Dairy products as alternatives to reduce glycemic index of wheat bread

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1. Introduction

Unhealthy dietary habits are characterized by excessive consumption of refined flours and sugars, i.e., foods full of empty calories, which correlate with the incidence of chronic metabolic diseases (CMD). As diabetes - type 2 is characterized by chronic hyperglycemia, research on innovative foods, with enhanced healthy properties, by reduced glycemic index (GI), is extremely timely.

Bread is a staple food widely appreciated and consumed in large quantities worldwide, with an important role in human diet. However, wheat bread elicits a high glycemic response, thereby increasing the risk of CMD. Foods can be distinguished into low GI (≤55), intermediate (55-69), and high GI (≥70).

Dairy products (DP) are commonly used in the baking industry due to their beneficial effect on technology aspects and positive impact on nutritional and functional profile. In addition, DP is reported as low GI, releasing glucose at a slower rate compared to high GI foods, these could be interesting alternatives to decrease starch hydrolysis rate on bakery goods and reduce the GI.

2. Main goals

Evaluate the impact of the yoghurt (Yg) and curd cheese (Cc) addition (6% up to 22% w/w) on pasting properties and *in vitro starch* digestibility;

Establish the possible relationship between the changes on starch behaviour with *in vitro* digestibility and evaluate the impact on glycemic index of the new breads;

Developed functional breads with positive impact on human health.

3. Experimental design

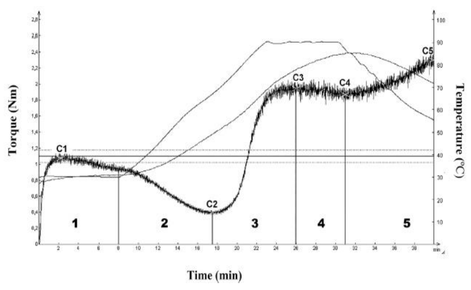
Effect of DP on starch rheology behaviour

1) Pasting properties of starch

Simulating mixing and baking process by mixing and heating-cooling cycles (Microdoughlab equipament - AACC 54-60.01)

Parameters evaluated:

- Dough developemnt (C1)
- Protein reduction (C2)
- Starch gelatinization (C3)
- Cooking stability (C4)
- Final viscosity (C5)



Typical heating –cooling curve ⇔ changes on wheat starch rheology behaviour

2) Bread development

3) In vitro starch digestibility and GI

(Goni, et al., 1997; Barine and Yorte, 2016

Determination of starch fractions:

- Rapidly digestible starch (RDS)
- Slowly digestible starch (SDS)
- Resistant starch (RS)

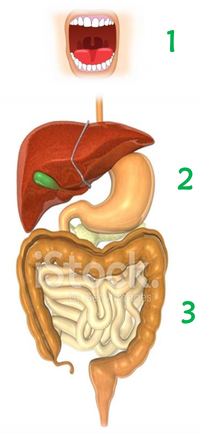
by

Simulation of digestion process:

- Chewing process (1)
- Gastric phase (2)
- Pancreatic phase (3)

to

Estimate the glycemic índex of the new breads

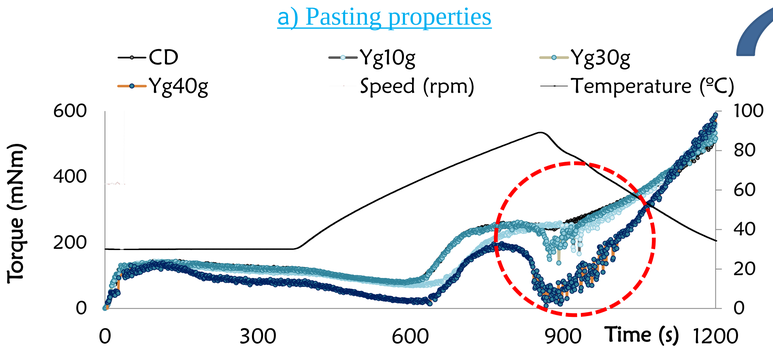


Effect of DP on starch digestibility and GI

4. Results and discussion

Impact of Yoghurt addition on:

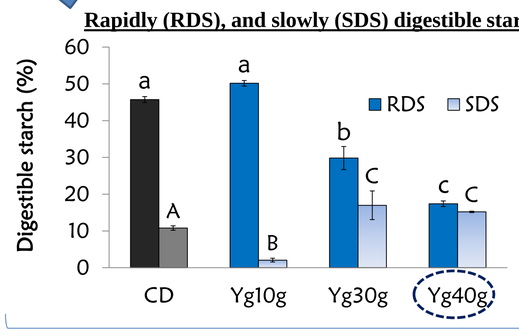
a) Pasting properties



- Caseins ⇔ strong interaction with starch molecules,
- Gel structuring ⇔ exopolysaccharides-amylose-casein interactions,
- Depletion flocculation mechanism (Nunes, et al., 2006).

