Human and animal *in vitro* gastrointestinal models: importance and applications

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Background

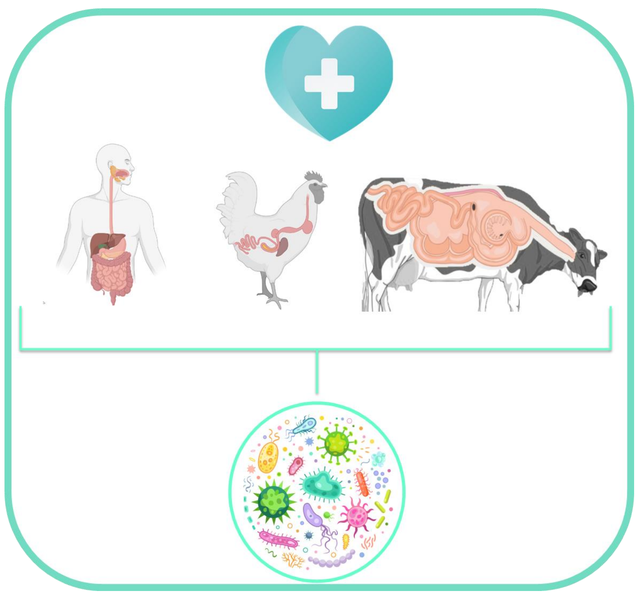
Gut microbiota has a key role and major impact on the host's health. Therefore, the need to maintain the gut microbiome community balanced and healthier has driven to an increase introduction of functional ingredients in the diet of both human and animals.

Functions of gut microbiota

- Fermentation of undigested food/feed
- Short chain fatty acids (SCFA) production
- Protection against pathogens or non-indigenous microorganisms
- Detoxification and stimulation of the immune system

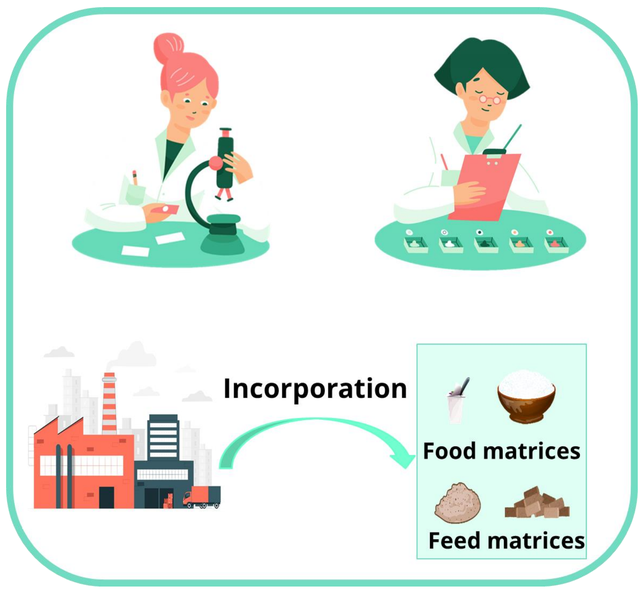
Benefits related to SCFA

- Host energy and hydration
- Bacteriostatic properties
- Maintenance of the gut barrier function
- Increase of the gastrointestinal tract absorption surface
- Anti-inflammatory role in gut mucosa
- Satiety and reduction of food intake

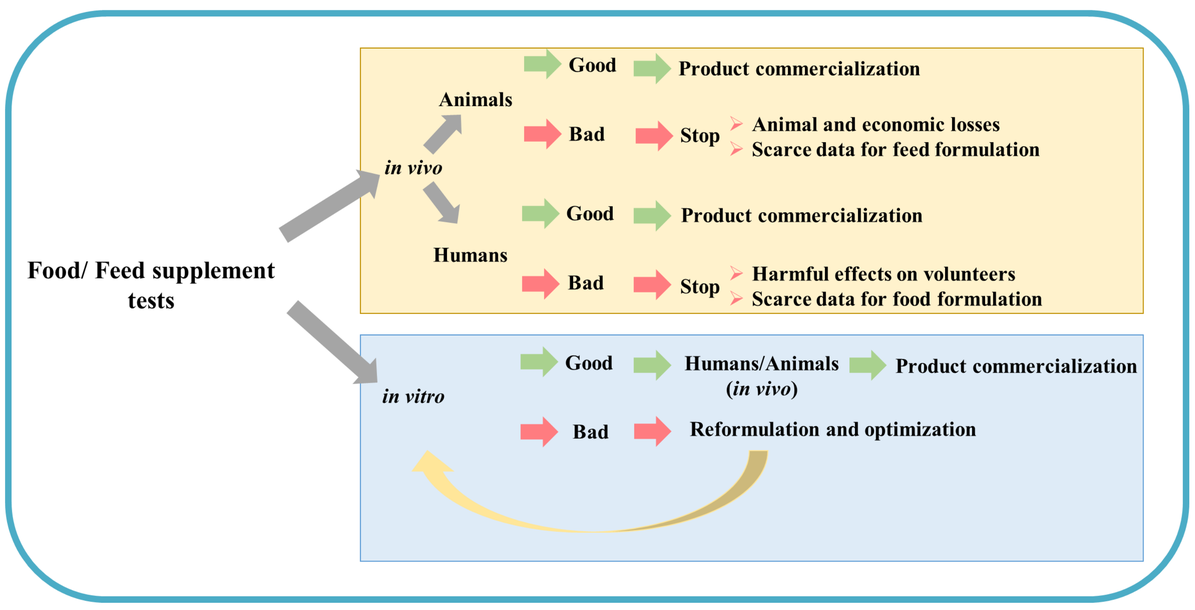


Functional ingredients properties

- Generally recognized as safe (GRAS)
- No contaminants and impurities
- No alteration of gut microbiota balance
- Non-carcinogenic
- Heat and pH stability
- Techno-functional properties (e.g., sweetener, thickener, etc.)
- Additional nutrients supply



In vitro gastrointestinal models can be used to screen food and feed ingredients by simulating the host physiological parameters, enabling the understanding of how different ingredients modulate the gut microbiota and the production of metabolites.



***In vitro* models**

Key factors

- Inoculum
- pH
- Temperature
- Fermentation time
- Food/ Feed matrix

Advantages

- Simple
- Flexible
- Reproducible
- Less time
- Cheaper

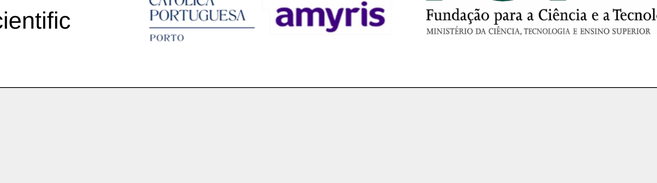
Assessment parameters

- Metabolites production

Examples: lactate, acetate, propionate, butyrate and valerate

- Ammonia/ammonium concentration (NH_3 / NH_4^+)
- Gut bacteria quantification and viability

Examples: *Lactobacillus*, *Bifidobacterium*, *Clostridium*, *Bacteroides* and *Enterobacteriaceae*



Conclusions

In vitro models can provide valuable information on functional ingredient suitability for the food/feed matrix in question, according to the host needs, contributing greatly for the development of new ingredients and minimizing the number of *in vivo* studies.

Acknowledgements

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