AMERICAN JOURNAL OF PSYCHOLOGICAL RESEARCH

Volume 3, Number 1
Submitted: May 3, 2007
Revisions: May 25, 2007 and June 25, 2007
Accepted: August 20, 2007
Publication Date: September 1, 2007

Sensory Acuity and Binge Eating

Sarah C. Sitton and Autumn F. Sullivan

St. Edward's University

email address: sarahs@stedwards.edu

ABSTRACT

While multiple cues govern eating behavior, the senses of taste and smell serve as important stimuli to appetite, and may be especially salient for persons diagnosed with eating disorders. If heightened abilities for taste and smell trigger greater than average urges to eat, they might also be expected to lead to increased consumption, even binge eating. In the present study we measured each of 35 undergraduates (ages 19-24) for acuity of taste and smell, body mass index (BMI), and tendency toward binge eating. However, rather than correlating with increased consumption, above average ability to taste showed a negative relationship with BMI. That is, increased numbers of taste buds were associated with lower weight. We found no relationship between taste sensitivity and food preferences or between taste and smell. Results are discussed in terms of cue reactivity to food and factors determining satiety.

INTRODUCTION

In 1931 A. F. Fox discovered that he was among the one-quarter of the population who could not taste the chemical Propylthiouracil (PROP) which many found horribly bitter. To describe his condition he coined the term "taste blind." Taste blind individuals have 25% fewer taste buds than those who can discern the chemical. At the other extreme, the one-quarter of the population classified as "supertasters" have greater than average numbers of taste buds on the tips of their tongues, the fungiform papillae, which could render bitter foods such as broccoli, Brussels sprouts, and grapefruit unpalatable (Logue, 1985).

If this is the case, one would expect supertasters to avoid fruits and vegetables in preference for calorie-dense fatty, sugary foods and to gain weight as a result. However, Tepper and Ullrich (2002) found that middle-aged female supertasters actually had lower body mass indexes than nontasters or medium tasters. They explained this result by suggesting that in addition to avoiding fruits and vegetables, supertasters also shunned foods high in fat and sugar. This explanation has been challenged by others, however, who point out that supertasters show no aversion to bitter foods such as dark chocolate if they are mixed with other ingredients including milk and sugar. And, in fact, chocolate confections are common binge foods (Mattes, 2004).

While research does indicate that supertasters are more sensitive not only to the bitter and sour tastes in foods (Prescott, Soo, Campbell, & Roberts, 2004) but also to capsaicin, the component that makes peppers hot (Tepper & Nurse, 1997), and the textural sensation of red wine (Pickering & Gordon, 2006), there is little evidence that increased sensitivity influences dietary choices. For example, Yackinous and Guinard (2002) found scant difference between supertasters and nontasters with regard to the consumption of bitter fruits and vegetables, and Drewnowski and his colleagues found that supertasters did not differ from nontasters in liking for sweets (Drewnowski, Henderson, Shore, & Barratt-Fornell, 1997) or fat/sugar mixtures (Drewnowski, Henderson, & Barratt-Fornell, 1998).

Other researchers have begun to explore the connection between sensory acuity and eating disorders. Roessner, Bleich, Banaschewski, and Rothenberger (2005) reported an olfactory deficit for anorexic patients. That is, anorexic individuals tended to be "smell blind." Missing the powerful olfactory stimuli which normally encourage eating, they don't experience hunger. Drewnowski et al. (1998) suggest that changes in metabolic and/or endocrine systems brought about by fasting can cause the loss of both smell and taste.

And while both taste and olfactory cues can trigger binges in those diagnosed with Bulimia Nervosa (Staiger, Dawe, & McCarthy, 2000), prolonged purging can actually result in loss of taste (Rodin, Bartoshuk, & Peterson, 1990). This may account for differences in hedonic responses to food between those with Bulimia Nervosa (BN) and others with Binge Eating Disorder (BED), a condition characterized by bingeing without purging. Mitchell, Mussell, and Peterson (1999) discovered that persons with BED rated the taste, smell and texture of food more positively than those with BN. One would then expect greater acuity of smell and taste to stimulate eating, even bingeing, in those with BED.

The present study assessed the hypothesis that super sensitivity to food tastes and/or odors correlates with tendencies toward binge eating as well as higher BMI's. We also tested the hypotheses that supertasters have superior senses of smell and that they show greater aversion to foods with intense or bitter flavors than nontasters.

