶ Parasitic hazards (parasites in insects) & Microbiological hazards (contamination of insects with food pathogen bacteria)
  - ▶ Not special for insects, but concern for all kind of livestock farming & food chain
  - ▶ Proper farm management & hygienic practices in preparation (cleaning, boiling/heating) & storage (freezing) can prevent contamination
- ▶ Chemical hazards
  - ▶ Toxic effects through poisons contained in insects: can be avoided through selection of suitable species; regulations should ban productions/sales of insects with known adverse health effects
  - ▶ Accumulation of heavy metals & other toxins: can be controlled through farming & provision of adequate/safe feed

# Conclusions

- ▶ Overall, insects have impressive nutritional values
- ▶ Insects can be a means to address different forms of malnutrition
- ▶ Insects can contribute to make food systems more sustainable by providing an alternative source of protein & other nutrients
- ▶ Food risks associated with insects not higher than with other foods

## Literature:

- ▶ Belluco S et al. 2013. Edible insects in a food safety and nutritional perspective: a critical review. *Comprehensive Reviews in Food Science and Food Safety*, vol.12, pp. 296-313. doi: 10.1111/1541-4337.12014
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**Thank you for your attention!**  
**Any Questions?**

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