


Global Harmonization Initiative

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## “Could edible insects processing enhance consumer health and food security”


Abenaa Akyaa Okyere  
BNARI-GAEC, Ghana  
GHI, Austria



## Global food & nutrition security status

- Global food production must increase by 70%
- Expected increase in production of high value protein foods (meat & fish)
- However, protein production from conventional livestock is expensive and is highly environmentally impacting
- To ensure food and nutrition security;
- Greater use of alternative protein sources e.g. insects protein has been suggested.

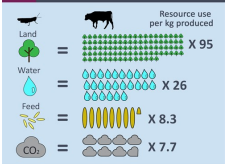
• Ref: Steinfeld et al., 2006; Van Huis et al., 2013



## Global food & nutrition security status 2

### Environmentally friendly

Cricket vs Beef - Sustainability



### Nutritional value

- Fat (13.4-33.4%),
- Proteins (35.9-61.3%),
- Fibre (5.0-12.6%),
- Ash (2.9-10.3%).


• Ref: FAO, 2003; Rumpold & Schlüter (2013)

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## Insects as food

- Insects form part of the food of > 2 billion people.
- Africa, Asia, Latin America
- 3000 ethnic groups in over 120 countries
- Highly influenced by culture, religion, gender, economic status
- Culture is a dominating factor in the acceptance or rejection of entomophagy.
- ❖ Culture should be a guiding principle in processing to attract targeted consumers

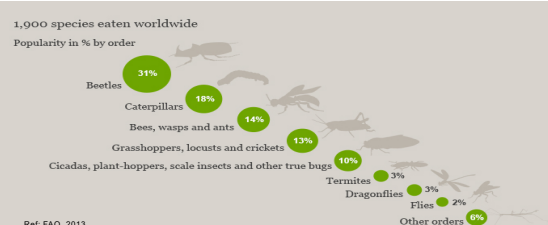
Ref: Mignon, 2002



## Insects as food 2

1,000 species eaten worldwide

Popularity in % by order




Ref: FAO, 2013

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## Processing of insects as food

- Edible insects processing can;
- ensure preservation (avoiding spoilage and foodborne diseases) improving food security.
- make insects palatable (better tasting and access to nutrients)
- transportation stability (development of supply chains)
- develop insect-based ingredients instead of whole products

Ref: Dayer et al. 2012



### Processing to solve challenges with use of insects as food - 1

#### Seasonality of insects

- Most edible insects harvested from the wild provide only food and income for a short period of the year.
- Commercial rearing provides insects all year round
- Crickets, mealworms, silkworms, African palm weevil, grasshoppers and locusts have been farmed commercially for human food.

Ref: EFSA, 2015



### Processing to solve challenges with use of insects as food - 2

#### • Food Safety

- Potential safety hazards are highly contextual and species dependent

- Heavy metals
- Mycotoxins
- Pesticide residues
- Pathogens
- Allergens
- Processing contaminants

➤ Insect processing should comply with HACCP, GMP, GHP, GKP

Knowledge of the potential safety hazards could help in selecting the appropriate treatments during processing to reduce risk or eliminate hazard

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### Processing of edible insects

- Occurs at different levels (factory, artisanal, household)
- Initial preparation includes;
  - Dipping in hot water/ freezing to inactivate the insects
  - De-gutting depending on the species
  - Washing in cold or tepid water
- Processing technique is applied with regards to the end product desired
- Processing methods can be very complex or relatively simple.
- Each process must be carefully assessed as to its potential for the presence of foodborne hazards and for the impact on safety
- Combination of treatments



### Types of processing in the insect food system.

Type 1	Type 2	Type 3
<ul style="list-style-type: none"> <li>• Primary producer</li> <li>• Mostly household level</li> <li>• Minimally processed</li> <li>• E.g. whole fried insects</li> </ul>	<ul style="list-style-type: none"> <li>• Small-scale processor</li> <li>• Processed culinary</li> <li>• Food industry ingredients</li> <li>• E.g. Insect flour, powders</li> </ul>	<ul style="list-style-type: none"> <li>• Factory level</li> <li>• Production of functional foods</li> <li>• Production of nutraceuticals</li> <li>• E.g. Protein, oil, chitin, minerals, vitamins</li> </ul>

Modified from Monteiro, 2010

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### Processing methods of insects as food

#### Traditional

Boiling, steaming, roasting, frying, fermentation

Improve palatability, reduce microbial load, enhance shelf life

Cause inevitable nutrient loss  
Adversely affect the nature & quality

#### Modern

Dry fractionation, 3D food printing, ultrasound-assisted extraction, freeze-drying, irradiation

Less nutrient, sensory losses.

