

Ethnicity, gender and physiological parameters: their effect on *in vivo* flavour release and perception during chewing gum consumption

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1. INTRODUCTION & OBJECTIVE

- Chewing gum is an ideal model food that can be tailored to investigate oral processing by combining simultaneously dynamic sensory and instrumental techniques;
- Flavour release is influenced by different physiological parameters (Salles et al., 2011) like salivary flow, breathing, mastication and swallowing. Moreover, flavour release is controlled by other intrinsic and extrinsic factors as flavor concentration, dissolution rate, sugar release, air bolus contact area, mass transfer coefficient in the bolus, sex and age (Baek et al 1999; Déléris et al., 2011; Doyennette et al., 2014; Weel et al., 2002)
- Cultural origin and, consequently, life experiences might also impact flavour perception (Croy et al., 2014; Yeretian et al., 2004)

The present work, aims at investigating the impact of ethnicity, gender and physiological parameters, on flavour perception and release of mint chewing gum through in nose Proton Transfer Reaction Mass Spectrometry (PTR-MS) approach coupled to discrete Time Intensity (dTI) sensory analysis and collection of physiological parameters.

3. RESULTS

The peak selection processes identified 6 volatile organic compounds related to peppermint oil used as flavoring in mint commercial chewing gum: monoterpenes, menthol, menthofuran, 1,8-cineole, menthone and menthyl acetate.

Chinese panelists presented a higher concentration of the flavour compound in the retro nasal cavity than European panelists (fig. 2 and 3). The Chinese panel also had an higher sensory evaluation for the product for both sweetness and aroma intensity. These differences were confirmed by p. values obtained from the Welch's two samples t-test run on the different time intervals.

For what concerns physiological parameters a significant difference was found between male and female in the volume of the oral cavity ($p.value < 0.05$); a weak negative correlation between salivary flow and flavor release was also found.

2. MATERIAL & METHODS

- 14 Caucasian-European and 15 Asian-Chinese panelists (13 male and 16 female) participated in the experiment that consisted of two training sessions and two experimental sessions.
- From each panelist the oral cavity volume, stimulated salivary flow, fungiform papillae density, and acetone in-nose concentration were collected.
- Sweetness and mint flavor intensity were recorded by applying dTI evaluation on Label Magnitude Scale at 8 different time intervals (15", 30", 1', 2', 3', 5', 7' and 1 min after gum removal)
- A commercial PTR-MS instrument (Ionicon Analytik) equipped with a time of flight and a quadrupole ion guide (PTR-QITOF) was used for in-nose volatile analysis.



Fig. 1: Example of experimental set up. Participants in-nose breath was collected during chewing gum consumption and sensory evaluation.

