Impact of BMI and gender on cross-modal interactions in custard desserts

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INTRODUCTION
Food perception and liking are the result of multiple sensory modalities (Delwiche, 2004; Small & Prescott, 2005). Among all, the olfactory functions play a major role in perceiving food sensory properties and on acceptability, the differences in sensory perception and their interactions with other modalities are poorly studied in relation to Body Mass Index (BMI) and gender (Richardson et al 2004; Stafford & Welbeck 2011). Only recently it has been suggested that the cross modal interactions occurs differently in relation to BMI in women subjects (Proserpio et al. 2016).

AIM
The aim of the present study was to investigate food cross-modalities interactions by examining whether adding butter aroma to a model custard dessert affects differently the perception of sensory properties and the acceptability in normal weight (NW) and obese (OB) subjects of both sexes.

MATERIALS AND METHODS
Subjects
91 subjects completed the study. Obese subjects were recruited among patients referred to the Istituto Auxologico Italiano (Milan, Italy). Normal-weight subjects were recruited among the students and the employees of the Faculty of Agriculture and Food Sciences of the University of Milan (see demographics in Table 1).

Table 1. Characteristics of study participants

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<th>Normal-weight (n=53)</th>
<th>Obese (n=38)</th>
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<tr>
<td>Age (years)</td>
<td>41.64 ± 6.22</td>
<td>47.36 ± 10.02</td>
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<td>BMI (kg m-2)</td>
<td>22.03 ± 2.14</td>
<td>37.52 ± 5.07</td>
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Stimuli
Samples consisted of 3 different formulations of custard dessert made with custard powder (Biaf Dofour S.p.a., Novi Ligure, Italy, 75 g of custard powder were added to 350 mL of skim milk to make the standard custard (ST). The experimental samples were prepared by adding either 0.05% [B1] or 0.1% [B2] of butter aroma (Flavourart, Oleggio, Italy) to the standard custard.

Procedure
Session 1: liking assessment of the custard samples (LAM scale; Schultz & Cardello, 2001)
Session 2: intensity assessment of a series of sensory properties (sweet taste, vanilla butter flavors, and creaminess) (gLMS,Bartoshuk, 2000).

RESULTS
The addition of butter aroma produced a significant (p<0.05) increase in butter flavor perception in B1 and B2 independently from subjects’ BMI and gender (data not shown). However, the addition of butter aroma elicited odor-taste, odor-flavor and odor-texture interactions only in OB.

Comparing Figure 1a and 1b, clear hedonic differences were observed between NW and OB subjects. The sample with the highest concentration of butter aroma (B2) was preferred significantly more by OB subjects than by NW subjects for both sexes (p<0.0001).

The sweetness perception was not affected in NW subjects (Figure 2a) by adding butter aroma. On the contrary, OB subjects (Figure 2b) perceived the modified samples as sweeter (B1; p<0.01; B2; p<0.001) than ST sample. Moreover, OB women provided higher scores to B1 compared to OB men (p<0.05).

Comparing Figure 2a and 2b, clear differences were observed between NW and OB subjects. B2 was perceived as significantly sweeter by OB subjects than by NW subjects for both sexes (women: p<0.0001; men: p<0.05).

Vanilla flavor perception was not affected in NW subjects (Figure 3a) by adding butter aroma. On the contrary, OB subjects (Figure 3b) perceived B1 and B2 with a more intense vanilla flavor than ST sample (women B1 and B2: p<0.0001; men B1: p<0.001; B2: p<0.01). Moreover, OB women provided significant higher scores than men to B2 (p<0.05).

Comparing Figure 3a and 3b B2 sample was perceived as significantly more intense only by OB women than by NW women (p<0.01).

The addition of butter aroma did not influence also the creaminess perception in NW subjects (Figure 4a), while OB subjects (Figure 4b) perceived the B2 sample significantly creamier than the ST (both women and men p<0.001).

CONCLUSION
Obese subjects seemed to pay more attention than normal weight subjects to stimului signaling high-calorie products. The addition of the butter aroma, without adding calories, increased the liking and the sensory perception of all the sensory characteristic more in the obese subjects than in the control group. Understanding cross-modal interactions in relation to nutritional status and gender is interesting in order to develop new food products with reduced sugar and fat, which are still satisfying for the consumer. This could have implications in reducing caloric intake and tackle the obesity epidemic.

REFERENCES

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