

LENTIL-BASED MUFFIN *IN VITRO* DIGESTION: UNRAVELING NUTRITIONAL INSIGHTS

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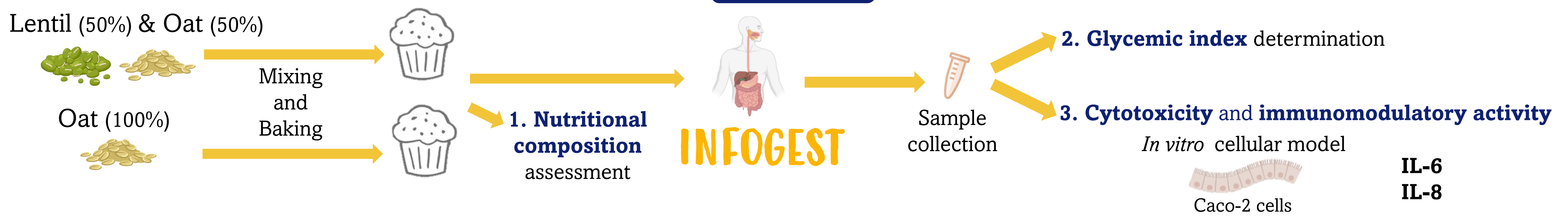
INTRODUCTION

- **Lentils** offer **essential nutrients** like protein, fiber, and flavonoids.
- With a **low glycemic index** that helps avoid peaks in blood glucose, there is recent epidemiological data suggesting **potential benefits against cardiovascular diseases and diabetes**. Yet, lentil consumption remains low.
- Understanding the gastrointestinal behavior of lentil-based alternatives is essential and can be achieved through ***in vitro* digestion models** such as INFOGEST, enabling insights into the glycemic index and immunomodulatory potential, vital for diabetes, cardiovascular diseases and obesity conditions.

OBJECTIVES

- Develop a **novel muffin recipe incorporating lentil flour** and compare it to a **conventional oatmeal muffin**.
- Evaluate the nutritional composition.
- Determine the glycemic index.
- Comprehend the immunomodulatory potential, within *in vitro* cellular models.

METHODS



RESULTS

1. NUTRITIONAL COMPOSITION

Health claims:

- SOURCE OF PROTEIN
- HIGH FIBRE CONTENT
- LOW SUGAR CONTENT

Oatmeal muffin Lentil/oatmeal muffin

Table 1 – Nutritional composition of 100 g of lentil/oatmeal and oatmeal muffins.

Nutritional composition	Lentil/oatmeal muffin	Oatmeal muffin
Energy (kcal)	231	275
Total fat (g)	5.1	6.4
Carbohydrates (g)	41.2	51.4
Protein (g)	8.1	5.5
Fibre (g)	5.8	5.0

2. GLYCEMIC INDEX

Oatmeal muffin Lentil/oatmeal muffin

70.28 ± 2.26 **63.88 ± 2.24**

Low (<50) Medium (51-69) High (>70)

