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INTRODUCTION

There are currently 5 accepted tastes (sweet, sour, salty, bitter and umami). In the past 'metallic' has been proposed as an additional taste, however evidence is inconclusive as literature indicates it may be a result of retronasal aroma perception [1] caused by volatiles released by lipid oxidation when the compound comes into contact with the phospholipid bilayer in the oral cavity [2]. Some divalent salts are found to elicit a metallic sensation when consumed, and prior research indicates this could be due to combined taste, aroma and tactile stimulation [3]. Metallic taints in food items can have negative implications for food manufacturers and consumer acceptability. This study aimed to explore the relative contribution of mouthfeel, taste, aroma & flavour qualities to the overall metallic sensation experienced when consuming divalent salts. **Aim 1:** Determine if samples had an aroma that could be detected orthonasally. **Aim 2:** Identify differing perceptual qualities of selected divalent salts. **Aim 3:** Investigate the effect of nasal occlusion on the perceptual qualities of samples.



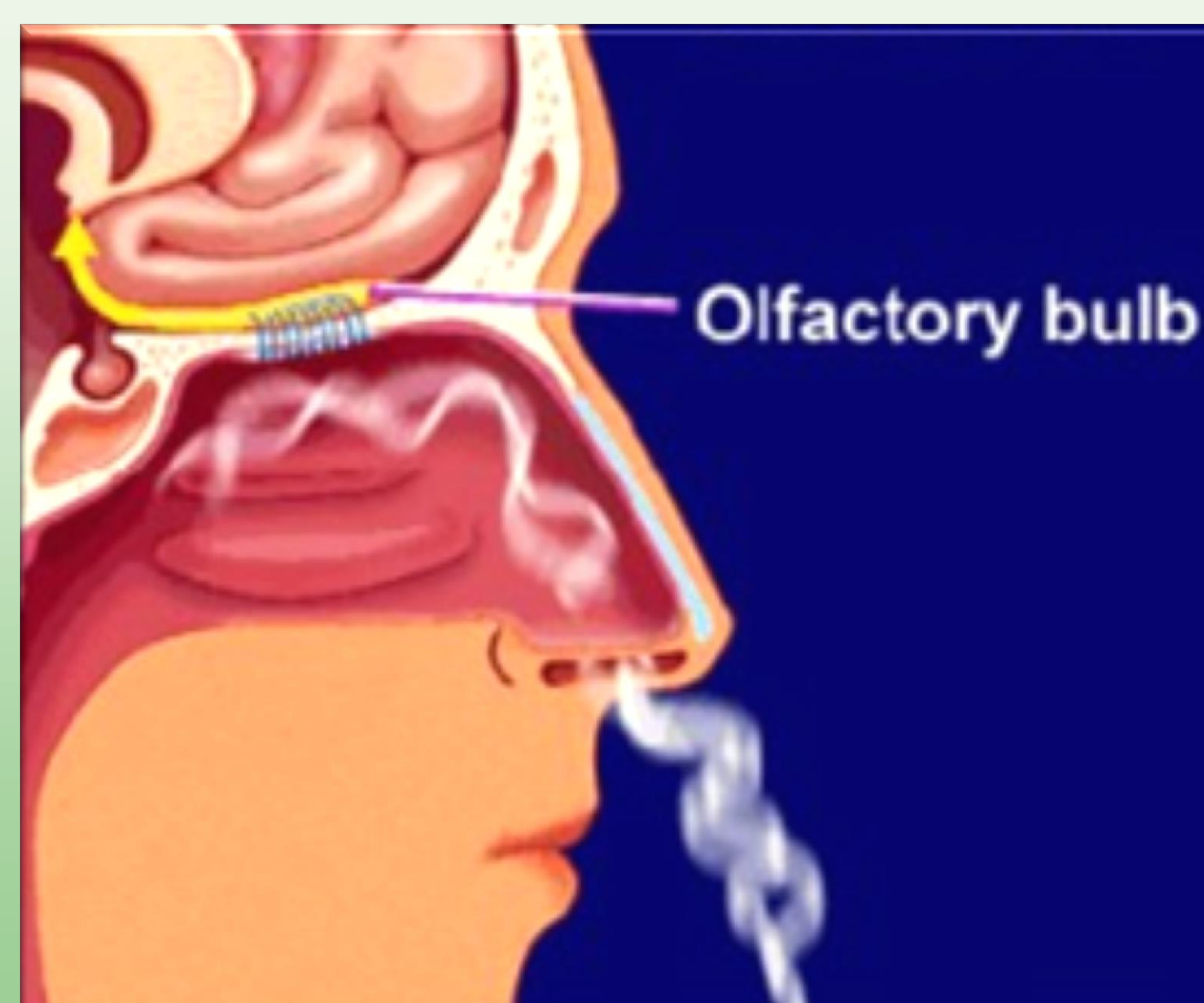
METHOD

Stimuli

- Iron sulphate
- Iron gluconate
- Iron chloride
- Copper sulphate
- Calcium chloride
- Water control

