Changes in pasta protein networks induced by drying and their relationship to protein digestibility and allergenicity
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Pasta is a popular food which possesses interesting nutritional quality but may trigger allergic reaction in sensitized people. Many questions remain open for research area, including the relationship between pasta processing, pasta structure and resulting nutritional properties. The purpose of this study was to characterise the structure of pasta dried at different conditions and to relate it to the in vitro digestibility and allergenicity of proteins. Four drying profiles were studied: Low Temperature 55°C (LT), High Temperature 70°C (HT), Very High Temperature 90°C applied either from the beginning of the cycle, when the moisture content of spaghetti was high (20%) (VHT) or at the end of the drying cycle, when the moisture content of pasta was low (12%) (VHT_LM).

**Proteins**: Size Exclusion HPLC (SE-HPLC) after protein extraction with SDS (detergent), then with DTE (reducer) in dried and cooked pasta (Fig.1).

**Microstructure**: Confocal Laser Scanning Microscope of cross sectioned cooked pasta after protein staining with rhodamine acid (Fig. 2).

**Protein digestibility**: In vitro digestion of cooked pasta composed of a buccal phase (α-amylase, pH7), a gastric phase (pepsin, PH2) and an intestinal phase (pancreatin, pH7). Protein hydrolysis was evaluated by measuring the increase in free amine groups in protein extracts (Fig. 3).

**Protein allergenicity**: Juices from in vitro bucco-gastric or pancreatic digestes were used to inhibit recognition of wheat proteins by IgE from a pool of allergic patients (table 1).

**Methods**

**Proteins**

<table>
<thead>
<tr>
<th>Digestion juice from the end of</th>
<th>LT</th>
<th>HT</th>
<th>VHT</th>
<th>VHT_LM</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-gliadin gastric phase</td>
<td>66</td>
<td>64</td>
<td>44</td>
<td>40</td>
</tr>
<tr>
<td>α-gliadin intestinal phase</td>
<td>16</td>
<td>14</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>α-gliadin gastric phase</td>
<td>88</td>
<td>79</td>
<td>80</td>
<td>81</td>
</tr>
<tr>
<td>α-gliadin intestinal phase</td>
<td>78</td>
<td>75</td>
<td>72</td>
<td>77</td>
</tr>
<tr>
<td>Low MW glutenins gastric phase</td>
<td>93</td>
<td>91</td>
<td>90</td>
<td>87</td>
</tr>
<tr>
<td>Low MW glutenins intestinal phase</td>
<td>51</td>
<td>66</td>
<td>46</td>
<td>63</td>
</tr>
<tr>
<td>Albumin/glutelin fraction</td>
<td>28</td>
<td>26</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Protein Solubility**

- **Dried pasta are different but cooked pasta are similar**
  - Increasing drying temperatures led to increased protein aggregation (lower protein solubility in SDS).
  - Aggregation probably occurred through disulphide bonds (increased DTE-soluble fraction) and through other covalent bonds (presence of insoluble proteins) with VHT drying profiles.

**Allergenicity of Digests from Cooked Pasta**

- **Bucco-gastric phase**: no significant effect of the drying profile (data not shown)
- **Intestinal phase**: VHT LM drying profile significantly decreased protein digestibility (by 10%) compared to other drying processes.

**Acknowledgement**

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d3 remplace 20 ppm
 gluten par 20 ppm