Intracultural study of European* Consumer Acceptability of *Hibiscus sabdariffa* L. Drinks.

*Portugal, United Kingdom and France

M. I. Franco, Geneviève Fliedel, Aurelie Bechoff, Corinne Rumney, M. Q. Freitas, S. Teixeira, A. P. Silva, M. J. Monteiro, M. Cissé, Dominique Pallet*, Ben Bennett, Keith Tomlins and M. M. Pintado

Dominique Pallet / CIRAD, France / dominique.pallet@cirad.fr
Collaborative research Project – FP7 – 2010/2014

AFTER aims to revisit traditional African products, knowledge and know-how in the light of new technologies for the benefit of consumers, producers and processors in Africa and Europe.

Support the implementation of a range of traditional products in African and EU markets

The project involves seven African countries / four EU countries. 16 partners
**Hibiscus sabdariffa L. drink**

- Bissap, Karkadé...
- Dry calyx of the flower (*Hibiscus sabdariffa* L.) is used in Senegal and other Western African countries
- Preparation of beverages and other products
- High anthocyanins content
• Objective
• Characterization of Bissap samples
• Consumer analysis
  • Hedonic tests
  • Check-All-That-Apply questions
• Conclusions
The aim of the consumer studies was gathering information based on a structured focus group and on a QDA performed in Portugal, to apply afterwards Check-All-That-Apply (CATA) questions to compare consumer perception in the development of *Hibiscus sabdariffa* L. drink products between European countries, namely Portugal, United Kingdom and France.
Four Bissap drinks were selected for consumer tasting:

- **Traditional ambient temperature Vimto infusion (3C)**
- **Traditional boiled Vimto infusion (3H)**
  (Vimto variety originated from Sudanese)
- **Commercial syrup**
  (syrup from Esteval, a Senegalese company)
- **Commercial instant drink**
  (instantaneous powder “Starling” commercialized by Racine, France)
Calyces were extracted in water at room temperature (2 hours) (5% (m/v)) or boiled (1 hour) (3.3% (m/v)).

Sugar (130 g/L) was added after filtration followed by pasteurization at T=85°C for 20 minutes.
The syrup drink was prepared by dilution (1:4) of the commercial syrup.

The instant drink was prepared after dissolving the granules in water, 10 % (m/v), at room temperature.
Stages in the identification and selection of descriptors for establishing a sensory profile
• **Hedonic Quantitative tests**
  • Preference: comparison between products
  • Acceptance: “affective status” of a product, how well it is liked by consumers
• **Check-All-That-Apply (CATA) questions**
  • list of words which respondents select all the words they consider appropriate to describe a product
Development of **hedonic** and **CATA questionnaires** were based on previous results from QDA and Focus Group to describe the samples, only performed in Portugal.
• Consumer’s studies were performed in:
  • **Porto - Portugal**, with 100 people from two Portuguese Catholic University Campuses;
  • **Chatham, United Kingdom**, with 120 people from the University of Greenwich and;
  • **Montpellier, France** with 120 people from two canteens at the CIRAD Campus

• Consumers were interviewed using the **central location method**.
• Consumers were asked to score their overall liking and to answer a CATA questionnaire that included 28 sensory and hedonic terms.
METHODOLOGY

Consumer study apparatus:

a) Portugal
b) United Kingdom,

c) France,

Bissap samples for consumer study
Global appreciation:
✓ appearance
✓ smell
✓ taste

Hedonic scale

METHODOLOGY – HEDONIC TESTS

Name: ___________________________ Age: ___________________________
Sex: ___________________________
Level of education: ___________________________

Please indicate how much you like/dislike the follow attributes of each sample, using the following scale.

Scale:
9 - Like extremely
8 - Like very much
7 - Like slightly
6 - Like moderately
5 - Neither like nor dislike
4 - Dislike slightly
3 - Dislike moderately
2 - Dislike very much
1 - Dislike extremely

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Global Appreciation</th>
<th>Appearance</th>
<th>Smell</th>
<th>Taste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### METHODOLOGY – HEDONIC TESTS

#### 2. Sweetness

Please classify the sweetness of each sample by using the next scale.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
</tbody>
</table>

**Scale:**
- 9 – Extremely more sweet than ideal
- 8 – Much more sweet than ideal
- 7 – Moderately more sweet than ideal
- 6 – Slightly more sweet than ideal
- 5 – Ideal
- 4 – Slightly less sweet than ideal
- 3 – Moderately less sweet than ideal
- 2 – Much less sweet than ideal
- 1 – Extremely less sweet than ideal

- **sweetness**

#### 3. Willingness to buy

If this beverage were easily available to buy which would be your buying attitude towards purchasing each sample?