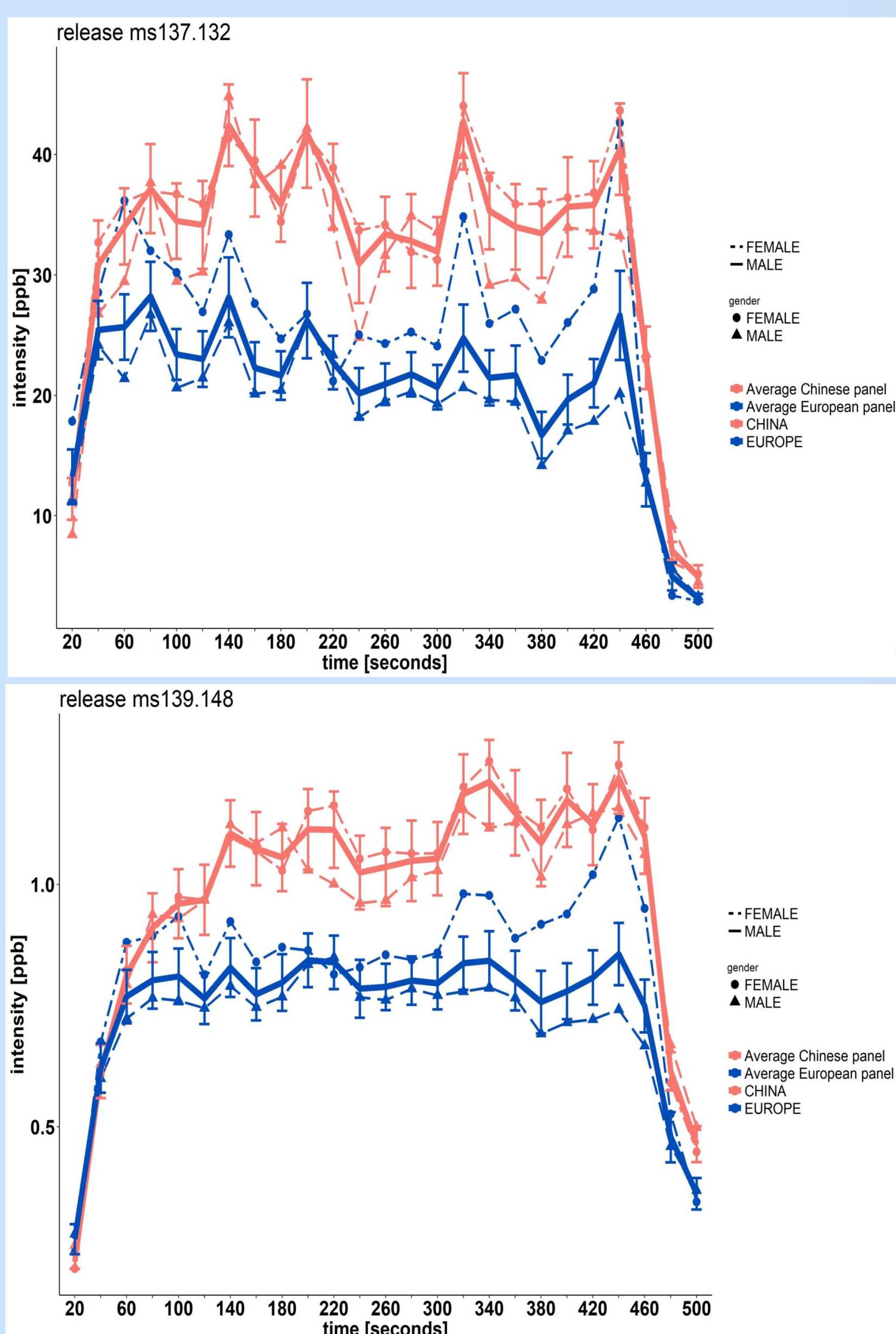
