Measurement and optimization of iron bioavailability from sustainably produced insects

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1 Introduction

Iron deficiency is estimated to affect up to 1.5-2 billion people worldwide, and meat fish and poultry (MFP) are an important source of bioavailable iron. Edible insects are rich in iron, and are likely to possess a substantially smaller environmental food print than MFP. Limited data exists on the potential contribution insect based foods could provide to human diets. Our recent stable isotope studies in humans with adult crickets suggest the presence of an absorption inhibitor which lowers iron absorption from cricket iron in humans, as well as from plant food iron. Chitin, a major component of insect biomass, is a known iron binder. Decreasing chitin content could allow the high amounts of iron in insects to be well-absorbed, and allow for the development of insect based foods with high iron bioavailability and little environmental impact.

2 Aim

- ❑ Estimation of the potential of different insect species as sources of dietary iron in human subjects
- ❑ Development of a food product based on sustainably produced insect biomass with improved iron absorption

3 Specific objectives

- Characterization of T. molitor and X. gideon (potential inhibitors, mineral content etc.)
- Process development for content determination and reduction of potential inhibitors (chitin)
- Determination of iron bioavailability in humans in relation to the inhibitor content
- Production of intrinsically labelled insects by feed enrichment with iron isotopes
- Investigation of the effect of feed iron content on iron concentration in the insect biomass

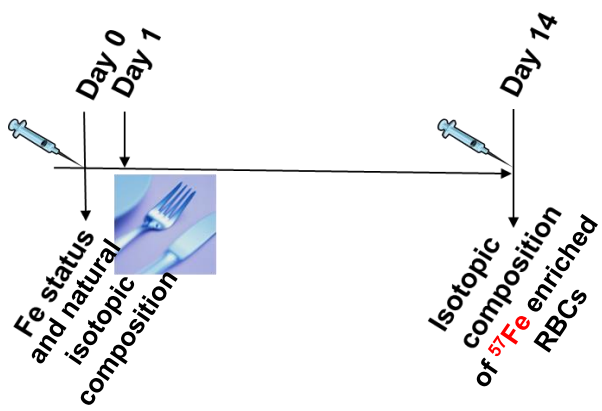
4 Study design and methodology

Three isotopically labeled test meals (2-4 mg ^{57}Fe):

Tenebrio molitor (larvae) (**native** chitin content)

Tenebrio molitor (larvae) (**reduced** chitin content)

Xylotrupes gideon (larvae, pupae) (**naturally low** chitin content)



Hypotheses

- Insects with naturally lower chitin content show higher iron bioavailability in humans.
- Reduced chitin content of an insect based meal will enhance iron bioavailability in human subjects.
- Presence of insect biomass with reduced chitin content in a test meal (cereals) will exert an enhancing effect on non-heme iron bioavailability

Isotope Abundance in Nature	
^{54}Fe	5.8%
^{56}Fe	91.8 %
^{57}Fe	2.1 %
^{58}Fe	0.3 %

Enrichment ratio of the ^{57}Fe into the 'natural' ^{56}Fe in the red blood cells after 14 days of test meal administration, measured by ICP-MS

=iron bioavailability

5 References

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