<table>
<thead>
<tr>
<th>Sample</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
<tr>
<td></td>
<td>( )</td>
</tr>
</tbody>
</table>

**Scale:**
- 5- Certainly I would buy
- 4- Probably I would buy
- 3-I have some doubts if I would buy it or not
- 2- Probably I would not buy
- 1- Certainly I would not buy

- **willingness to buy**
Consumers check all the terms they considered appropriate to describe each samples.
<table>
<thead>
<tr>
<th>SENSATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
</tr>
<tr>
<td>Artificial</td>
</tr>
<tr>
<td>Smooth</td>
</tr>
<tr>
<td>Bond</td>
</tr>
<tr>
<td>Rough</td>
</tr>
<tr>
<td>Healthy</td>
</tr>
<tr>
<td>Fresh</td>
</tr>
<tr>
<td>Instantaneous</td>
</tr>
<tr>
<td>Watery</td>
</tr>
<tr>
<td>Strong</td>
</tr>
<tr>
<td>Diluted</td>
</tr>
<tr>
<td>Concentrated</td>
</tr>
</tbody>
</table>

Please describe other relevant observations or notes:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Thank you very much for your collaboration!
RESULTS – SENSORY PROFILE QDA

PORTUGAL

• Samples 3H & 3C
are characterized by
colour intensity,
viscosity, floral and
acid attributes

Sensory profile (QDA) of Traditional ambient
temperature Vimto infusion (3C) and
Traditional boiled Vimto infusion (3H)
RESULTS – SENSORY PROFILE QDA

PORTUGAL

• **Syrup** is characterized by colour intensity, viscosity, sweet, floral and sour cherry attributes

• **Instantaneous** is characterized by raspberry and sweet attributes

Sensory profile (QDA) of Commercial syrup diluted 1:4 (Syrup) and Commercial instant drink (Instantaneous)
### RESULTS – HEDONIC TEST – OVERALL LIKING

**PORTUGAL**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Mean</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instantaneous</td>
<td>5,780</td>
<td>A</td>
</tr>
<tr>
<td>Syrup</td>
<td>5,400</td>
<td>A</td>
</tr>
<tr>
<td>3H</td>
<td>4,980</td>
<td>B</td>
</tr>
<tr>
<td>3C</td>
<td>4,770</td>
<td>C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Samples</th>
<th>Average (Overall)</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syrup</td>
<td>6,212</td>
<td>A</td>
</tr>
<tr>
<td>Inst. Juice</td>
<td>6,035</td>
<td>A</td>
</tr>
<tr>
<td>Cold extraction</td>
<td>5,381</td>
<td>B</td>
</tr>
<tr>
<td>Hot extraction</td>
<td>4,814</td>
<td>C</td>
</tr>
</tbody>
</table>

**UK**

<table>
<thead>
<tr>
<th>Category</th>
<th>Average (Overall liking)</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syrup</td>
<td>6,525</td>
<td>A</td>
</tr>
<tr>
<td>Inst. Juice</td>
<td>6,042</td>
<td>B</td>
</tr>
<tr>
<td>Cold extraction</td>
<td>5,925</td>
<td>B</td>
</tr>
<tr>
<td>Hot extraction</td>
<td>5,667</td>
<td>B</td>
</tr>
</tbody>
</table>
The terms grouped into two categories:

- **Sensory properties**: Appearance (5), Smell and Flavor (11)
- **Sensations/Perceptions** (12).

Frequency by counting the number of consumers that used that term to describe each sample.

A multiple factor analysis (**MFA**) was performed on responses to the CATA question

- to identify **relationships** between the terms and the samples
- to get a **sensory map of the samples**.

