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Understanding the bioavailability of micronutrients and bioactive compounds for improved public health

Bioavailability of phenolic compounds from brewer's spent grain extracts

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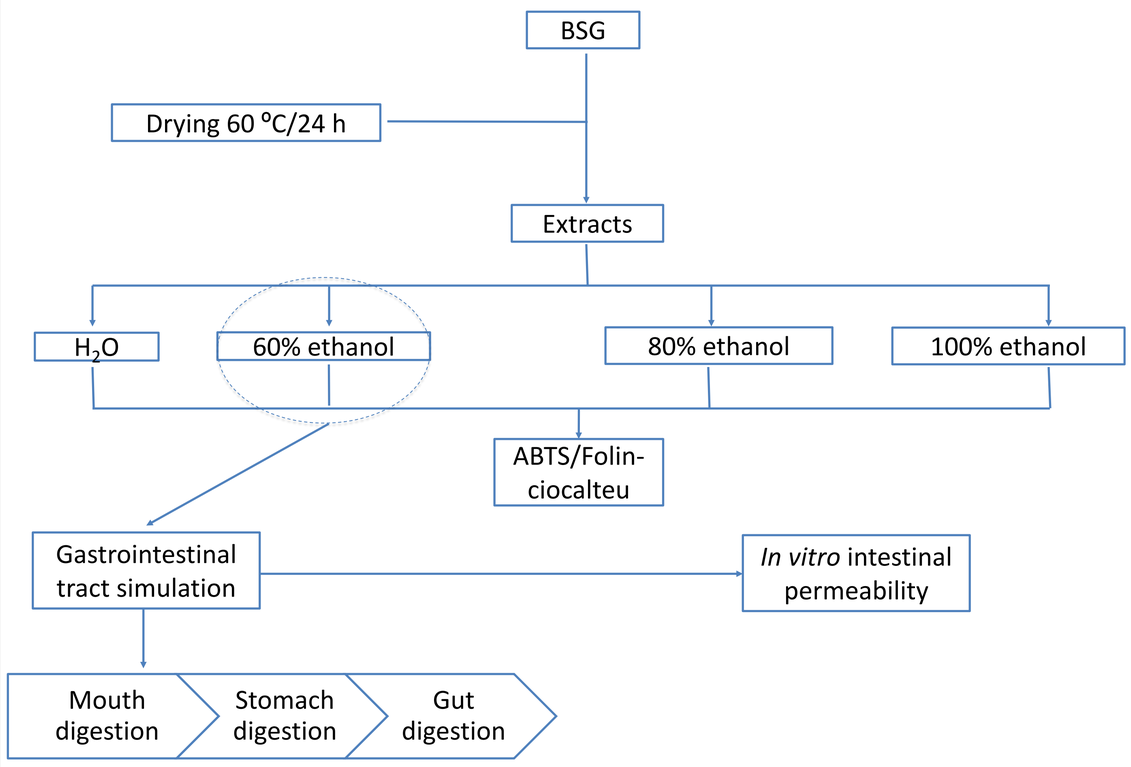
Introduction

Brewer's spent grain (BSG) is one of the most abundant by-product of the brewing industry. While currently used as animal feed, BSG has some components with nutritional and functional (e.g. dietary fiber, protein and phenolics) potential, which makes it an interesting source for added-value compounds/products to be incorporated into foodstuffs or cosmetic products.
Antioxidant compounds can help maintain the oxidative homeostasis and therefore they are thought to play an important role in the prevention of degenerative diseases. Moreover, from a technological standpoint they may aid preventing product oxidation and, consequently, extend the shelf life of products.
The aim of this study was to obtain bioactive extracts from BSG and understand the impact of gastrointestinal passage on their bioavailability to predict future applications.

Methods



Results

1) Extract characterization

The 60% ethanol extract showed the highest ABTS and Folin-ciocalteu results (768.38 ± 6.82 mg ascorbic acid/g BSG; 662.86 ± 9.64 mg gallic acid/g BSG, respectively),
So, the gastrointestinal tract simulation and in vitro intestinal permeability assay was conducted with this extract.

2) Gastrointestinal tract simulation

Before the gastrointestinal tract simulation the phenolic content was measured though HPLC-UV. The extract was composed by protocatechuic acid, 4-hydroxybenzoic acid, vanillin, catechin, p-coumaric, ferulic acid and syringic acid.
80 mg/ml of 60% extract were submitted to gastrointestinal simulation and after the most relevant compound present was syringic acid (330 µg/g).

Results

3) *In vitro* intestinal permeability of syringic acid

Permeability of syringic acid in the 60% ethanol fraction and in the control (syringic acid – 100 µg/ml) across Caco2/Ht29-MTX cell layer was determined along 120 min and results are outlined in **figure 1.**

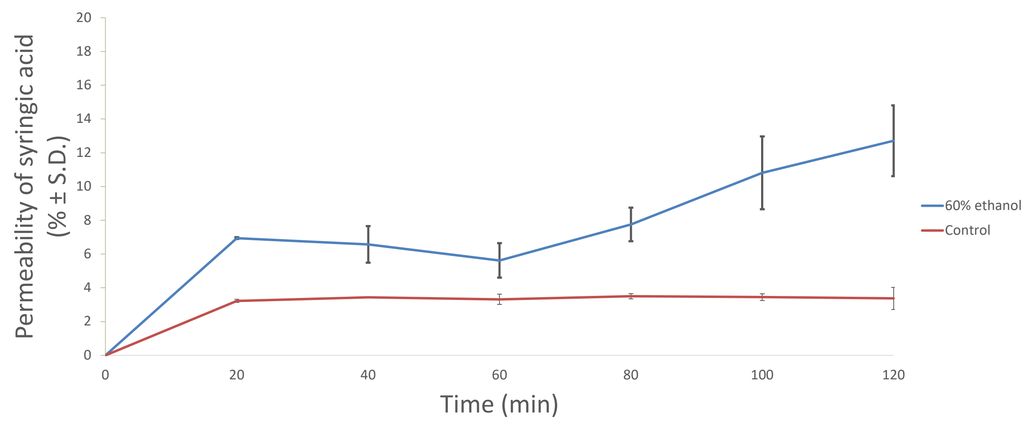


Figure 1 –Permeability of syringic acid through Caco2/HT29-MTX cell layer of 60% ethanol extraction and control (syringic acid solution 100 µg/ml)

It was possible to observe that the syringic acid, resulting from the simulated digestion, is more extensively permeated across Caco2/HT29-MTX cell layer when compared to the control.
Moreover, the apparent permeability coefficient of the syringic acid resulted from the simulated ($2.50x10^{-4}$ ± $1.17x10^{-4}$ cm/s) was significantly higher when compared to the control ($2.07x10^{-5}$ ± $5.94x10^{-6}$ cm/s).

Conclusion

The extraction method using 60% (v/v) ethanol as solvent was the fraction with the highest antioxidant capacity and content in phenolics.
The syringic acid obtained in the 60% ethanol extract is more bioavailable than the syringic acid present in the control.
In sum, hydroethanolic extracts obtained from BSG contain valuable polyphenols with high bioavailability that can demonstrate BSG as potential source of functional food ingredients.

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