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## Encapsulation of bioactive phenolic extract from brewers' spent grain for use in functional foods Investigating bioequivalence in a cellular setup

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### CONTEXT

The brewers' spent grain (BSG) is the main solid by-product from beer industry, representing up to 30% of the starting malted grain. The composition of BSG is variable according to the barley variety and quality, malting and mashing conditions but regardless of these factors it con-

tains appreciable amounts of valuable molecules. One way to valorise BSG is by recovering these high-value components such as phenolic compounds that can be reused as functional ingredients in food industry or other related sectors.

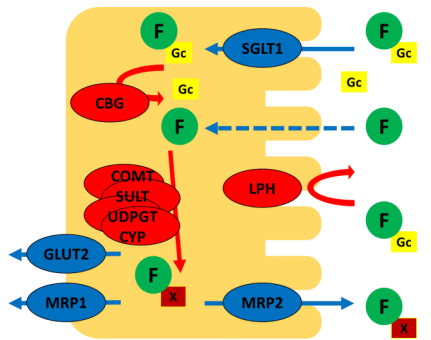
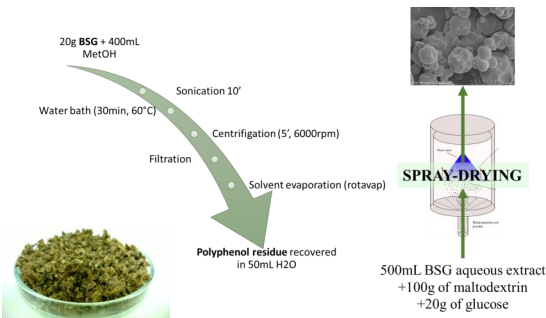
### OBJECTIVE

The extract is targeting the bakery industry as an antioxidant additive. To reduce the risks of degradation or oxidation during the baking process, as well as keep organoleptic properties, it was encapsulated. It is however necessary to prove that the bioactives are being delivered to

the body in order to provide their health benefits.

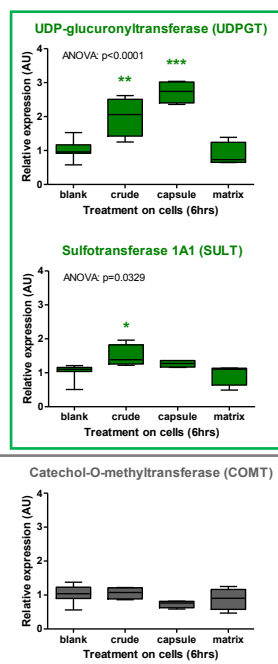
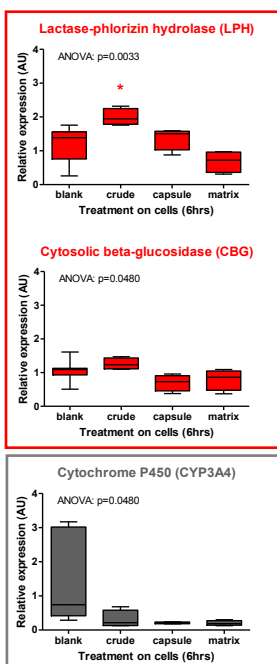
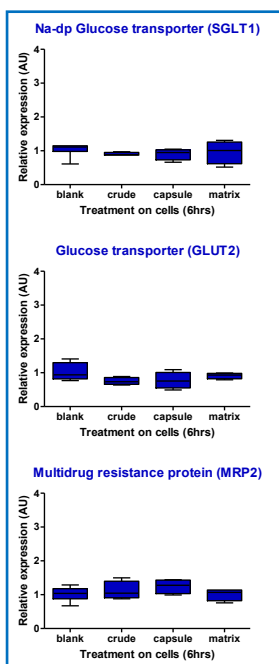
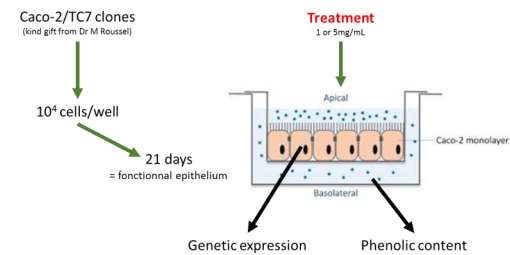
*The objective of the study was thus to validate in vitro whether the bioactive phenolic compounds are absorbed in a similar manner through the intestinal barrier.*

### BSG extraction and encapsulation



Mechanisms of intestinal absorption and metabolism

### Measuring bioavailability



### RESULTS (modulation of genetic expression)

- \* Transporters were not modulated by either product
- \* LPH and CBG expressions were increased by the crude but not encapsulated extract
- \* UDPGT was stimulated by both extracts while SULT expression was only increased by the crude extract
- \* COMT and CYP3A4 were not modulated by either product

For the crude extract only (not shown):

- \* Low dose only modulated UDPGT, COMT and GLUT2 at 2h while high dose modulated most genes up to 6h
- \* There was time dependent modulation with highest expression at 2h, then reducing over time

### CONCLUSIONS

- \* Transporter and metabolic enzymes were stimulated by both extracts. However the crude extract was a stronger modulator than the encapsulated extract, suggesting a small masking effect of the matrix on the absorption and metabolic pathways
- \* Encapsulation seems however to protect the cells from IL8 expression (not shown) compared to the crude extract

### Ongoing analyses (phenol absorption)

\* Polyphenol analyses in the basal compartment of the cell system are still ongoing. It is therefore too early to draw conclusions on the equivalent bioavailability of both extracts or the impact of genetic modulations on the actual uptake and metabolic parameters

### To go further

- \* Modulations of enzyme expression suggest nutrigenomic applications
- \* More biological activities need to be investigated for a full spectrum of applications of the bread or any other functional food using BSG extract