



**HAL**  
open science

## Protein enriched pasta: impact of protein network structure on the in-vitro protein digestibility

Karima Laleg, Cecile Barron, Denis Cassan, Stephane Walrand, Valerie Micard

### ► To cite this version:

Karima Laleg, Cecile Barron, Denis Cassan, Stephane Walrand, Valerie Micard. Protein enriched pasta: impact of protein network structure on the in-vitro protein digestibility. 1. Congress on Food Structure Design, Innovation in food structure relationships, Oct 2014, Porto, Portugal. Universidade do Minho, 2014. hal-01601495

**HAL Id: hal-01601495**

**<https://hal.science/hal-01601495>**

Submitted on 3 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License

Ref: 3284

## Protein enriched pasta: impact of protein network structure on the *in-vitro* protein digestibility

**Laleg, Karima<sup>1</sup>; Barron, Cécile<sup>2</sup>; Cassan, Denis<sup>2</sup>; Walrand, Stéphane<sup>3</sup>; Micard, Valérie<sup>1</sup>**

<sup>1</sup>SupAgro - INRA - IATE – Montpellier, France;

<sup>2</sup>INRA – IATE, France;

<sup>3</sup>INRA, France

E-mail: micard@supagro.inra.fr

**Keywords:** Pasta structure, amino acid profile, egg white, faba bean, gluten, protein network, rheology, microstructure, SE-HPLC, FTIR, *in vitro* protein digestibility

### Abstract

Pasta, a traditional and highly popular cereal-based food, is produced with durum wheat semolina. It contains 13% (db) of proteins, but is deficient in some amino acids.

Protein enriched (17%) pasta with better amino acid profile were produced using 35% faba bean flour or 5% egg white powder. The impact of pasta enrichment on the structuration of their protein network was studied from the macro to the supramolecular scales against two pasta controls: classical 100% durum wheat pasta (13% protein) and wheat gluten enriched pasta (17% protein). Pasta is traditionally obtained after kneading, extruding and drying steps. Different temperature barrels can be used in industry. The effect of such drying temperature on the protein network structuration was studied using low (55 °C) or very high temperature (90 °C) on all enriched and control pasta. Changes in dried and cooked pasta structure were monitored by rheological, microscopic, SE-HPLC and FTIR methods and linked to *in vitro* protein digestibility of cooked pasta

Different structural changes were detected in pasta especially at the macroscopic and supramolecular scales, related to the nature of the protein source used for the enrichment. The gluten and egg white enriched pasta presented a strengthened structure due to their high covalently linked protein network, unlike faba bean enriched pasta which presented a weakly bounded protein network. This variability in pasta matrix structure may impact the protein digestibility of cooked pasta. Protein conformation ( $\beta$ -sheet and  $\beta$ -turns) was highly related to the amino acid content of the raw mater used for enrichment. Rising temperature induced a fortification of pasta structure, notably for gluten and egg pasta, by increasing the level of covalently bounded proteins and induced a higher  $\beta$ -sheet proportion, while decreasing  $\alpha$ -helix structures in dried pasta. Despite these structural high temperature-induced changes, no effect on protein digestion after cooking pasta was observed.

**Acknowledgements:** K. Laleg funding was provided by the « Région Auvergne ». This study was undertaken with the financial support of the « Institut Carnot Qualiment » as part of the Vegage project, entitled « Rate of digestion and nutritional value of vegetable protein sources on nitrogen retention and protein metabolism during aging ». Gemef and Syral industries are thanked for kindly providing faba bean flour and wheat gluten. The authors thank J. Bonicel (UMR IATE-Montpellier) for skilful technical assistance.