Changes on starch → Reflected on

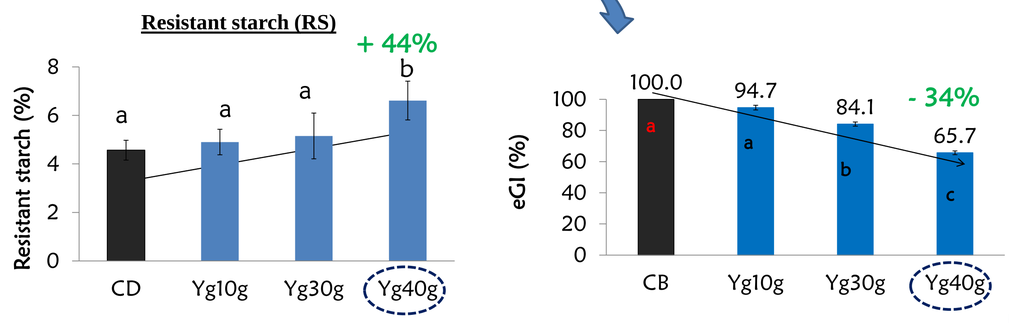
b) *in vitro* Starch hydrolysis



- Reduction of 62% in RDS
- Increase on 41% in SDS

Decrease of RDS and increase of RS → Reduced GI

c) Glycemic índex of the breads

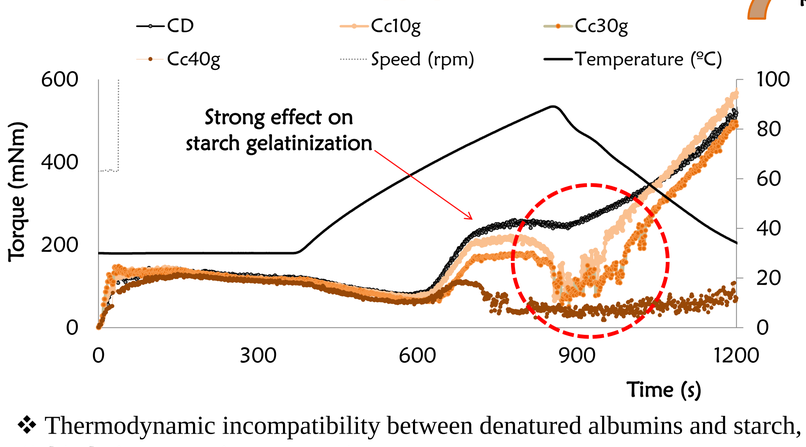


- Increase 44% of RS

Intermediate GI bread

Impact of Curd cheese addition on:

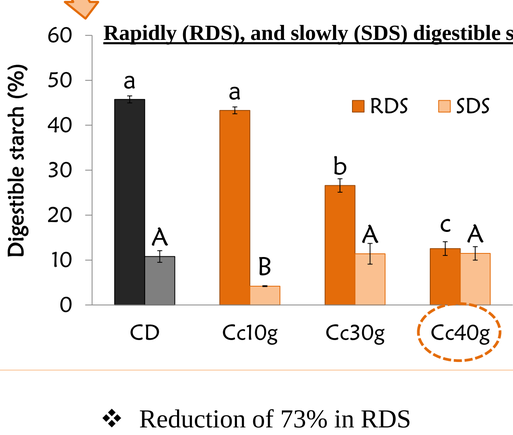
a) Pasting properties



- Thermodynamic incompatibility between denatured albumins and starch,
- ⇔ hindering a matrix structuration,
- Dilution effect of starch granules and water competition for Cc proteins.

Changes on starch → Reflected on

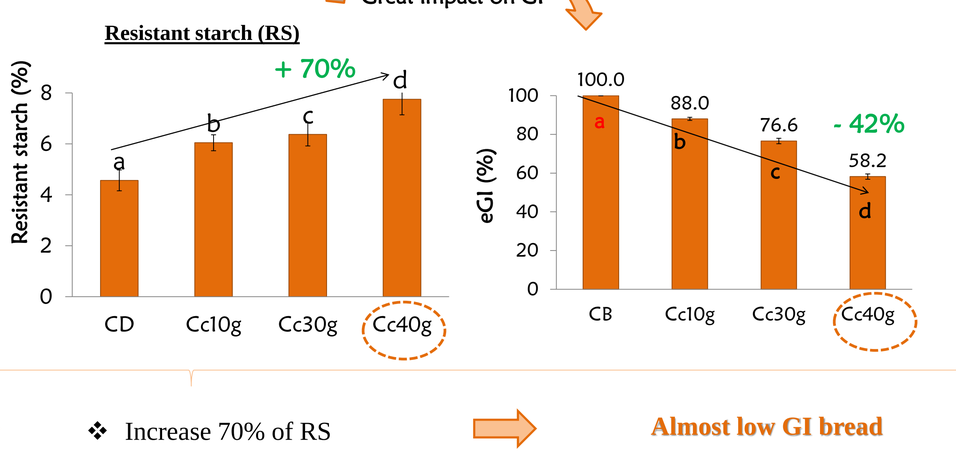
b) *in vitro* Starch hydrolysis



- Reduction of 73% in RDS
- Increase on 7% in SDS

Significant reduction on RDS and increased of the RS → Great impact on GI

c) Glycemic índex of breads



- Increase 70% of RS

Almost low GI bread

5. Conclusions

According to the results obtained, the yoghurt and curd cheese promoted different impacts on starch rheology behaviour that are clearly reflected on *in vitro* starch digestibility as well as on glycemic índex of the breads. For higher concentrations tested (40g), a significant reduction of 34% for Yg and 42% for Cc, resulting in breads with intermediate-low (55-69) glycemic index, compared to control bread (CB).

In conclusion, it can be stated that both dairy products studied are potential ingredients to reduce the glycemic index of the bakery products.

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