Assessors

- 29 naïve assessors
- 7 male, 22 female
- Aged 18-45 years



AIM 1 Orthonasal aroma

- Smell headspace over samples
- Triangle test comparing samples to a blank water control

RESULTS

- Only iron sulphate & iron chloride could be discriminated from the water sample ($p < 0.05$)
- Indicates there was a perceivable aroma in the headspace over these samples



AIM 2 & AIM 3 Perceptual qualities of divalent salts with nose open & occluded

- Samples consumed under 2 conditions: 1) Nose open to allow retronasal aroma stimulation 2) Nose occluded to eliminate retronasal aroma contribution
- Attributes rated using a 10 point line scale (astringent, tingling, bitter, sweet, salty and metallic)

Data analysis

- 2 factor ANOVA (sample & condition)
- Tukey HSD post hoc test



Table 1: Attributes that were rated significantly higher ($p < 0.05$) than water control under nose open or nose occluded conditions.

Sample	Nose open	Nose occluded
Iron sulphate	Metallic, sweet	Sweet
Iron chloride	Metallic, sweet	None
Iron gluconate	Metallic	None
Copper sulphate	Bitter, astringent, metallic, salty, tingling	Bitter, astringent, metallic, salty
Calcium chloride	Bitter, astringent, salty	Bitter, astringent, salty

