Introduction

Sensory tests are often conducted in blind conditions but don’t refer to the real conditions of consumption. Also, the aim of this study is to observe how some information like the packaging can affect the sensorial perception of a food product, the orange juice. For that, a sensory analysis was performed in two situations: in blind and with information. The same questionnaire, using a 5-points “Just About Right” scales and a hedonic scale, was filled by 105 assessors for each session.

Nowadays, the penalty analysis tests the significance of the mean drop (difference in mean hedonic score between those who feel a flavor has too much or not enough of an attribute and those who feel that attribute is just right). However, this method doesn’t consider the relation between descriptors causing a bad estimation of penalties. This poster presents a new methodology to treat penalty analysis to better determine drivers of liking.

Consumers’ data

The questionnaire is structured as follows:
- 6 sensorial descriptors using a 5-points “Just About Right + (JAR)" scale:
  - Color Nuance (Io)
  - Acidity (Ac)
  - Odor Intensity (Io)
  - Bitterness (Am)
  - Sugar Taste (Su)
  - Pulp Character (Pu)
- 1 hedonic score (0-10 scale)

105 assessors evaluated 8 orange juices in two situations:

<table>
<thead>
<tr>
<th>Situation 1</th>
<th>Situation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blind sensory analysis</td>
<td>Sensory analysis with information (packaging, price, shelf…)</td>
</tr>
</tbody>
</table>

Method

Penalty Analysis

In sensory analysis, descriptors are often correlated between them. Also, it seems important to consider them together in a model in order to not admit that a single descriptor impacts the overall score. A product is evaluated with the set of variables. The proposed models will avoid an overestimation of the coefficients for all the descriptors which are considered together in the model. The new methodology is performed in 4 steps:

1. JAR scale are aggregated in 3 levels (« Not enough », « JAR », « Too much »).
2. For each descriptor, levels are recoded in complete discrete table.
3. Anova model is performed with all the descriptors. Nevertheless, modality "JAR" is not included in the model to get $\text{Cov} = 0$ and so will be considered in the constant. Recoded variables are analyzed as quantitative variables.
4. Other factors (Product and assessor) can be added in the model: the constraint $2\alpha = 0$ is applied in the model and these variables are qualitative.

Also, the quality of the model is improved.

The penalty analysis is performed with the following analysis of variance:

$$H_0: \beta_0 = 0$$

All products together Analysis: Model 1

Hedonic score $= \operatorname{Descriptor}_\text{io} + \operatorname{Descriptor}_\text{Ac} + \operatorname{Descriptor}_\text{Io} + \operatorname{Descriptor}_\text{Am} + \operatorname{Descriptor}_\text{Su} + \operatorname{Descriptor}_\text{Pu} + \operatorname{Product} + \operatorname{Assessor}$

Penalities of descriptors (in blue) are quantitative and their coefficient estimated correspond to the penalty.

Results

For the situation 1 using this model are presented below:

<table>
<thead>
<tr>
<th>Penalty</th>
<th>0.59</th>
<th>0.01</th>
<th>0.59</th>
<th>0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Io</td>
<td>5.53</td>
<td>2.34</td>
<td>10.03</td>
<td>Bt</td>
</tr>
<tr>
<td>Ac</td>
<td>1.51</td>
<td>3.74</td>
<td>1.42</td>
<td>2.12</td>
</tr>
<tr>
<td>Io</td>
<td>1.01</td>
<td>2.34</td>
<td>1.02</td>
<td>1.11</td>
</tr>
<tr>
<td>Io</td>
<td>1.01</td>
<td>2.34</td>
<td>1.02</td>
<td>1.11</td>
</tr>
<tr>
<td>Io</td>
<td>0.8</td>
<td>2.34</td>
<td>0.81</td>
<td>2.09</td>
</tr>
</tbody>
</table>

The most penalizing defects on the hedonic score are those related to the balance of flavours whatever orange juices.

Analysis by product: Model 2

Hedonic score $= \operatorname{Descriptor}_\text{io} + \operatorname{Descriptor}_\text{Ac} + \operatorname{Descriptor}_\text{Io} + \operatorname{Descriptor}_\text{Am} + \operatorname{Descriptor}_\text{Su} + \operatorname{Descriptor}_\text{Pu} + \operatorname{Product} + \operatorname{Assessor}$

This model is advocated to estimate penalties of each product. Graphics below compare estimations of penalties performed with our model and done with classic method (mean drop). We observed that the mean drop overestimates penalties of each descriptor.

Conclusion

A part of results shows that the brand name is less penalized than the own brand by assessors and every products were perceived as better quality when information was available.

The model proposed allows a better estimation of penalties and to easily identify important descriptors by considering all of them into an Anova model. The method can be adjusted according to the issue: study a product category or only one product.