African food tradition revisited by research

COORDINATOR
CIRAD - France
France (Actia, Adiv, CVG, Inra, Racines)
Italy (Spes)
Portugal (ESB)
UK (NRI)

EUROPE
Benin (UAC)
Cameroon (Ensai)
Egypt (FAAU, NRC)
Ghana (FRI)
Madagascar (UT)
Senegal (Ucad et Aafex)

AFRICA
South Africa (CSIR)
Gowé: from the traditional know-how to an innovating technology for Europeans and Africans markets

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\textsuperscript{a}: UAC/FSA, Benin \hspace{1cm} \textsuperscript{b}: CIRAD, UMR QualiSud, France
• Cereals main sources of macro and micro nutrients (Asiedu et al. 1992)

• Investigation of many African malted and/or fermented cereal products (Hounhouigan 1994, Mugula et al. 2003b, Lei and Jakobsen 2004)

• Investigation of Gowé, sorghum-based food widely consumed in Benin (Michodjehoun-Mestres et al. 2005, Vieira-Dalodé et al., 2007, Adinsi et al., 2014)
What is gowe??

- Sweetish paste of malted, fermented and cooked sorghum and/or maize flour wrapped in leaves (*Thalia welwichii* or *Tecktona grandis*)

- Shelf-life: 1-3 days

- Consumed in its pure state but preferentially as a beverage after homogenizing with water, sugar, milk and ice

- Processing exclusively artisanal
Sorghum and/or maize grains

Grinding

Sorghum and/or maize flour

Cooking

Porridge

Malting and grinding

Malted sorghum or maize flour

Saccharification

Fermentation

Cooking

Cooked Gowé (leaves)

Mixing

Ready to drink Gowé

Water, ice, sugar

TRADITIONAL Processes
Four (4) PROCESSES – Sorghum or/and maize

Gowé from non-malted and malted grains

Five types Three (3) Processes
(Malting, Saccharification or not, fermentation, cooking)

Gowé from non-malted grains

three types One (1) Process
(Fermentation, cooking)
Consumer acceptance et sensory analysis: choice for re-engineering

Cluster analysis, sensory and acceptability scores of the different types of Gowe

<table>
<thead>
<tr>
<th>Cluster</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MFp</td>
<td>SSaFs</td>
<td>SSaFp</td>
<td>XFp</td>
</tr>
<tr>
<td></td>
<td>MFs</td>
<td>SSaSFs</td>
<td>SSaSFp</td>
<td>SFp</td>
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<tr>
<td></td>
<td></td>
<td>SFs</td>
<td></td>
<td>XFs</td>
</tr>
</tbody>
</table>

Selected sensory attributes

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown color</td>
<td>13a</td>
<td>58bc</td>
<td>75c</td>
<td>43b</td>
</tr>
<tr>
<td>Cereal odor</td>
<td>48a</td>
<td>39b</td>
<td>41b</td>
<td>39b</td>
</tr>
<tr>
<td>Fermented odor</td>
<td>36ab</td>
<td>23ac</td>
<td>18c</td>
<td>49b</td>
</tr>
<tr>
<td>Sweet taste</td>
<td>50a</td>
<td>49a</td>
<td>6b</td>
<td>27c</td>
</tr>
<tr>
<td>Acidic taste</td>
<td>40ab</td>
<td>21a</td>
<td>18a</td>
<td>59b</td>
</tr>
<tr>
<td>Cereal taste</td>
<td>46a</td>
<td>39b</td>
<td>38b</td>
<td>40b</td>
</tr>
</tbody>
</table>

Mean overall acceptability scores

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>5.8b</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>6.6c</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>3.8a</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>6.3bc</td>
<td>1.6</td>
</tr>
</tbody>
</table>
SSaSF process

Sorghum grain
- Grinding
- Malting and grinding

Sorghum flour
- Cooking
- Porridge

Malted sorghum flour
- Saccharification
- Fermentation
- Cooking
- Cooked Gowé

Water, ice, sugar
- Mixing
- Ready to drink Gowé

Taste, texture
Moulds

Taste, aroma
Temperature

Taste, aroma
Spontaneous

Taste, aroma
Shelf-life
Sorghum process optimisation

Sorghum → Cleaning

- Washing - water
- Drying 45°C C/2h
- Milling

Sorghum flour

75% → Washing - NaCl

25% → Egouttage

- Soaking (30°C C-15h)
- Germination (30°C C)
- Drying (45°C)
- Milling

Malted sorghum flour

- Kneading (with water~1:1)
- Saccharification (65°C C)

Saccharified paste

- Fermentation (with starters)
- Drying (70°C C)

Water
Final product: gowé flour

- Gowé flour in carton package
- Shelf-life: 180 days
- Gowé flour easily reconstituted in vegetal yoghurt
- Dilution, cooking, cooling and addition of sugar, milk and ice
<table>
<thead>
<tr>
<th>Quality parameters</th>
<th>Traditional process</th>
<th>Optimized process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moulds (malt) (log CFU/g)</td>
<td>5.7</td>
<td>4.1</td>
</tr>
<tr>
<td>$\alpha$- amylase activity (malt) (CU/g)</td>
<td>14.8</td>
<td>47</td>
</tr>
<tr>
<td>Malting duration (days)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Processing duration (days)</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>pH</td>
<td>4.0</td>
<td>3.9</td>
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<tr>
<td>Moisture content (%) wb</td>
<td>76.5</td>
<td>12</td>
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<tr>
<td>Maltose + glucose (%)</td>
<td>4.7</td>
<td>23.5</td>
</tr>
<tr>
<td>Sucrose (%)</td>
<td>7.1</td>
<td>0</td>
</tr>
<tr>
<td>Lactic acid (%)</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Lactic acid bacteria (log CFU/g)</td>
<td>4.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Self life (days)</td>
<td>1-3</td>
<td>180</td>
</tr>
</tbody>
</table>
Consumer acceptance of new gowe product

- Taste: 7.5
- Appearance: 7.3
- Aroma: 7.1
- Texture: 7.1
- Overall acceptability: 7.5
Production of gowé in dried form (flour), with long shelf-life, controlled sanitary, nutritional and sensorial qualities

High acceptance for improved product; then presentation easy to be taken abroad

Production cost, starters supply ➔ need for a support for enterprise appropriation
THANK you for YOUR ATTENTION