3. CYTOTOXICITY AND IMMUNOMODULATORY ACTIVITY

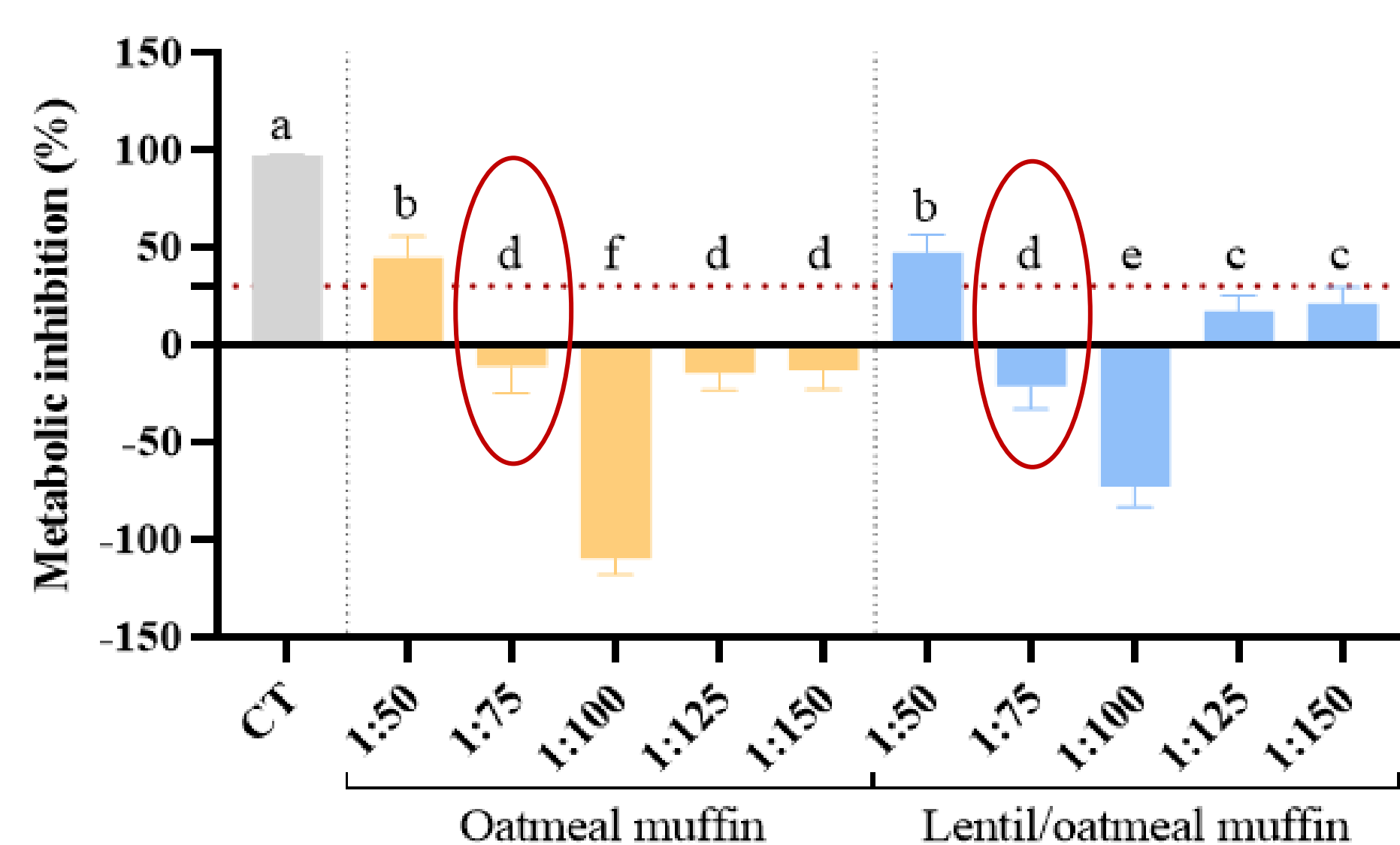


Figure 1- Post-digestion samples cytotoxicity towards Caco-2 cells at different dilutions. CT is the negative control (40% of DMSO). The dotted line represents 30% cytotoxicity limit (ISO 10993-5:2009). Different letters mean significant differences ($p < 0.05$).