Less microbial proliferation

Can alter allergenicity of insects proteins

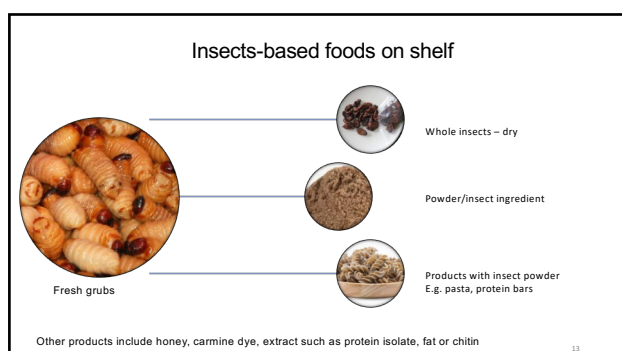
Expensive startup cost

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### Processing methods used in insect foods 2

- Packaging using MAP
- High fat content and the mono and polyunsaturated fatty acids
- Packaging prevents microbial recontamination
- Retards lipid oxidation





### Potential use as functional foods & nutraceuticals globally

- **Insects based foods as functional foods in Africa**
- **Composite fortified foods**
  - Enhancing Protein Energy Malnutrition, micronutrient deficiencies.
  - Grubs of the African palm weevil to bread which provides the major and minor nutrients
  - Termites to cereals to increase  $\beta$ -carotene, niacin, vitamin B6 and B12 content.
  - Oil extracted from African palm weevil grubs with high level of unsaturated components
  - Palm weevil larvae, orange-fleshed sweet potato, and wheat composite flour biscuits to produce acceptable biscuits of high nutritional value.

Ref: Elipo & Origbode, 2005; Barjo et al, 2006; Ayensu et al., 2019



### Potential use as functional foods & nutraceuticals globally 2

- **Insect derived functional foods** include;
  - Omega-3 and six fatty acids,
  - Casein, glucosamine and chondroitin sulfate
  - Silkworm powder (a blood-glucose-lowering) as a diabetic medicine
  - Chitin use as a nutraceutical to reduce fat or cholesterol, use as a drug carrier
- Enhance immunity, modulate inflammation, and protect against neurodegenerative diseases

Ref: ARAI et al., 2016



### Insect processing to enhance consumer health (case study of WUR)

- Leading institution of research in insects as food
- Over a decade research which has contributed a great deal of knowledge on the subject matter
- The book "*Edible insects: future prospects for food and feed security* (2013)", has been downloaded seven million times
- Current research shows the hazard of **edible insects** being a transmission vector of **SARS-CoV-2** is extremely low
- New processing techniques e.g. use of Yellow mealworm in 3D food printing
- To enhance consumer appeal
- Improve nutritional value of the food carrier

Ref: [www.wur.nl](http://www.wur.nl); [www.3dfoodprintingconference.com/wp-content/uploads/2017/07/Domenico-Azzolini-wur](http://www.3dfoodprintingconference.com/wp-content/uploads/2017/07/Domenico-Azzolini-wur)



### Insect processing to enhance consumer health (case study of BNARI-GAEC)

- Production and fortification of bouillon cubes in line with WHO statement on "**Fortification of condiments and seasonings with vitamins and minerals in public health**"
- Over 95% of households in West Africa consume bouillon cubes on a daily basis.
- African palm weevil larvae, selected local vegetables
- As a vehicle to reduce micronutrient deficiencies among school children in Ghana

Ref: WHO, 2014



### Conclusion

- Edible insects are a source of key nutrients in human
- Research & development over the years has led to increasing availability of insects and their products thereof.
- There must be continuous focus on processing approaches to determine optimal conditions and standardization of important parameters for nutritional value retention in the insects based food.
- To ensure consumer health and food security.



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Acknowledgement

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THANK YOU

*"What we eat is, after all, more a matter of custom and fashion than anything else... It can be attributed only to prejudice, that civilized man of today shows such a decided aversion to including any six-legged creatures in his diet."* - Joseph Charles Cornille Bequaert (1921)

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