

Insects, a pathway to a new nutritional source

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Introduction

According to FAO (2017) the world population will reach 9.7 billion by 2050 which makes it necessary to develop sustainable food and feed systems that answer the growing population nutritional needs without exerting a large ecological impact. Recent studies have shown the relevance of insects as a food source due to their nutritional content (they are good sources of protein, fibre and fatty acids). Moreover, insect farming, for human or livestock consumption, is relatively low-cost and eco-friendly when comparing to the common livestock industry. The impact of an insect containing diet upon the human organism is then relevant, particularly at the gut microbiota level which has been described as being linked to overall health. Future studies, focusing upon this relationship can reveal the true potential of insects as a balanced nutrient source and eventual benefits for the human gut microbiota and overall well-being.

Turning points on societies are made to achieve the equilibrium of mankind

Nutritional demands worldwide are a social challenge, particularly when meeting nutritional safety and healthy dimensions.



Insects are excellent nutrient sources, however not all insects have the same nutritional content.



It still is necessary to assess the potential impact of insect based foods upon human health to fully understand the outcome of their consumption.



Environmental impact of the production of 1 Kg of protein of different sources.

Type of meat	Average Greenhouse gas (GHG) production (g)	Quantity of feed (g)	Quantity of water (L)	Arable land (m ²)
Beef	2850	10000	22000	200
Pork	1130	5000	3500	50
Chicken	300	2500	2300	45
Cricket	1	1700	1	15

Source: Van Huis *et al.* (2013) in Edible insects: future prospects for food and feed security and McGill (2015) personal communication in Entomophagy - Edibles bugs.



A change in the food industry is necessary to be able to match population demands as well as be sustainable and bring benefits for people's health.

Proposed methods

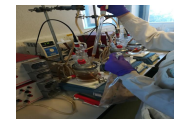
Different study models (*in vivo* or *in vitro*) can be used to assess the potential impact of a food ingredient upon human gut microbiota and, therefore, in human health.



Clinical trials



Mice models



In vitro studies

In vivo studies

Several molecular quantitative techniques can be performed to evaluate the effect of a food ingredient upon the gut microbiota. The principal techniques are related to the quantification of different bacteria groups and metabolic products (e.g. ammonia and SCFA).

Examples:



Bacterial enumeration by FISH-FCM

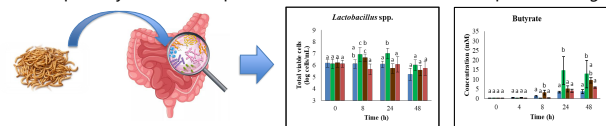


Evaluation of SCFA production by GC



Evaluation of ammonia production

In the gut microbiota studies is important to observe and analyse the impact of the food ingredient in the growth and/or upkeep of beneficial bacterial groups, the production of organic acids (especially SCFA) and production of harmful metabolic products (e.g. ammonia).



Conclusions

The demand for healthier food sources is important, however, it must be a conscientious demand defined by the boundaries of what is safe to eat, nutritionally balanced and even what is a sustainable practice. Nowadays, studies can show the impact of food sources and their nutrients on human health. Gut microbiota studies are leading the way to show the major interactions on the human body by screening the effects of novel foods and bioactives upon the organism. Insects and insect-based products are emerging as a possible response to all these concerns, as they are a good nutrient source and their farming is an eco-friendly and low cost process. Therefore, insects and insect-based ingredients may very well be one of the answers to a sustainable and healthier dietary shift, that may bring unforeseen benefits to the individual and the community.

References

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