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Influence of Technological Modifications of the Protein Network from Pasta on *in vitro* Starch Degradation

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ABSTRACT

The pasta protein network limits starch hydrolysis rate *in vivo* leading to low post-prandial glycemia. To better understand the mechanisms involved, various pasta products were processed to obtain protein network structures differing from that in reference pasta extruded at 40 °C and dried 17 h at 55 °C. After cooking, pasta strands were submitted to *in vitro alpha*-amylolysis. Compared to reference pasta, higher extrusion temperature (70 °C), high-temperature drying treatment (2 h at 90 °C) or autoclaving (115 °C for 15 or 40 min) had no marked effect on the rate of dextrin release from pasta particles. Protein enrichment at a 20%-level and flour fractionation-reconstruction with removal of insoluble fibre before pasta extrusion significantly ($p<0{\cdot}05$) delayed (≥ 1 h) the rate of dextrin release (-14% at 8 h). Confocal laser scanning microscopy allowed the three-dimensional structure of the protein network from protein-enriched pasta to be observed, and suggested that increased starch encapsulation may explain the reduced accessibility of starch to *alpha*-amylases. A stronger cohesiveness between starch and protein, due to insoluble fibre removal, was probably responsible for the decrease of starch accessibility to *alpha*-amylase in fractionated-reconstructed flour pasta. Modified geometrical characteristics (e.g., tortuosity) of the protein network were not correlated with starch degradation rates.

Keywords: pasta, protein networks, *alpha*-amylolysis.

ABBREVIATIONS USED: CLSM = confocal laser scanning microscopy; HSA = human salivary *alpha*-amylase; SI = swelling index; DSC = differential scanning calorimetry; F_{max} = maximum shear strength; RS = Resistant starch; SDS = Slowly-Digestible Starch; SP_{ref} = reference spaghetti; $SP_{40/HT}$ = spaghetti extruded as reference spaghetti extruded at 40 °C and dried at high temperature (2 h at 90 °C); $SP_{70/LT}$ = spaghetti extruded at 70 °C and dried as reference spaghetti at

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