

Investigating edible insects as a sustainable food source: nutritional value and techno-functional and physiological properties

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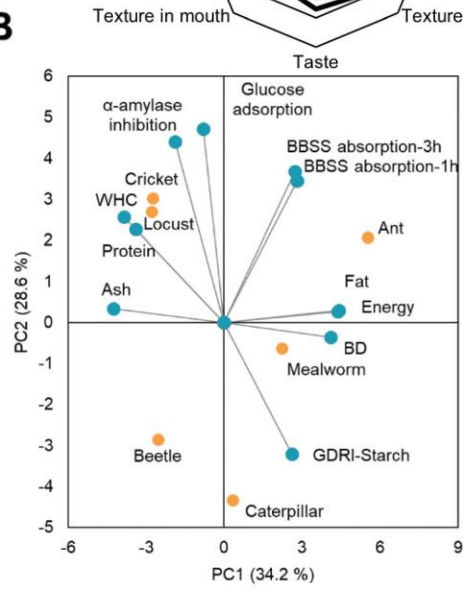
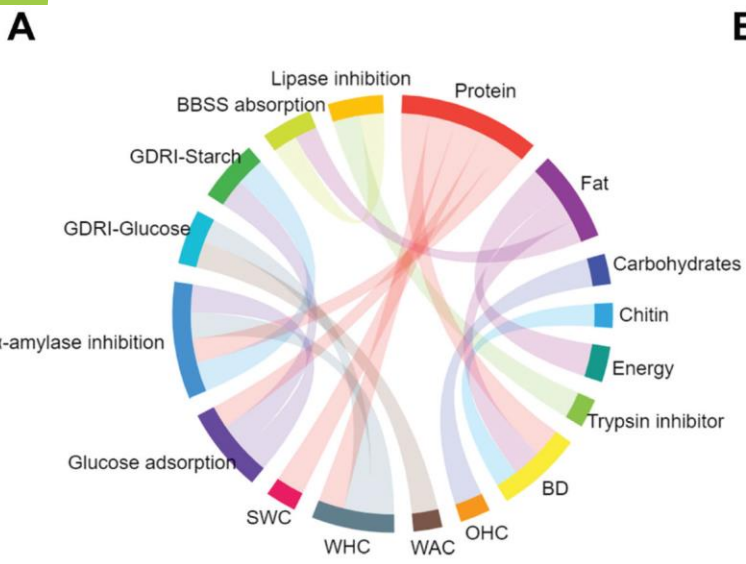
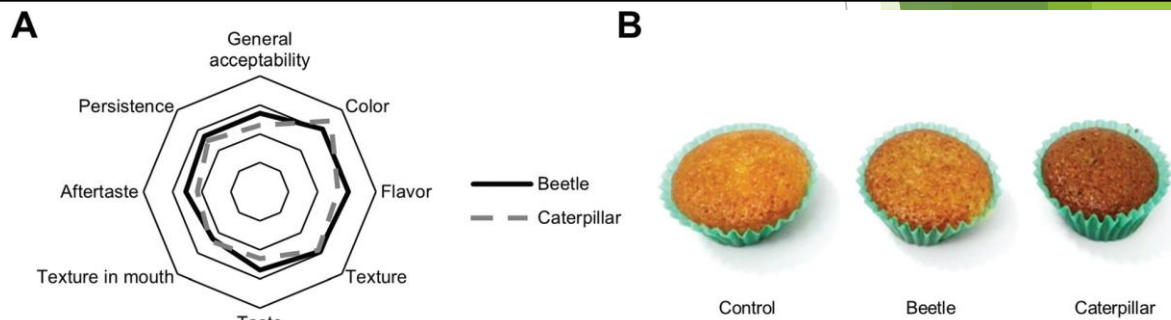
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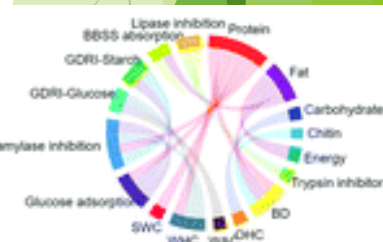
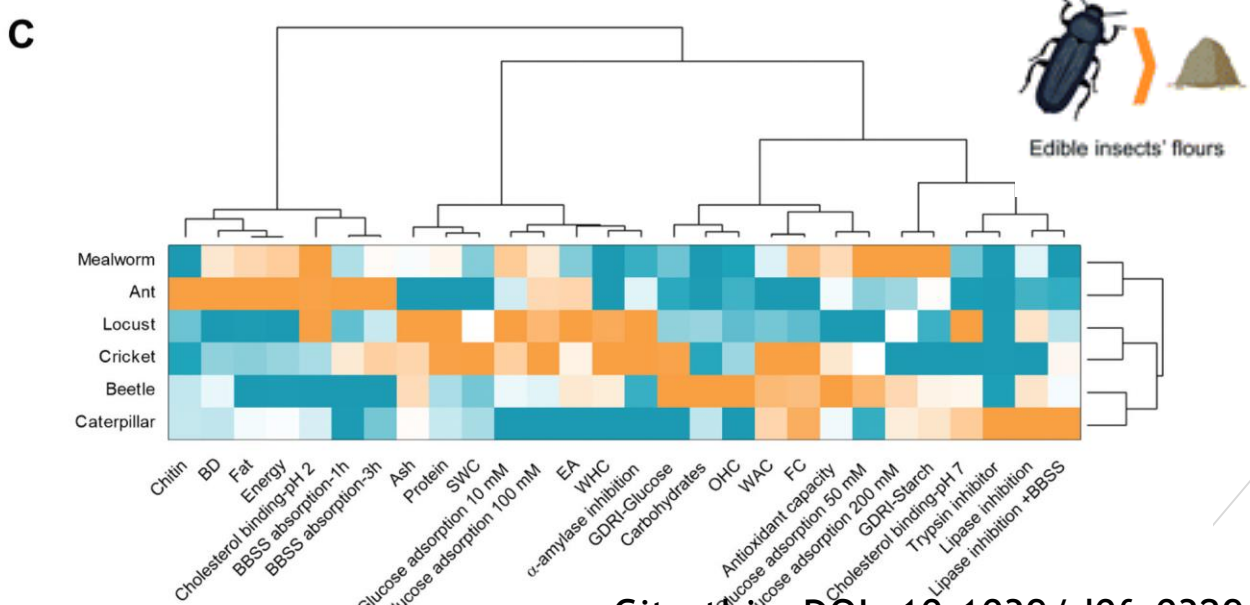
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This work is aimed to evaluate the nutritional composition, and the techno-functional and in vitro physiological properties of flours made using six different insect species and the sensorial feasibility of including them in bakery products. The insect flours exhibited high protein and fat contents as their main components, highlighting the presence of chitin in ant samples. The techno-functional properties showed high oil holding, swelling, and emulsifying capacities in all the analysed insect flours, whereas their bulk density, hydration properties, and foaming capacity showed average values and no gelation capacity. Moreover, these edible insect flours exhibited effective hyperglycaemia and hyperlipidaemia properties, which together with their high antioxidant capacity are associated with beneficial in vitro physiological effects. The beetle and caterpillar flours stand out in these properties, and thus were selected to make a cupcake. The sensory evaluation confirmed that the edible beetle powder can be successfully included in baked goods to provide excellent sensory properties and very high acceptance. Thus, these insect flours may be of great interest to the food industry as a healthy source of protein, exerting a positive impact on functional and sensory food properties, and with a potential role in the prevention of diseases associated with hyperglycaemia and hyperlipidaemia.

Spider-web diagram of sensorial attributes of insect flour-enriched cupcakes (A). Results are reported as the mean score (n = 30) for each parameter (general acceptability, colour, flavour, texture, taste, texture in mouth, aftertaste, and persistence). Representative pictures of the baked cupcakes (B).



Chord diagram depicting the significant ($p < 0.05$) Pearson correlations (≥ 0.65) among the chemical constituents of the insect flours, techno-functional properties, and in vitro physiological properties (A), principal component analysis (PCA)(B), and agglomerative hierarchical cluster analysis coupled to heat map (from the lowest to the highest value for each parameter) (C) showing the associations among the measured parameters and classification of insect flours according to them.



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