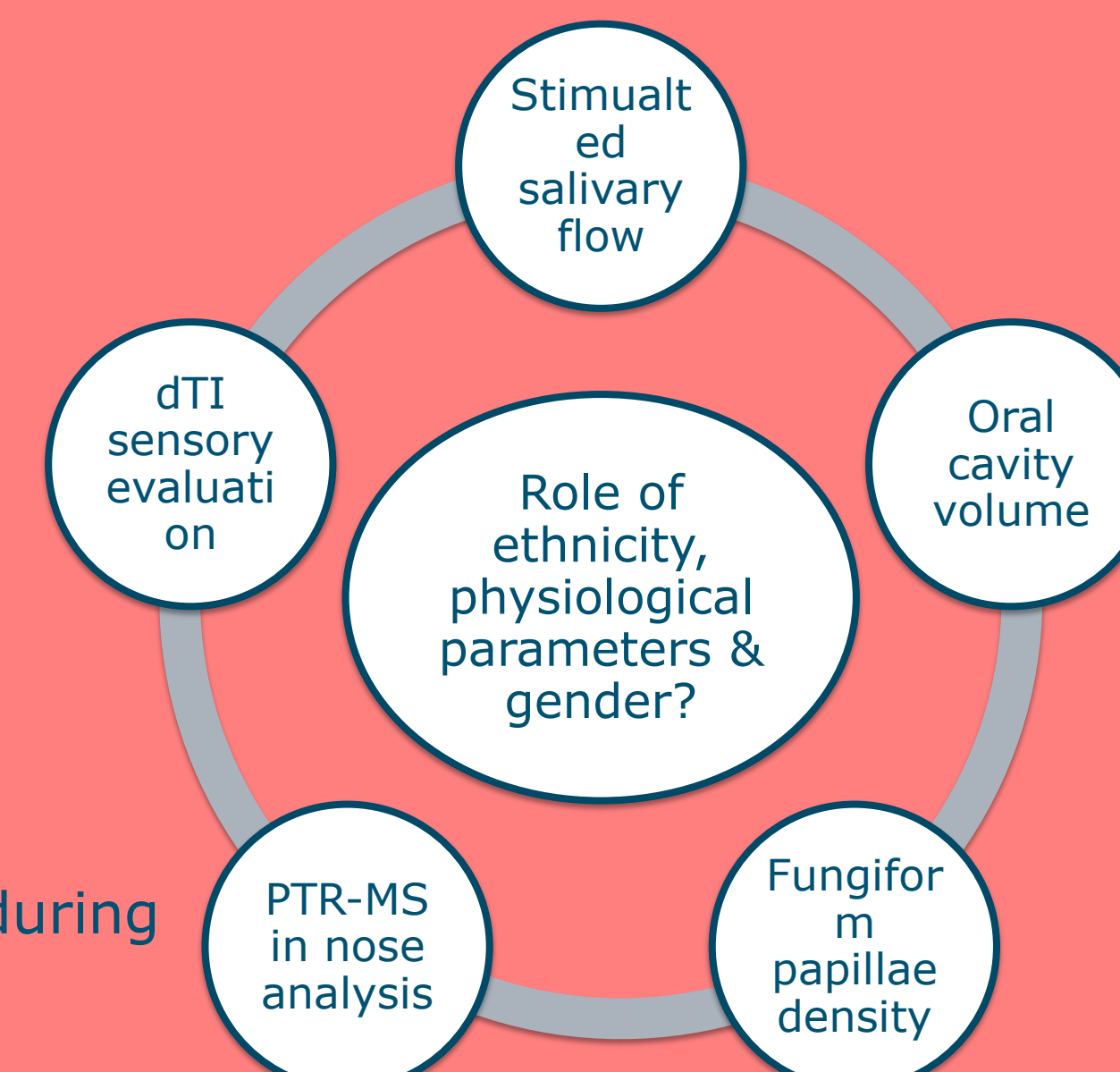