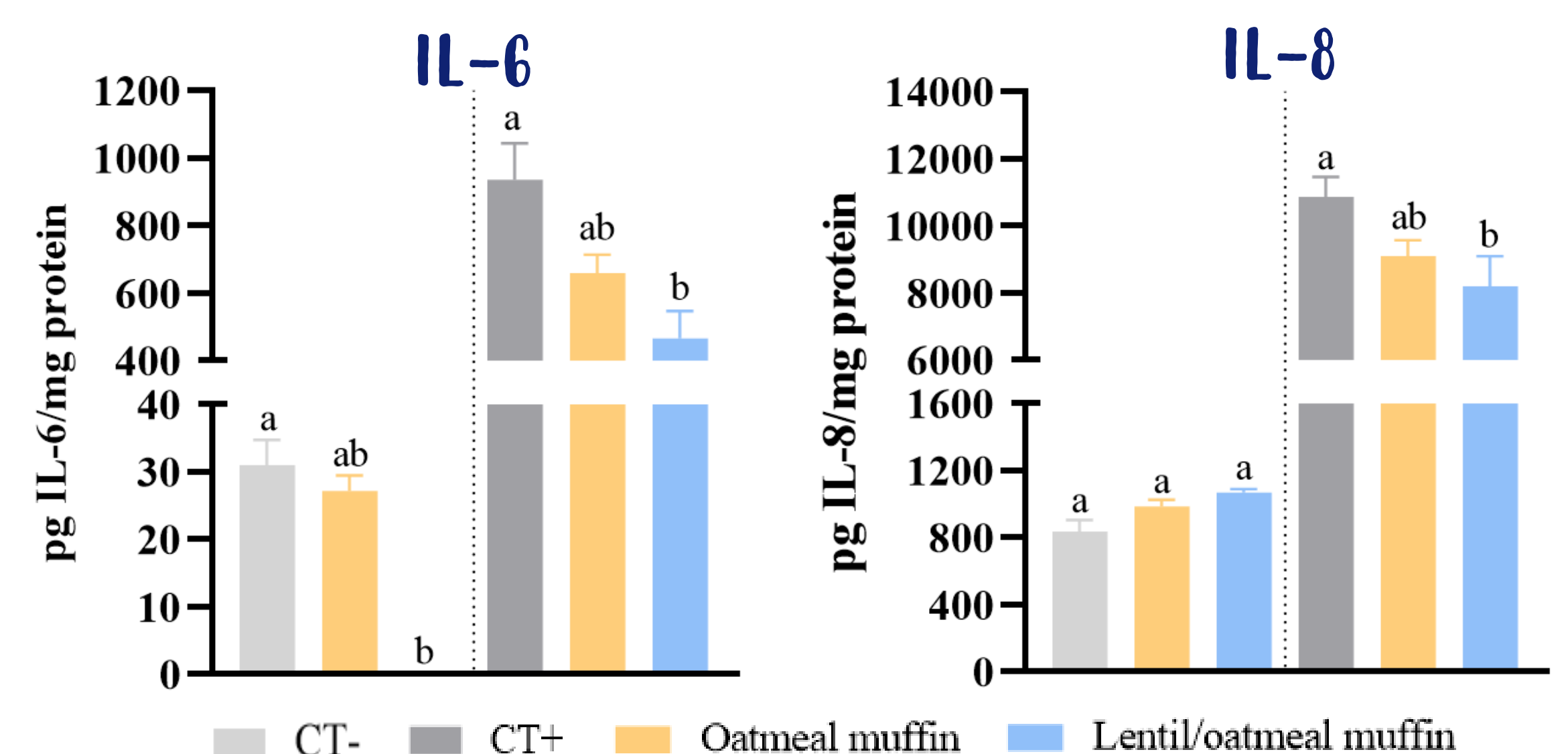


Figure 2- Modulation of inflammatory response in Caco-2 cells by post-digestion samples (1:75 dilutions). Left part corresponds to non-stimulated cell's response, and right to the inflammatory effect (using IL-1 β). Different letters mean significant differences within each stimulus treatment ($p < 0.05$).

CONCLUSIONS

- The lentil/oatmeal muffin **improved nutritional properties**, including a 25% reduction in fat, a 47% increase in protein, and a 16% rise in fibre, while it also exhibited a 9% **lower glycemic index**.
- **No deleterious effect in terms of metabolic inhibition** was observed in Caco-2 cells in post-digestion samples below 1:75 dilutions. Regarding the immunomodulatory results:
 - The **production of IL-6 significantly decreased** in the presence of lentil/oatmeal muffin pos-digestion sample, while no differences were observed in IL-8 secretion.
 - In cells stimulated with IL-1 β , the lentil/oatmeal muffin post-digestion sample showed relevant **anti-inflammatory effects**, as demonstrated by reductions in the selected cytokines' secretion.

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