Influence of Mouth Behavior and Bitterness Sensitivity on Consumer Acceptability of Packaged Salads

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Introduction

Vegetable consumption, especially bitter vegetables, has been implicated in the reduction of dietary related chronic conditions, such as diabetes and cardiovascular disease; however, the majority of adults in the United States do not consume enough vegetables [1,2]. With the growth in packaged salad kit sales and the recent inclusion of bitter vegetables, packaged salads provide a convenient opportunity for individuals to increase their vegetable consumption. Bitter vegetables are found in many packaged salads, but the bitter taste is a key deterrent of vegetable consumption.

Mouth Behavior (MB), which is the way consumers manipulate food in their mouth as they eat, is another important component of understanding consumer acceptability because an individual's MB determines the type of food textures they prefer. The four MB groups are Chewers, Crunchers, Smooshers, and Suckers. While Chewers and Suckers primarily like to use their teeth to breakdown food, Smooshers and Suckers primarily like to move food between the tongue and roof of the mouth to breakdown food [3].

The objectives of this study were to determine if MB and/or bitterness sensitivity influence consumer acceptability of packaged salads.

Methodology

Consumers and Samples

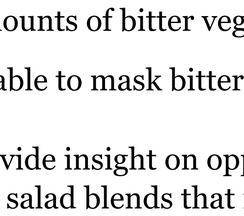
- n = 101
- Salad samples
  - Eat Smart Sweet Kale
  - Eat Smart Wild Greens & Quinoa
  - Fresh Express Caesar
  - Taylor Farms Asian Chopped
- Bitterness strips
  - Control
  - Phenylthiocarbamide (PTC)
  - Sodium benzoate
  - Thiourea
  - n-propylthiouracil (PROP)

Table 1. Ingredients of packaged salad kits that were evaluated

Component	Eat Smart Sweet Kale	Eat Smart Wild Greens and Quinoa	Fresh Express Caesar	Taylor Farms Asian Chopped
Dressing	Poppyseed	Avocado Herb	Classic Caesar	Seasame Ginger
Vegetables	Broccoli Cabbage, Green Brussels Sprouts Kale Chicory	Carrots Cabbage, Red Kale Beet Greens Broccoli Stalks	Romaine Lettuce	Cabbage, Savoy Cabbage, Green Romaine Lettuce Carrots Celery Green Onion
Toppings	Cranberries, Dried Pumpkin Seeds, Roasted	Feta Cheese Almonds Quinoa, Crispy	Parmesan Cheese, Aged Croutons, Savory Garlic	Wonton Strips Almonds, Sliced, Toasted Cilantro

Test Design

1. Consumers received 4 salad samples in randomized order
2. Consumers received 5 bitterness strips in randomized order
3. Consumers used the JBMB® typing tool to determine their MB



Results

Table 2. Means[1] for the 9-point hedonic scores of the overall opinion of the four salads evaluated

Salad	All Subjects	Normal Taster	Standard Supertaster	Recessive Supertaster	Dominant Supertaster	PROP Taster
Eat Smart Sweet Kale	6.84[a]	6.85[a]	6.29[ab]	7.27[a]	6.88[a]	6.78[a]
Eat Smart Wild Greens & Quinoa	5.58[c]	6.00[a]	4.86[b]	5.73[bc]	5.32[c]	5.64[b]
Fresh Express Caesar	6.10[b]	6.36[a]	6.14[ab]	5.40[c]	6.09[b]	6.01[b]
Taylor Farms Asian Chopped	6.90[a]	6.77[a]	6.71[a]	6.87[ab]	7.15[a]	6.83[a]

[1]Means sharing superscripts in a column do not differ at $p<0.05$



Figure 1. PCA biplot of overall liking between MB and packaged salad kit product

Table 3. Means[1] for the 9-point hedonic scores of the bitterness of the four salads evaluated

Salad	All Subjects	Normal Taster	Standard Supertaster	Recessive Supertaster	Dominant Supertaster	PROP Taster
Eat Smart Sweet Kale	5.72[a]	5.67[ab]	5.57[a]	6.07[a]	5.68[a]	5.81[a]
Eat Smart Wild Greens & Quinoa	5.00[b]	5.18[b]	4.07[b]	5.40[ab]	5.00[b]	5.04[b]
Fresh Express Caesar	5.65[a]	6.10[a]	5.43[a]	4.93[b]	5.53[ab]	5.56[a]
Taylor Farms Asian Chopped	5.71[a]	6.00[a]	5.14[a]	5.20[ab]	5.82[a]	5.64[a]

[1]Means sharing superscripts in a column do not differ at $p<0.05$

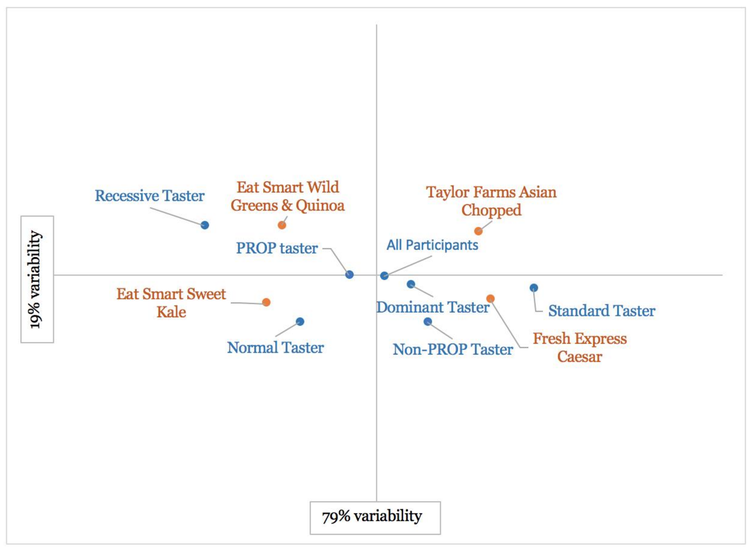


Figure 2. PCA biplot of overall liking between bitterness sensitivity and packaged salad kit product

Conclusion

- Role of Mouth Behavior (MB) in acceptance
  - Appears to have a textural component to liking of the salads
  - Smoosher (n=8) and Sucker (n=4) segments were supplemental data because such small segments
- Role of bitterness in acceptance
  - Bitter sensitive individuals tended to like the packaged salads that contained higher amounts of bitter vegetables
  - Dressing able to mask bitterness
- Jar scores provide insight on opportunity to create custom salad blends that meet needs of consumers based on differences in bitterness sensitivity and MB groups

References

[1] Liu, R.H. (2003). Health benefits of fruit and vegetables are from additive and synergistic combinations of phytochemicals. *American Journal of Clinical Nutrition*, 78, 517S-520S.
[2] U.S. Department of Agriculture, U.S. Department of Health and Human Services. (2015). 2015-2020 Dietary Guidelines for Americans. 8th edition. Available at: https://health.gov/dietaryguidelines/2015/guidelines/. Accessed 20 May 2018.
[3] Jeltema, M., Beckley, J., Vahalik, J. (2016). Food texture assessment and preference based on Mouth Behavior. *Food Quality and Preference*, 52, 160-171.

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