Fig. 3: Average in-nose release during time for : (A) m/z = 137.134 (C10H16H+) Monoterpenes (B) m/z = 139.148 (C10H19+) (-)Menthol / Fragment of Menthyl Acetate.

PTR-MS *in vivo* flavor release

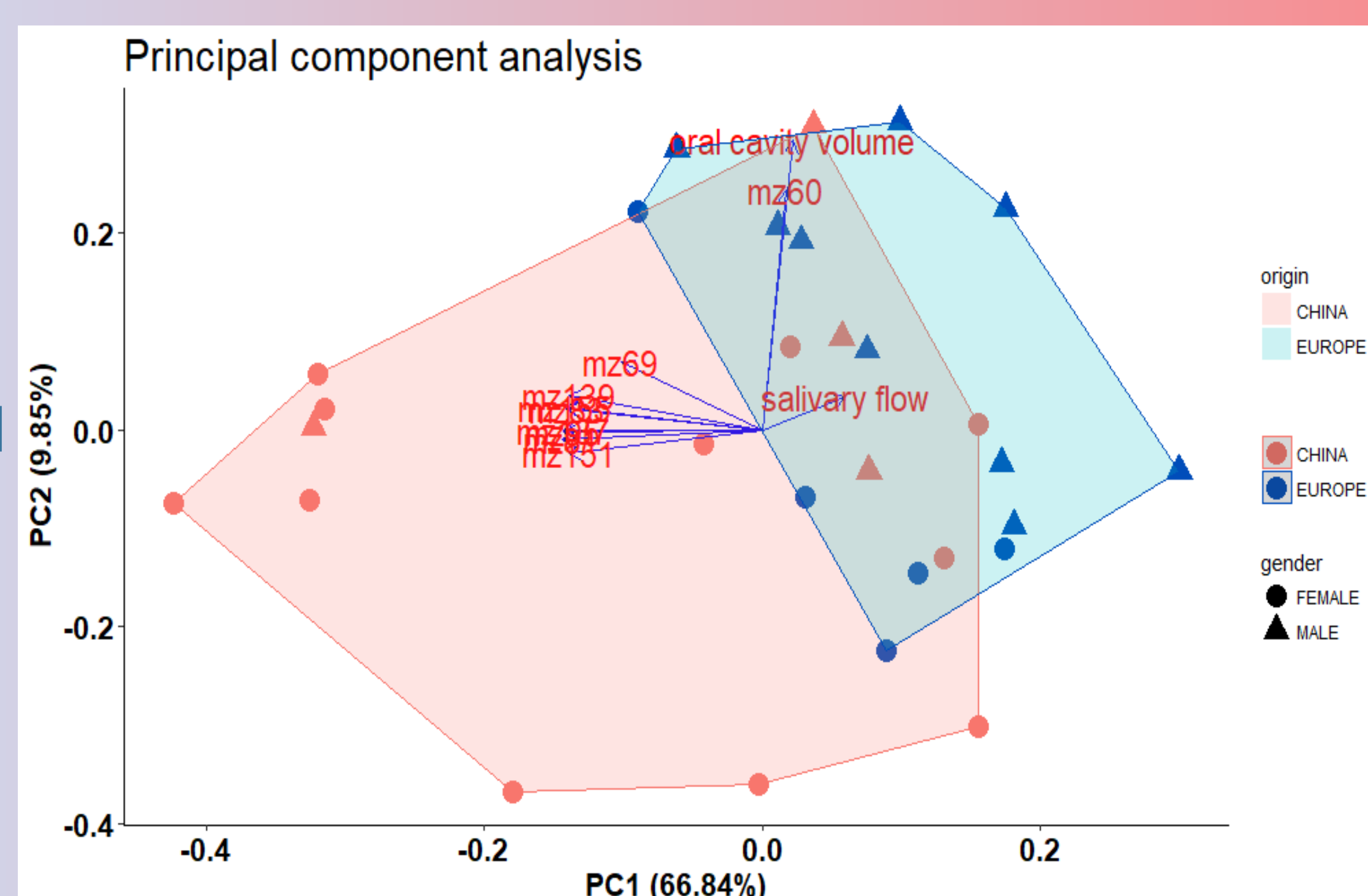


Fig. 2: Principal component analysis Biplot. PC1 is represents flavour compounds release, PC2 by physiological parameters and acetone level in the breath. The two clusters (Chinese and European panelists) are highlighted with frames of different colours while gender distinction is highlighted based on shape.