RESULTS

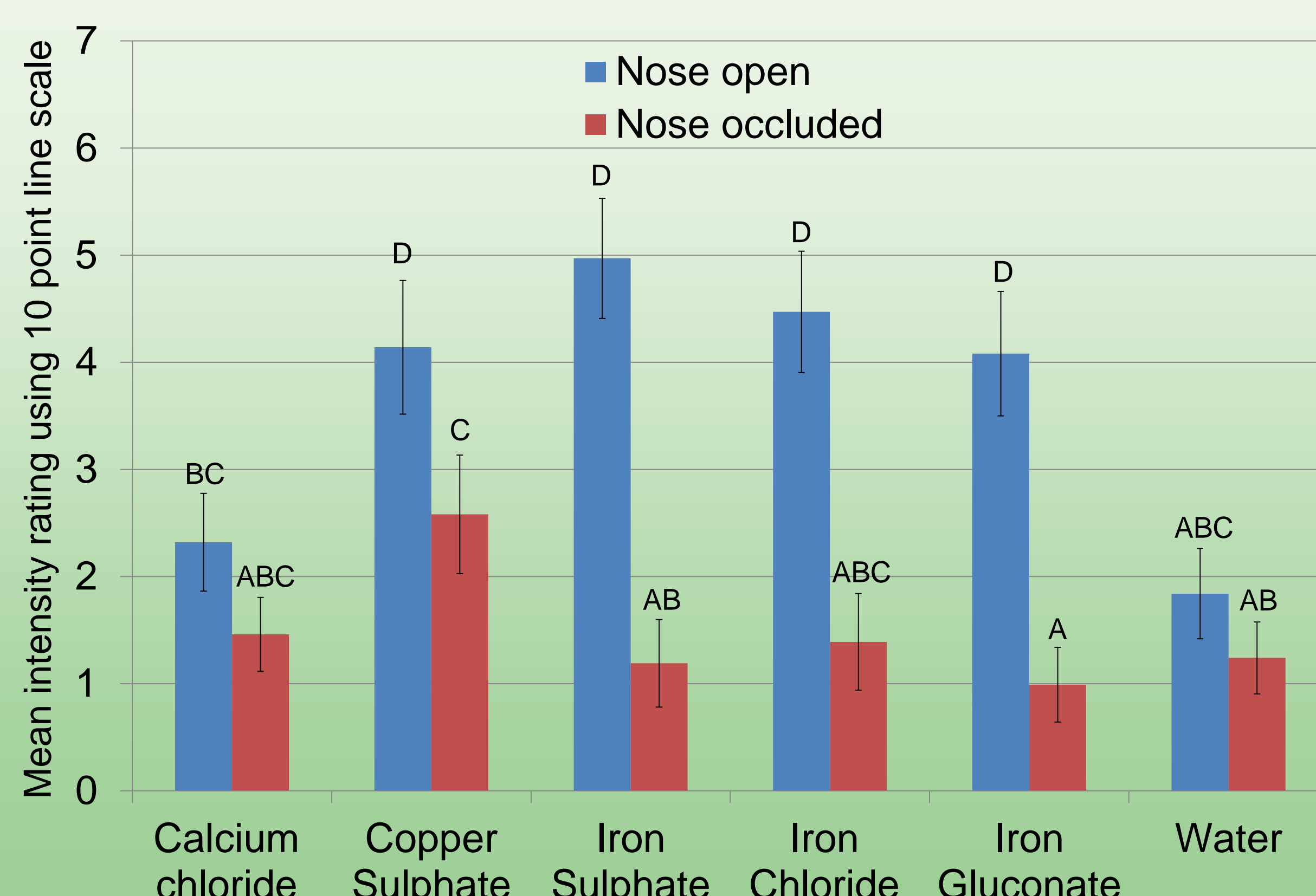


Figure 1 Mean metallic intensity rating \pm 1 standard error with the nose open and occluded. abcd bars with different letters show significant differences across samples and nose conditions.

CONCLUSION

1. Iron sulphate and iron chloride were the only samples that had a perceivable orthonasal aroma.
2. Perceptual qualities of samples were; metallic & sweet for iron compounds, bitter, astringent, metallic, salty & tingling for copper sulphate, bitter, astringent & salty for calcium chloride.
3. Nasal occlusion significantly reduced metallic intensity ratings for iron compounds & copper sulphate.



DISCUSSION

AIM 1: There is little evidence documenting the orthonasal qualities of divalent salts. Previously iron sulphate has not been found to have a perceivable orthonasal aroma [3]. However, the low concentration sample that was used may have been below detection threshold. A strong intensity sample was used in the current study which may explain the differences.

AIM 2: The perceptual qualities of samples reported in this study are comparable to those identified in prior research using a trained sensory panel to create a descriptive profile [4].

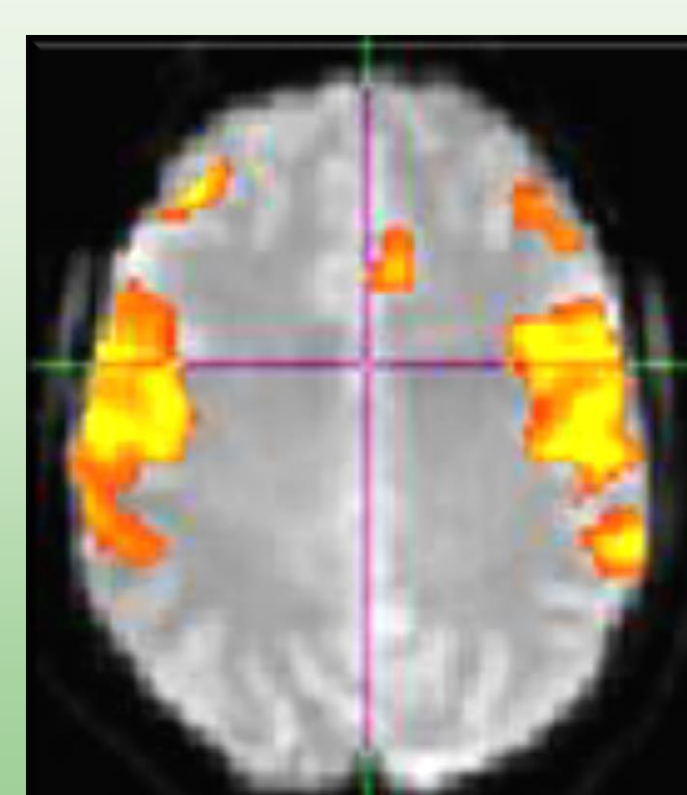
AIM 3: As found by previous researchers, the metallic intensity rating was significantly reduced when the nose was occluded compared to open [1]. This supports the hypothesis that metallic is a sensation stimulated by retronasal aroma delivery and possible tactile contributions as opposed to taste. Retronasal aroma stimulation is likely due to volatiles released from lipid oxidation of the phospholipid bilayer in the oral cavity after exposure [2].

FUTURE WORK

Use functional magnetic resonance imaging to identify the cortical response to iron sulphate & copper sulphate samples while they are sprayed into the mouths of participants being scanned.

References

- [1] Hettinger *et al* (1990) *Chem. Senses*. 15 (6) pp.755-760.
- [2] Omur Ozbek *et al* (2012) *J. Agric. Food. Chem* 60 pp 2274-2280
- [3] Lawless *et al* (2004) *Chemical Senses* 29 (1) pp. 25-33
- [4] Yang *et al* (2005) *Journal Sensory Studies* 20 pp 97-113



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