Influence of protein quality on baking performance of wheat bread

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Koprivnica
General Trends in Food and Nutrition

1. The biggest trend
   - Naturally Functional

2. Dairy's rebirth as a natural whole food
   - Dairy 2.0

3. Beyond the tipping point
   - Protein

4. An unstoppable global trend
   - Energy

5. Consumer thinking redefines a market
   - Weight Wellness

6. The snackification of everything
   - Snacking

7. A new frontier
   - Slow Energy

8. The demonisation of sugar
   - Sugar

9. A very smart strategy
   - Permission to Indulge

10. The consumer-led trend
    - Free-from

11. Opportunity for science and smaller companies
    - FortifiT

12. Communication: indulgence & naturalness key to kids success
    - Kids' Nutrition

The impact of food trends on bakery sales

A. Fremaux 2009: The future of European bakery - the shape of the industry through 2013
Definition of Bread Types

- **Fresh bread**
- **Industrial prepacked long-life bread**
- **Industrial prepacked part-baked bread**
  - **Ambient**
  - **Frozen**
- **“Soft” bread**
- **“Crisp” bread**

**CONSUMER PRODUCTS**

**“Artisanal”**
- Made from scratch on the premises

**“Industrial”**
- Bought fresh from industrial bakers

**PRODUCTION METHOD**

**Bake-off**

BAKING+BISCUIT ISSUE 06 2008
Market and Development of sold bakery products

- Share of industrial production is expected to reach 69% by 2016
- Increasing Bake-off share
  - More and more frozen doughs
Quality of different Bread Types

D. Curic et al. 2008, Food Research International 41: 714–719
Gluten Composition

Wieser 2007, Food Microbiology 24: 115–119
Dough Formation

Glutenin

Gliadin

Water

Gluten
Gluten Structure and Network

Wieser 2007, Food Microbiology 24: 115–119
## Influence of HMWs on Dough and Bread Quality

<table>
<thead>
<tr>
<th>Assortment 1</th>
<th>Assortment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Properties [18]</strong></td>
<td><strong>HMW</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>Dough</td>
<td></td>
</tr>
<tr>
<td>$R_{\text{max}}$</td>
<td>0.85</td>
</tr>
<tr>
<td>Ext</td>
<td>-0.16</td>
</tr>
<tr>
<td>DDT</td>
<td>0.71</td>
</tr>
<tr>
<td>Gluten</td>
<td></td>
</tr>
<tr>
<td>$R_{\text{max}}$</td>
<td>0.90</td>
</tr>
<tr>
<td>Ext</td>
<td>-0.62</td>
</tr>
<tr>
<td>GI</td>
<td>0.82</td>
</tr>
<tr>
<td>Bread</td>
<td></td>
</tr>
<tr>
<td>MRMT</td>
<td>0.53</td>
</tr>
<tr>
<td>MBT</td>
<td>0.82</td>
</tr>
</tbody>
</table>

SED: Zeleny sedimentation value  
MHE: maximum height of extensogram  
BAQ: bread volume score  
MBT: volume of micro-baking-test  
EXT: Extensibility  
DDT: dough development time  
EXA: extension area of extensogram  
RMT: volume of rapid-mix-test  
Rmax: maximum resistance to extension  
GI: gluten index

Influence of freezing of Dough and Bread Quality

- Gluten weakening
- Decreased Yeast Activity
- Structural Damage by formation of ice-crystals
  - Reduced textural and sensory Quality of Bake off Products

Sallas-Mellado and Chang 2003, Brazilian Archives of Biology and Technology 46 (3): 461-468
Changes in Gluten Structure due to Freezing

Meziani et al. 2012, LWT - Food Science and Technology 46:118-126
Changes in Gluten Structure due to Freezing

**FIG. 1.** CHANGES IN THE PROPORTION OF INSOLUBLE POLYMERIC PROTEIN (IPP) IN THE DOUGH AT DIFFERENT FREEZING RATES AND STORAGE TIMES

Influence of flour characteristics

### Characteristics of Flour Samples

<table>
<thead>
<tr>
<th>Quality Tests</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein content, %</td>
<td>14.4</td>
<td>13.9</td>
<td>13.7</td>
<td>13.7</td>
</tr>
<tr>
<td>Ash content, %</td>
<td>0.52</td>
<td>0.54</td>
<td>0.58</td>
<td>0.60</td>
</tr>
<tr>
<td>Starch damage (Farrand unit)</td>
<td>21</td>
<td>23</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Falling number value</td>
<td>538</td>
<td>566</td>
<td>337</td>
<td>500</td>
</tr>
<tr>
<td>Farinograph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorption, %</td>
<td>65.1</td>
<td>63.5</td>
<td>58.6</td>
<td>58.9</td>
</tr>
<tr>
<td>Dough development time, min</td>
<td>7.0</td>
<td>6.0</td>
<td>5.5</td>
<td>30.5</td>
</tr>
<tr>
<td>Gassing power, $^{b,c}$ mm Hg</td>
<td>459 ± 5</td>
<td>461 ± 8</td>
<td>519 ± 11</td>
<td>477 ± 5</td>
</tr>
<tr>
<td>Standard proofing height, $^{b,d}$ cm</td>
<td>10.0 ± 0</td>
<td>10.0 ± 15</td>
<td>10.1 ± 0</td>
<td>9.8 ± 0.1</td>
</tr>
<tr>
<td>Extensigraph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum resistance, $^{b,d}$ BU</td>
<td>627 ± 6</td>
<td>623 ± 15</td>
<td>680 ± 10</td>
<td>1,273 ± 21</td>
</tr>
<tr>
<td>Extensibility, $^{b,d}$ mm</td>
<td>121 ± 3</td>
<td>120 ± 2</td>
<td>137 ± 2</td>
<td>102 ± 3</td>
</tr>
<tr>
<td>Loaf volume, $^{b,d}$ cm$^3$</td>
<td>792 ± 8</td>
<td>780 ± 5</td>
<td>838 ± 5</td>
<td>863 ± 8</td>
</tr>
</tbody>
</table>

- Similar protein content
- Big differences in Extensograph values
  - Strong gluten (high resistance) lowest loss in volume after frozen storage
  - Protein Quality more important than quantity

INOUE and BUSHEK 1992, Cereal Chem. 69:423-428
Summary

• Convenience Trend leads to increase of Bake off Products
  ➢ Demand to improve Quality
• Gluten depolymerisation
  ➢ more viscous and less tensile strength
• Decreased Yeast Activity less influence than gluten network weakening on Frozen Dough Quality
  ➢ Further research about protein quality needed
  ➢ Demand for flours and wheat varieties with high gluten strength
Pilot plant of the Institute of Food Technology

THANK YOU for your attention!