Aroma and sweetness discrete time intensity perception

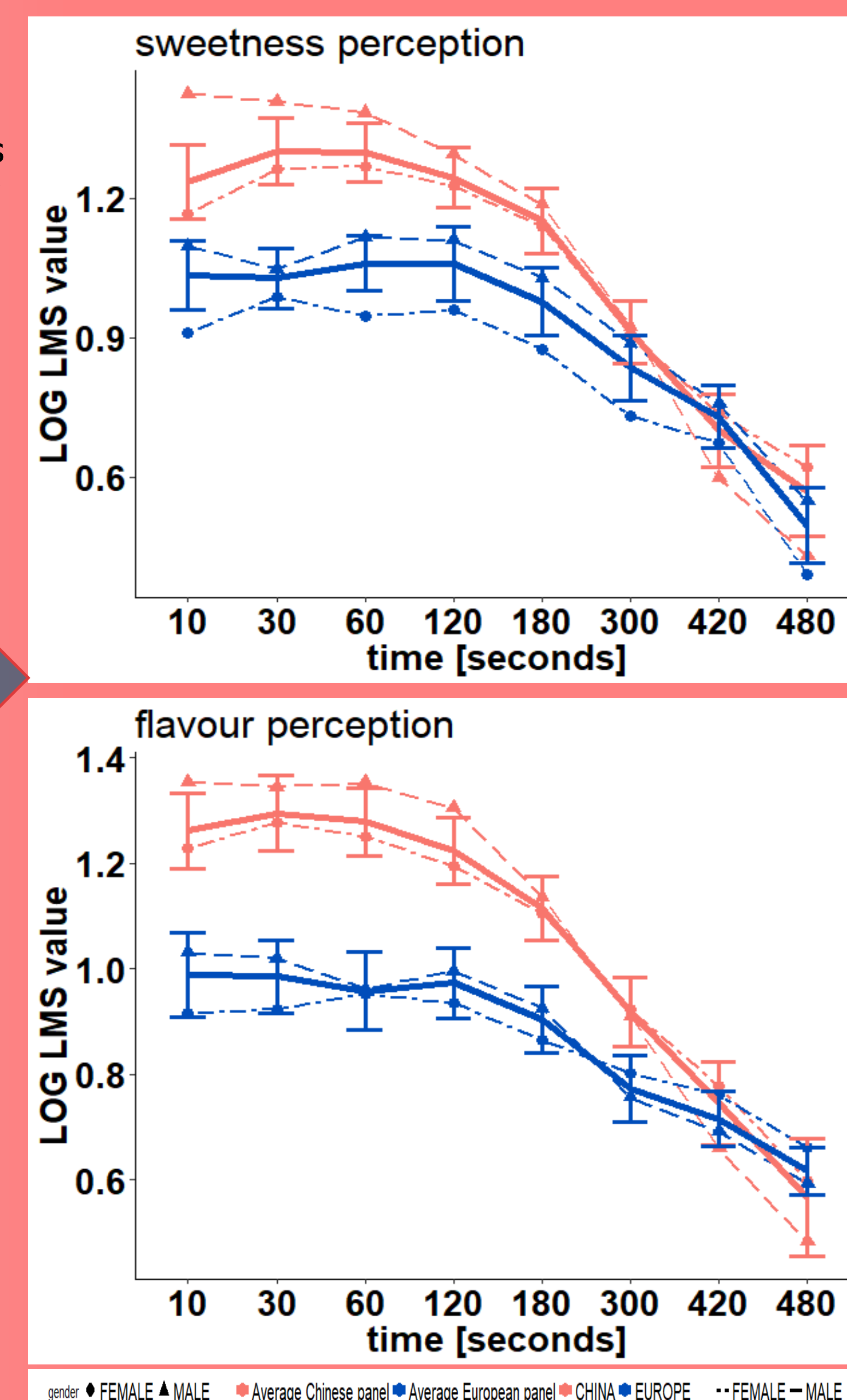


Fig. 4: Perceived intensity of overall mint flavour and sweetness during time. Distinction based on gender and origin are highlighted by using different colours, different line shapes and symbols.

5. CONCLUSIONS

- Despite of the high inter-individual differences, significant difference between Chinese and Europeans has been observed for in nose flavour release of chewing gum aroma compounds. The same difference were found for sweetness and flavour perception.
- Gender had a limited effect as only a marginal significant difference related to the oral cavity volume was found.
- Physiological parameters have a limited role in explaining aroma perception and release differences. A weak negative correlation between salivary flow and aroma release was found.
- Composition of saliva might play a role since saliva proteins can interact with aroma compounds through both covalent and non-covalent bonds and consequently influence their partitioning between the liquid and air phases.
- This work provides both methodological and fundamental insights for further investigation in geographical variability in flavour release and perception. Further investigation should be toward the investigation of saliva and mucosa composition, their role on *in vivo* flavour release and perception, and how do they differ among ethnic groups.

6. REFERENCES

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