Results for **Portugal, U.K and France / Sensory & Emotional**
• **Sample 3H** - red colour, viscous, cold black tea and raisins attributes

• **Sample 3C** – acid, bitter and hay attributes

• **Syrup** – sweet, fruity and fresh herb attributes

• **Instantaneous** – pink colour, clarity and floral attributes
MFA RESULTS – CATA QUESTION

FRANCE / EMOTIONAL CATEGORY

- **Hot extraction:** concentrated, full body, rough and strong descriptors
- **Cold extraction:** concentrated, full body, rough and strong descriptors
- **Syrup:** smooth attribute
- **Instantaneous:** like an instant beverage, diluted, artificial and watery attributes

Attributes:
- Red Colour AT1
- Pink Colour AT2
- Clarity AT3
- Viscous AT4
- Fluid AT5
- Flowers AT6
- Fruity AT7
- Fresh herb AT8
- Cold Black Tea AT9
- Raisins AT10
- Honey AT11
- Acid AT12
- Sweet AT13
- Bitter AT14
- Sour Cherry AT15
- Hay AT16
- Natural AT17
- Artificial AT18
- Smooth AT19
- Bond AT20
- Rough AT21
- Healthy AT22
- Fresh AT23
- Instantaneous AT24
- Watery AT25
- Strong AT26
- Diluted AT27
- Concentrated AT28
## CONCLUSIONS – HEDONIC STUDY

<table>
<thead>
<tr>
<th>Hedonic</th>
<th>PT</th>
<th>FR</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall liking (in a decrease order of magnitude)</strong></td>
<td>instantaneous juice &gt; syrup &gt; hot extraction &gt; cold extraction</td>
<td>syrup &gt; instantaneous juice &gt; cold extraction &gt; hot extraction</td>
<td>syrup &gt; instantaneous juice &gt; hot extraction &gt; cold extraction</td>
</tr>
<tr>
<td><strong>Sweetness (ideal)</strong></td>
<td>instantaneous juice followed by hot extraction.</td>
<td>cold extraction, instantaneous juice, hot extraction.</td>
<td>cold extraction, instantaneous juice, hot extraction.</td>
</tr>
<tr>
<td></td>
<td>Syrup is slightly more sweet than the other samples.</td>
<td>Syrup is slightly more sweet than the other samples.</td>
<td>Syrup is slightly more sweet than the other samples.</td>
</tr>
<tr>
<td><strong>WTB</strong></td>
<td>instantaneous juice</td>
<td>syrup followed by cold extraction</td>
<td>syrup followed by instantaneous juice</td>
</tr>
</tbody>
</table>

Two clusters
## An European consumer profile of *Hibiscus sabdariffa* L. drinks

### CATA questionnaire

**Sensory properties**

<table>
<thead>
<tr>
<th>CATA questionnaire</th>
<th>PT</th>
<th>FR</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>instantaneous juice</td>
<td>pink colour, clarity, floral</td>
<td>pink colour, clarity, fluid</td>
<td>pink colour, clarity, fruity</td>
</tr>
<tr>
<td>syrup</td>
<td>sweet, fruity, fresh herb</td>
<td>sweet, flowers, fruity, honey</td>
<td>sweet, flowers, honey</td>
</tr>
<tr>
<td>hot extraction</td>
<td>red colour, viscous, cold</td>
<td>acid, viscous, harsh taste, bitter, hay</td>
<td>acid, cold black tea, viscous, harsh taste, hay</td>
</tr>
<tr>
<td>cold extraction</td>
<td>acid, bitter, hay</td>
<td>cold black tea, fresh herb</td>
<td>raisins, bitter</td>
</tr>
</tbody>
</table>

### Emotions/Perceptions

<table>
<thead>
<tr>
<th>CATA questionnaire</th>
<th>PT</th>
<th>FR</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>instantaneous juice</td>
<td>fresh, like an instant beverage, diluted, watery</td>
<td>like an instant beverage, diluted, artificial, watery</td>
<td>diluted, watery, like an instant beverage, artificial</td>
</tr>
<tr>
<td>syrup</td>
<td>natural, smooth</td>
<td>smooth</td>
<td>smooth, fresh</td>
</tr>
<tr>
<td>hot extraction</td>
<td>concentrated, full bodied</td>
<td>concentrated, full bodied, astringent, strong</td>
<td>concentrated, full bodied, astringent, strong</td>
</tr>
<tr>
<td>cold extraction</td>
<td>bitter, strong</td>
<td>concentrated, full bodied, astringent, strong</td>
<td>concentrated, full bodied, astringent, strong</td>
</tr>
</tbody>
</table>
This CATA methodology applied to African product offered to European consumers:

- was able to detect differences in consumer perception of the drinks.
- simple methodology to get an insight on consumer perception of a food product.
- could be a simple way to perform external preference mapping (alternative to the sensory trained panel).
- could consist on a complementary technique to traditional preference mapping.
- seem to be promising for studying the relationship of consumers’ perception of sensory and non-sensory attributes of products.
Thank you for your attention!!!!!

Website: www.after-fp7.eu