AMINO ACID SCORING PATTERNS ALTER THE *IN VITRO* PROTEIN QUALITY OF PRE-TREATED CHICKPEA (*CICER ARIETINUM*) PRODUCTS

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INTRODUCTION

- The Protein Digestibility Corrected Amino Acid Score (PDCAAS) is required for communicating protein content claims in the US & Canada
- PDCAAS uses an older amino acid reference pattern (1991) and a rat bioassay (true faecal protein digestibility), whereas the Digestible Indispensable Amino Acid Score (DIAAS) uses an updated reference pattern (2013) and ileal amino acid digestibility
- *In vitro* offers an alternative protein digestibility approach which is economical, rapid and ethical
- Pulse (legume) inclusion, such as chickpea, to grain-based ready-to-eat foods can improve protein quality
- Anti-nutritional factors in pulses can decrease protein digestibility and quality
- Thermal (roasting & micronization) and biological (germination) treatments *can* decrease these factors and improve protein digestibility and quality

OBJECTIVES

Determine the protein quality of chickpea-based bread, pasta and extrudate made from untreated, roasted, germinated and micronized chickpea

1. Using *in vitro* protein digestibility with current (1991) and new (2013) amino acid scoring patterns for school-aged children
2. Impact of ANFs—phytate, polyphenols and trypsin inhibitors—on protein quality

METHODS

- Samples: Pre-treated chickpea, their products, and controls (Table 1) were provided by Cereals Canada (1000-303 Main Street Winnipeg, MB, Canada)
- Preparation: Pasta was cooked to optimally (Cereals Canada), covered and allowed to come to room temperature, frozen and freeze dried. Half loaves of baked breads were frozen and freeze dried. All products were milled to a flour (≤ 0.75mm) and kept in a freezer prior to analysis
- *In vitro* Protein Digestion: static enzymatic pH Drop (1); pH balanced multi-digestive enzyme solution added to pH balanced protein solution suspended in deionized water. Change in pH recorded over 10 minutes at 37°C
- Amino acids: Standardized protocols through AOAC (982.30 & 994.12) and ISO (13904) for regular, oxidized and tryptophan respectively
- Antinutritional Factors: Spectrophotometric analysis of phytate (2), total polyphenols (3) and trypsin inhibitor activity (4)
- Statistics: Products produced in duplicate and analyzed in duplicate by two-way ANOVA (GraphPad Prism V. 9.5.1). Significant differences determined if $P < 0.05$

Table 1. Summary of chickpea treatments and ratio of chickpea flour inclusion in each product

	Chickpea Treatment				Control
	Untreated	Roasted	Germinated	Micronized	
Bread	20:80	20:80	20:80	20:80	0:100 Wheat
Pasta	50:50	50:50	50:50	50:50	0:100 Semolina
Extrudate	60:40	60:40	60:40	60:40	0:100 Corn

RESULTS

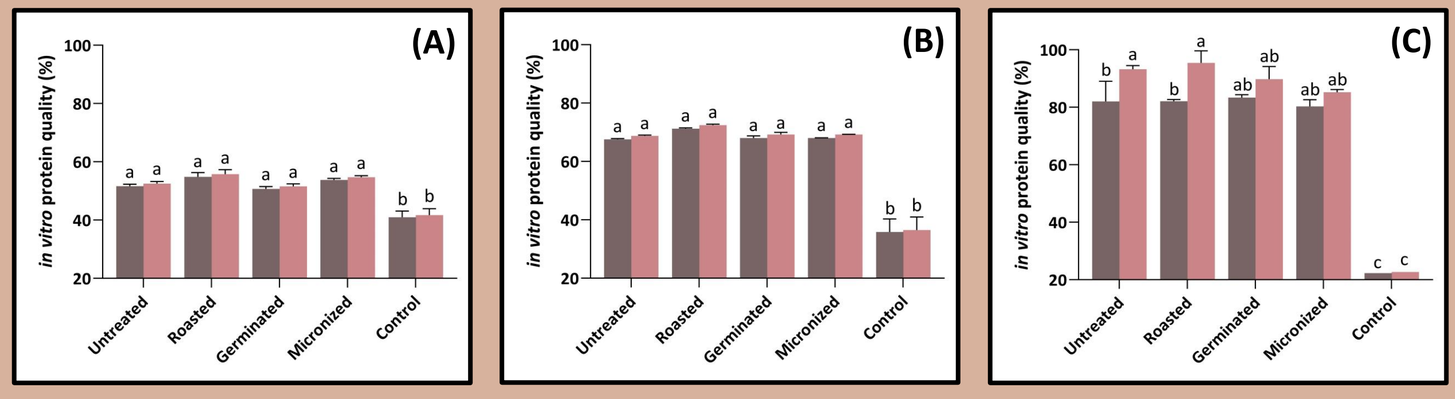

Figure 1. *In vitro* PDCAAS (Brown) and DIAAS (Rose) for pre-treated chickpea bread (A), pasta (B) and extrudate (C). Significant difference indicated by difference in letter within same product class ($P < 0.05$)

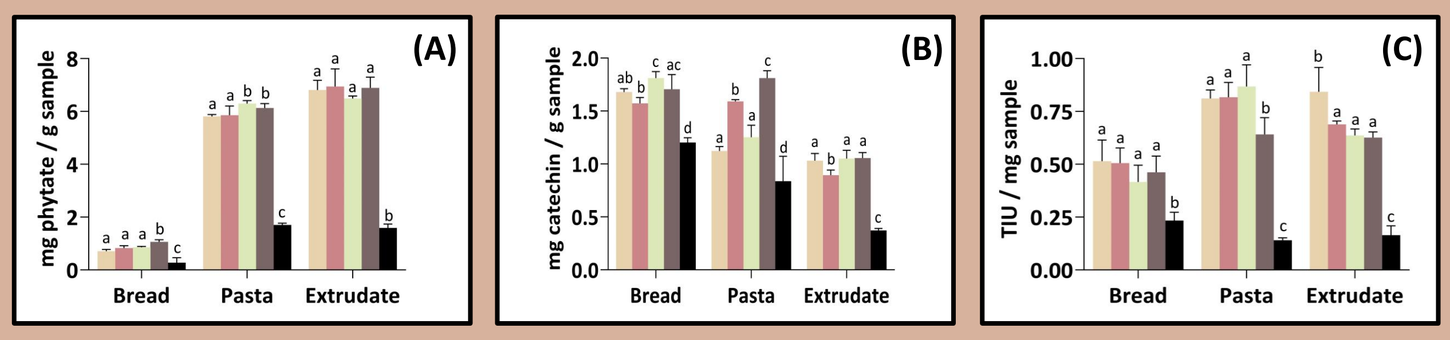

Figure 2. Antinutritional factors, phytate (A), polyphenols (B) and trypsin inhibitors (C) in chickpea bread, pasta and extrudate according to untreated (sand), roasted (rose), germinated (lime), and micronization (brown) chickpea pre-treatments and control (black). Significant difference indicated by difference in letter within same product class ($P < 0.05$)

KEY MESSAGE

Proposed reference patterns lead to improved protein quality of chickpea-based extrudates

DISCUSSION

- Pre-treatment of chickpea did not alter ($P < 0.05$) protein quality in any product
- Increased content of antinutritional factors decrease protein digestibility ($P < 0.05$) in bread and pasta but not extrudate, which did not translate to decreased protein quality
- Reference patterns proposed for DIAAS increases protein quality scores, but only significantly ($P < 0.05$) in extruded products which are untreated or roasted

IMPACT

- Choice of reference patterns can influence which proteins achieve content claims, particularly for plant-based proteins

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