Insects as Food:
Relevance for Human Nutrition

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

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

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)

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

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:


Thank you for your attention!
Any Questions?

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