Combining fibres and proteins in a cereal product reduces appetite sensations with some effects on gastric emptying and gluco-insulinemic response

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Background and Objectives:
The decreasing effects of proteins and fibres on appetite sensations have been largely assessed in the literature (Slavin, 2005; Westerterp-Plantenga et al., 2009) but the association with decreased energy intake is not systematically found (Fischer et al., 2004; Vitagliano et al., 2010). In addition, few studies have focused on the effect of a combination of fibres and proteins on satiety in comparison to isocaloric control foods (Halford et al., 2008; Lluch et al., 2010; Keogh et al., 2011) and the results do not allow drawing clear conclusion of their combined effect on satiety and energy intake (Karthunen et al., 2010). The objective of this study was to evaluate the single and potential combined effects of proteins and fibres in biscuits as well as the underlying peripheral mechanisms behind the expected satiety effects.

Methods:

**Design PART A: 56 healthy women**

- **Weight of food → Energy intake (kJ)**
  - VAS → Appetite sensations
  - 4 separate randomized sessions
  - Each session: one type of biscuit

**Design PART B: 16 healthy women**

- Same criteria of age, BMI and TFEQ
  - **Gastric emptying:** 13C enrichment breath test
  - **Physiological markers:** insulin, GLP-1, glucagon, ghrelin, PYY, CCK
  - **Metabolite:** glucose

Results:

**Appetite and food intake**

- **Appetite sensations:**
  - HPHF reduced hunger, prospective consumption and desire to eat compared to C, HF and/or HP. Therefore HPHF reduced the average appetite score compared to HP with a tendency compared to C and HF.
  - **Food intake:** No effect is observed

**Effects of biscuits on gluco-insulinemic responses**

- **Insulinemia**
  - HPHF was lowered after HP and HPHF compared to C and HF.
  - Peak insulinemia 30 min after breakfast was lowered after HPHF and HP vs. C.
  - HP biscuit increases active GLP-1.
  - The glycemia level was lowered after HPHF and HP vs. C.

Conclusions: A combination of fibres and proteins transiently reduces appetite sensations but the effect might be too small to induce lower food intake. HPHF induces a slow down of gastric emptying and then a slowed gluco-insulinemic response. Similar physiological effects are observed after the fibre-enriched biscuit although no effect on appetite sensations. The protein-enriched biscuit shows no effect on appetite, a decreased glycemia, an increased insulin secretion and increased active GLP-1.

Our results are consistent with some in vitro mechanisms such as induced viscosity but no possible clear link between physiological markers and satiety can be made. The difference in palatability, both the nature and the energy level of the food carriers could have influenced the results.

Keywords: combination of fibres and proteins, satiety, physiological markers