Dr. Daniel Rico
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Agrotechnological Institute of Castilla y León-Instituto Tecnológico Agrario de Castilla y León (ITACyL)
THERE ARE NEW CHALLENGES
AGRIFOOD INDUSTRY
Recent study* with 30,000 consumers from 63 countries showed:

Consumers try to eat healthier food

*Nielsen Company 2015
More valuable characteristics for consumers

- Contains fruits and vegetables: 62%
- High content in protein: 61%
- High content in fibre: 57%
- Recommended portion: 57%
- Whole grain: 57%
### Classifications of Food for Consumers

<table>
<thead>
<tr>
<th>Healthy</th>
<th>Semi-Healthy</th>
<th>Indulgent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Bread</td>
<td>Carbonated soft drinks</td>
</tr>
<tr>
<td>Dairy-based shakes</td>
<td>Cheese</td>
<td>Chips</td>
</tr>
<tr>
<td>Fruit</td>
<td>Cereal</td>
<td>Chocolate</td>
</tr>
<tr>
<td>Sports drinks</td>
<td>Granola bars</td>
<td>Cookies/Biscuits</td>
</tr>
<tr>
<td>Tea</td>
<td>Juice</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>Popcorn</td>
<td></td>
</tr>
<tr>
<td>Yogurt</td>
<td>Pretzels</td>
<td></td>
</tr>
</tbody>
</table>
Germination as novel strategy to produce bioactive barley flour

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Merlin and Volga varieties (2017/2018)

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>10.84 %</td>
</tr>
<tr>
<td>Fat</td>
<td>2.84 %</td>
</tr>
<tr>
<td>Protein</td>
<td>14.25 %</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>70.21 %</td>
</tr>
<tr>
<td>(Fibre)</td>
<td>(18.9 %)</td>
</tr>
<tr>
<td>Ash</td>
<td>1.865 %</td>
</tr>
</tbody>
</table>
Temperature (12-20 °C)

Time (1-9 days)
• PROXIMAL
  • PROTEIN
  • FAT
  • CARBOHYDRATES
  • ASH
  • MOISTURE
  • FIBRE
• NUTRITIONAL
  • FATTY ACIDS
  • VITAMIN C
  • VITAMIN E
  • VITAMIN B1/B2
• QUALITY
  • STARCH
  • LIPID OXIDATION
• ORGANOLEPTIC
  • SENSORY
  • COLOUR
• BIOACTIVE
  • BETAGLUCANS
  • GABA
  • ANTIOXIDANT CAPACITY
  • GLYCEMIC INDEX

• QUALITY MARKERS
• SENSORY MARKERS
• BIOACTIVE MARKERS
QUALITY-NUTRITIONAL
Superficie de Respuesta Estimada

TEMPERATURA

TIEMPO

MOISTURE (%)

(before germination)
(before germination)
BIOACTIVITY
DPPH-QUENCHER (µmol TE/100g)

DPPH• (517nm)
(1,1-diphenyl-2-pierylhydrazyl radical)

DPPHH
(1,1-diphenyl-2-pierylhydrozine)
OPTIMAL CONDITIONS
### ADVANTAGES

- Germination increased protein content and reduced fat content
- Increased Vitamin C, E and B2
- Improved preference for aroma, color and texture
- And increased antioxidant activity, extractable polyphenols and GABA

### DISADVANTAGES

- Germination increased oxidation in barley
- Increased glycemic index

### BALANCED OPTIMAL CONDITIONS FOR BARLEY GERMINATION:

- 16 º C for 3,5 days