METHOD

Participants

Thirty-five volunteers were recruited from students in psychology classes in exchange for extra credit. There were five men and 30 women. Their ages ranged from 19 to 24 (*M* = 20.29, *SD* = 2.35.)

Procedure

Since assessment of taste sensitivity by a taste test for propylthiouracil (PROP) has on a few occasions resulted in serious adverse reactions, super tasting ability was assessed through a count of the fungiform papillae taste buds instead. Participants swabbed their tongues with blue food coloring and imprinted the tip of the tongue on white paper. Taste buds were counted within a 4 mm circle placed on this imprint.

Olfactory ability was measured by the University of Pennsylvania Smell Intensity Test (UPSIT) which asks participants to identify twelve different odors (Doty, 1989) through a scratch and sniff procedure. Participants then responded to a locally constructed food preference test. See Appendix for this test. In addition, scores were tabulated for the Binge Eating Scale (Gormally, Black, Daston, & Rardin, 1982) and Body Mass Indices (BMI) were recorded for each participant based on self-report of height and weight.

RESULTS

We used Pearson Product Moment Correlations to assess the degree of relationship between abilities of taste and smell and eating behavior. There was a significant negative correlation between the number of taste buds (*M* = 23.94, *SD* = 6.95) and BMI (*M* = 22.65, *SD* = 5.57), $r = -0.404$, $p = 0.016$. That is, higher numbers of taste buds were associated with lower body mass. While the relation between taste buds and Binge Eating Scale (*M* = 27.77, *SD* = 6.02) scores narrowly missed significance, $r = -0.32$, $p = 0.062$, none of the other correlations came close. The number of taste buds did not correlate with olfactory acuity, $r = 0.20$, $p = 0.25$ (*M* = 10.77, *SD* = 0.81) nor with food preferences, $r = -0.125$, $p = 0.51$.

DISCUSSION

Consistent with the research by Tepper and Ullrich (2002) which found that middle-aged women with the highest numbers of taste buds had the lowest BMI ratings, the present study demonstrated the same effect for college-aged participants. Supertasters consume less food rather than more. It may be that their experience of greater intensity of flavors produces satiety more quickly, or that other dietary differences in their eating habits contribute to lowered consumption. For example, some studies indicate that supertasters select higher levels of fat in their diets than nontasters (Kamphuis & Westerp-Plantenga, 2003; Yackinous & Guinard, 2002). If high fat diets produce more rapid feelings of satiety than low-fat diets, this could explain their consumption of fewer calories.

The failure to find a relation between taste and smell may well be the result of a ceiling effect on the UPSIT scale. Almost all participants correctly identified 11 or 12 of the 12 aromas. Additional research with a more sensitive measure of olfactory ability is needed to test for any positive associations with taste sensitivity.

The lack of differences in food likes and dislikes is more puzzling. It had been suggested that supertasters would not enjoy and would not consume foods with bitter flavors. However, we found no differences between supertasters and nontasters on self-reported liking for broccoli, dark chocolate, beef liver, black coffee, cucumbers, Brussels sprouts, black olives, grapefruit, chili peppers or cilantro.

It appears that taste sensitivity is by no means the only determinant of eating behavior or, indeed, even the most important one. Beverly Tepper, quoted in an article by Flaherty (2006), suggests that additional factors that determine what we eat include “food adventurism,” or the motivation to try new foods, and dietary restraint which is the ability to control impulsive eating. Certainly, food choices reflect a complex array of physiological, psychological and cultural processes and are not determined by the taste of food alone.

APPENDIX

Food Preference Test

On a scale of 1-5, with 1 being strongly disagree(SD) and 5 being strongly agree (SA), please rate the following foods for how much you enjoy consuming them.

I enjoy	SD	D	N	A	SA
Broccoli	1	2	3	4	5
Dark chocolate	1	2	3	4	5
Beef liver	1	2	3	4	5
Black coffee	1	2	3	4	5
Cucumbers	1	2	3	4	5
Brussels sprouts	1	2	3	4	5
Black olives	1	2	3	4	5
Grapefruit	1	2	3	4	5
Chili peppers	1	2	3	4	5
Cilantro/Coriander	1	2	3	4	5

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