EXPLORING AGE-RELATED SENSORY CHANGES

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From Baby to Grandparent... what should we ... (dietitian, nutritionist, nurse, AHP, sensory scientist, product developer, marketeer, consumer) ... consider ??

- Changes in perception ?
- Changes in exposure / familiarity ?
- Changes in needs (physiological / psychological / social) ?
- Designing foods to meet the needs of an increasingly older population ?
- Designing “healthier foods” to appeal to the sensory preferences different age groups?
- How to modify food choice behaviour of specific age groups?
As Older Person:
- Olfaction & Taste diminished
- Dentition and muscle strength influencing texture acceptability
- Lots of experience or Set experiences?
- Health influencing perception

As Adult:
- Increasing tolerance of the trigeminal…”maturing” but reducing sensitivity?

As Adolescent:
- Is “junk” diet influencing perception??
- High sweet & fatty diets reducing sensitivity?

As Child:
- Teeth !...Exploring texture
- Exposure & Neophobia

As Baby:
- Olfaction -Complete & Familiarity already influencing liking
- Sensitive & dislike of Bitter & Sour
- Sensitive & like Sweet & Savoury
Changes in Perception with Age
How does taste change with age & health?
Taste Detection Thresholds: Why They May Increase with Age

**Morphological changes**
- decrease in receptor numbers

**Stimulus persistence hypothesis**
- the signal from the taste cells continues to be sent to the brain even when stimulus falls below threshold

**Disinhibition hypothesis**
- cognitive inaccuracies make an individual unable to retrieve information from memory and connect with current signals from taste cells

**Perceptual noise hypothesis**
- Repetitive neural firing from the taste cells makes brain unable to ignore irrelevant signals

**Neural noise hypothesis**
- the signal to noise ratio in the brain is lowered by decrease in signal intensity and increase in spontaneous firing from the taste receptor cells

**Functional changes of gustatory cells**
What does the literature say?

- Meta-analysis of 23 studies
- Consensus was that taste detection thresholds increased with age (p<0.001) across all taste modalities
- Identification thresholds higher for older adults in 17 out of 18 studies
- 16 out of 25 studies reported perception of taste intensity at supra-threshold levels to be significantly lower for older adults

Chemosensory loss is connected with Frailty not just Age

**Orosensory decline correlates with dependency** (poor health, medication, cognitive dysfunction):

- N=559 France (65-99 yr)
- Independent living & Nursing Home
- Measured:
  - Salt taste detection
  - Olfaction: detection, characterisation & discrimination
- Results:
  - Well preserved abilities: 43%
  - Moderate Impairment: 21%
  - Clear trend between impairment & level of dependence

### Our Evidence: Taste Detection Thresholds

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean Age (range)</th>
<th>Sweet (sucrose)</th>
<th>Salt (NaCl)</th>
<th>Umami (MSG)</th>
<th>Bitter (quinine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital patients</td>
<td>(50) (42) (51) (28)</td>
<td>84 (65-98)</td>
<td>16 mM (0.5%)</td>
<td>19.4 mM (0.12%)</td>
<td>3.7 mM (0.06%)</td>
<td>0.03 mM (0.002%)</td>
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<tr>
<td>Healthy older volunteers</td>
<td>38 (35)</td>
<td>71 (62 – 87)</td>
<td>5.9 mM (0.03%)</td>
<td>1.8 mM (0.03%)</td>
<td>0.006 mM (0.0005%)</td>
<td></td>
</tr>
<tr>
<td>Healthy younger volunteers</td>
<td>35</td>
<td>(25-35)</td>
<td>2.5 mM (0.01%)</td>
<td>0.5 mM (0.01%)</td>
<td></td>
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</tr>
</tbody>
</table>

**Significant increase in taste thresholds between YV & OV and between OV & OP** (p<0.001 to p<0.05)
Taste Thresholds: Age & Health

**Salt Taste Detection Thresholds**

- Frequency (%)
- Salt (NaCl) Detection Threshold (mM)
- 0.08, 0.2, 0.7, 2.1, 6.3, 18.9, ≥56.8
- Older Volunteers (%) and Older Patients (%)

**Umami (glutamate) Detection Thresholds**

- Frequency (%)
- Umami (MSG) detection threshold (mM)
- 0.08, 0.2, 0.7, 2.1, 6.3, 18.9, ≥56.8
- Older Volunteers (%) and Older Patients (%)

**Bitter (quinine) Detection Thresholds**

- Frequency (%)
- Bitter (quinine) detection threshold (mM)
- 0.0008, 0.002, 0.005, 0.013, 0.03, 0.08, ≥0.2
- Older Volunteers (%) and Older Patients (%)
WHAT ABOUT AROMA: Ortho & Retronasal?

What are the impacts of ageing on odour perception?

- Diminished olfaction with age more common than taste decline
- Effects > 50% of adults 65–80 yrs; ca. 75% of adults > 80

Olfactory Detection Thresholds with SNIFFIN’ Sticks

- SNIFFIN’ Sticks of butanol; 3 AFC

Younger group (20 – 40 yrs)
Average = 0.03 mg/L

Older group range (65+ yrs)
Average = 0.35 mg/L

14 x higher
Supra-threshold Aroma Perception

• Caramel flavours in sweetened milk at supra-threshold levels

• Both ortho-nasal (smell) and retro-nasal (flavour in mouth) perception were assessed to determine...

JND: How much does flavour need to be increased before a younger and older consumers can detect any change?
Lots of Younger people noticed small increases.

Lots of Older people need more to notice a difference.
WHAT ABOUT TEXTURE?

Generally accepted increase in preference for foods that are easier to breakdown & swallow with age
Sensory Perception with Ageing: Key Findings

- Taste perception declines with ageing, with sweetness most preserved.
- Odour and flavour thresholds are generally affected by ageing, although the extent is stimulus specific.
- Thickness and mouth coating perception not or less influenced by ageing.
- Older people can detect milk-based mouth drying to a greater extent than younger people.
DEVELOPING FOODS FOR OLDER PEOPLE: Taste Enhancement of Food for Older Hospital Patients using natural ingredients
Development of Fortified Foods

The effect of macro- and micro-nutrient fortification of biscuits on their sensory properties and on hedonic liking of older people

Roussa Tsikritzi, Paula J Moynihan, Margot A Gosney, Victoria J Allen and Lisa Methven**

The Effect of Nutrient Fortification of Sauces on Product Stability, Sensory Properties, and Subsequent Liking by Older Adults

Older Adults & Sensory Challenges

• Taste & Flavour Enhancement
  • Do it for more dependent older adults
  • Use a “real food” approach

• Nutrient Fortification (Protein)
  • Need to overcome sensory negatives
  • Need to ensure familiarity & congruency

• Need Better Understanding of Appetite control
• More focus on Texture for Older adults
• Need Better understanding of sensory/ nutrient feedback mechanisms
• Understand & Modify older adults emotional food experiences
Thanks

- Our Volunteers
- Dr Maria Dermiki
- Dr Lisa Methven
- Prof Margot Gosney

- Project & PhD Students
- Royal Berkshire Hospital NHS
- MMR Sensory panel
READING’S APPROACH:

• Oral Nutritional Supplements: making these more palatable so that they are consumed more
• Tastier Food: enhancing the taste of food by maximising naturally occurring tastants
• Energy Dense Foods: developing energy dense foods for use in hospitals & care homes
• Improvements to Thickened drinks: to help those with swallowing difficulties
• Micronutrient deficiencies - investigating if correcting these can improve taste perception
• 24/7 Food: evaluating if 24/7 food provision is beneficial