PENNSTATE 1855

Using Rejection Thresholds to Explore Segmentation and the Role of Eating Style in Solid Compound Chocolate

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Background

• Classical threshold methods often fail to predict liking.

• The rejection threshold method combines dose-response and hedonic measures to assess *how much is too much*?

• All previous applications of this method had been in liquid food systems (i.e. Prescott et al., 2005; Lee et al., 2008; Saliba et al., 2009; Harwood et al., 2012).

• For chocolate especially, rates of mastication and melting may influence flavor release and therefore perception and preference ratings.

• The objective of this study was to investigate the effects of self-identified preference for milk or dark chocolate as well as eating style on group rejection thresholds for bitterness in solid compound chocolate.

• A secondary aim of this study was to confirm the utility of the rejection threshold method for use with more complex, solid samples.
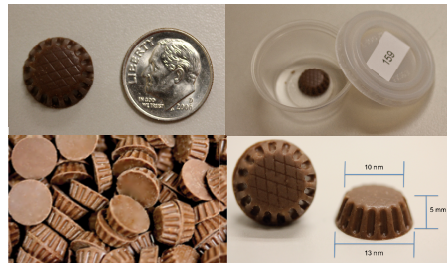
Methods

• Overview – Sucrose octaacetate (SOA) was selected as the bitter stimulus because it is GRAS and there is minimal evidence of genetic variation in its perception (Boughter & Whitney, 1993; Hansen, 2006; Harwood et al., 2012). Data was collected in individual test booths in the Penn State Sensory Evaluation Center using Compusense *five* (Guelph, ONT). Procedures were exempt from Institutional Review Board review by the Penn State Office of Research Protections under the wholesome foods/approved food additives exemption in 45 CFR 46.101(b)(6).

• Participants – 85 reportedly healthy, non-smoking individuals were recruited from the Penn State campus and surrounding area (State College, PA). 63 women and 22 men, aged 18 – 45 years participated. See table below for self-endorsements when asked about preference when eating solid chocolate and eating style. All participants provided informed consent and were paid for their time.

• Eating styles (Based on Carvalho-da-Silva et al., 2011):
  ➤ Thorough Chewers: 'I chew the chocolate until smooth before swallowing.'
  ➤ Quick Chewers: 'I chew the chocolate quickly.'
  ➤ Melters: 'I suck on/melt the chocolate in my mouth before chewing/swallowing.'

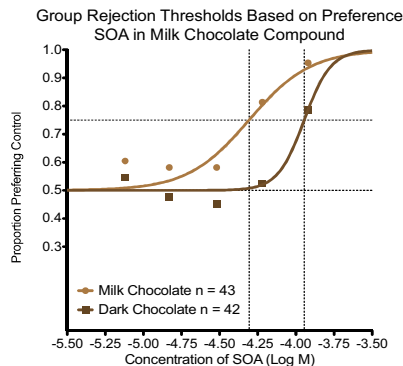|	Total n	n Preferring Milk Chocolate	n Preferring Dark Chocolate
Thorough Chewers	45	26	19
Quick Chewers	8	2	6
Melters	32	15	17
All Participants	85	43	42

• Procedure – A two-alternative forced choice (2-AFC) preference test was carried out according to ASTM method E-2263. Five pairs of samples were presented to each participant, each pair containing a spike and a blank. Pairs were presented in order of ascending concentration. Within each pair, sample order was randomized. Participants evaluated pairs one at a time by tasting both samples and indicating which they preferred before moving on to the next pair. A "no preference" option was not provided.

Materials

• Stimuli – Solid milk chocolate-flavored compound coating was purchased from a commercial source (Chocoley.com), melted, and spiked with varying concentrations of SOA: 0 (blank), 7.5, 15, 30, 60, and 120µM. Concentrations were selected based on published rejection thresholds for SOA in chocolate milk (Harwood et al., 2012) and adjust via informal piloting. Samples were then molded, cooled, and stored at ambient temperature (23°C) for two weeks prior to testing. Individual samples (~.63g) were presented in clear plastic soufflé cups labeled with random 3-digit blinding codes. Only one piece at each concentration was presented to prevent re-tasting.


Results

Group Rejection Threshold - All Participants
SOA in Milk Chocolate Compound

Rejection threshold in solid compound chocolate (81.5 µM)

Rejection threshold in fluid chocolate milk (5.86 µM) (Harwood et al., 2012)

Results

Group Rejection Thresholds Based on Preference
SOA in Milk Chocolate Compound

— Milk Chocolate n = 43
— Dark Chocolate n = 42

Summary of Group Rejection Thresholds:

Group	n	Rejection Threshold	p-value
All Participants	85	81.5 μM	n/a
Milk Chocolate Preferring	43	43.9 μM	0.011*
Dark Chocolate Preferring	42	113.5 μM	
Thorough Chewers	45	70.0 μM	0.144
Quick Chewers	8	-	
Melters	32	93.3 μM	

* Statistically significant between groups
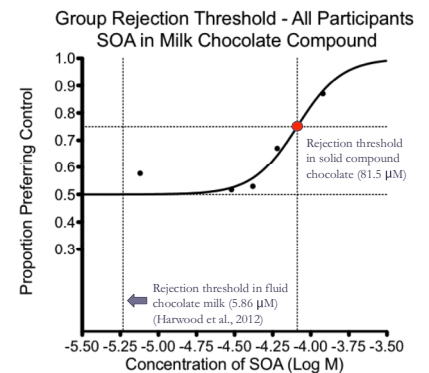
Discussion and Conclusions

• As expected, as the concentration of SOA increased, rejection of spiked samples also increased.

• Consistent with rejection thresholds in chocolate milk, there was a significant difference between rejection thresholds for the milk and dark chocolate preferring groups (p = 0.0106). Here, rejection thresholds were much higher than in chocolate milk (43.9 and 113.5µM compared to 3.95 and 9.0µM), which may be due to the complexity of the stimuli.

• Dark chocolate preferring group rejection threshold was ~2.58 times higher than the milk chocolate preferring group. This difference is not due to the ability to detect SOA as detection thresholds were previously found to be functionally identical across these two segments (Harwood et al., 2012).

• No association was found between eating style and chocolate preference (Fisher's exact test, p = 0.36).

• Our study failed to find differences in rejection thresholds across eating styles, although this may be due to the small size of the samples. It remains possible that given larger samples, differences in mastication/melting may influence preference ratings.

• Partially confirmed findings of Carvalho-da-Silva and colleagues (2011) on chocolate eating style classification. Differences are possibly due to self-identification rather than EMG/EEG measurements, sample size, and/or cultural differences

Acknowledgements