Introduction

-Volatile compounds play an important role in the perceived aroma of food. Direct injection mass spectrometry allows in vivo monitoring of volatile release in the nose. Nosespace analysis (NA) coupled with proton transfer reaction-time of flight mass spectrometry (PTR-ToF-MS) is a promising new technique in the last decade to study the relationship between flavor release and food properties [1].

-Temporal Dynamics of Sensations (TDS) permits to describe the temporal evolution of the dominant sensations during product consumption. A dominant sensation is described as "a sensation catching the attention at a given time" [2].

In this study, a combination of TDS and NA with PTR-ToF-MS techniques were used to study the effect of roasting degree and sugar addition to espresso coffee on flavor perception and volatile release.

Material & Methods

Samples:
- 2 types of coffee: A (light) and B (dark)
- 3 levels of sugar: 0, 1/2, and 1/1.25/g

TDS Panel:
- 18 judges trained on TDS (EF = 50%/M = 44%; 23-37 years old)

TDS Method:
- 9 attributes (Taste and sensation: sweet, sour, bitter, astringent; Aroma: roasted, burnt, caramel, nutty, vegetal)
- Evaluation:
  - 60 seconds (putting the sample in mouth, swallowing after 5 s)
  - 3 samples/series - 10 min break between samples 4 x sessions
- Presentation according to William’s latin square (constraint to have 2 sweetened samples/session

The TDS method allows differentiation of samples. Sugar addition (Fig 3) modifies the dominant attributes. In both coffees A and B, the fact to add sugar tends to mask/decrease sour and bitter taste dominance and to enhance the "positive aroma" perception described with the attributes Caramel, Nutty and Roasted instead of Burnt.

Results & Discussion

Dominance rates of TDS data (proportion of panelists who chose one attribute as dominant at a specific time) were calculated for each attribute and each product. The TDS curves obtained were represented on one graph per product (Fig 3). Two lines were drawn in the graphs to help comprehension of TDS data: 1) the "chance level" which corresponds to the dominance rate that an attribute can obtain by chance. Its value, Pchance, is equal to 1/p, p being the number of attributes. 2) the "significance level" represents the minimum value that must be reached to consider the dominant rate as significantly higher than Pchance. This value is calculated following the confidence interval of a binomial proportion based on a normal approximation [6].

The TDS method allows clustering of release curves into two distinct groups characterized by different patterns/time evolution in terms of physico-chemical basis (cluster 1 and 2) (on the right).

The change in the dominant attribute in the different phases of coffee drinking: could be explained by an early and/or late onset of some mass peaks responsible for a sensory note: e.g. Possible markers of Burnt note (methyl-pyrrole (cluster 1) or acetyl- methyl-pyrrole (cluster 2)).

Pyrazines (cluster 2) could be good temporal dominance markers of Roasted notes those could explain the increase between coffee A and B.

The effect of sugar was more complex and difficult to explain the results because of different palette of sensory attributes used by the panel.

Dynamics of flavor perception: combining sensory methods and direct injection mass spectrometry

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References

Conclusions

- The simultaneous application of TDS and NS analysis allowed differentiation of products with a marked effect of roasting.
- NS analysis can identify differences between panelists and provide a better understanding of sensory data.
- Addition of sugar modified sensory profiles of coffees in terms of selected attributes but no significant effect was observed on aroma release underlying the presence of cognitive multisensory interactions.
- The grouping of volatile compounds according to their release characteristics can be related to explain the changes in aroma perception in TDS analysis.

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