The Journal of Undergraduate Neuroscience Education (JUNE), Spring 2024, 22(3):A177-A184

ARTICLE
Use of Buzz Buttons to Illustrate Taste Perception Principles in a Sensation and Perception Laboratory Exercise

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https://doi.org/10.59390/BCLX3929

The buzz button is an edible flower that induces a tingling, electric sensation in the mouth and alters the perception of different flavors. The buzz button's taste-altering effect is thought to be caused by the bioactive compound spilanthol. The present article details a laboratory exercise that explores taste perception principles using the buzz button in an undergraduate Sensation and Perception course. A detailed step-by-step guide for the laboratory exercise is included along with analyzed student results. Students first sampled various food items that spanned the different taste sensations (i.e., salty, sweet, sour and bitter) and then rated their perceived taste intensity on a scale from one (not intense) to ten (very intense). Next, students consumed a buzz button and resampled each food item as well as re-rated their perceived taste intensities. It was found that students' perceived taste intensities for sour items and sweet items were decreased after consuming the buzz buttons. Additionally, students also completed a post-activity survey in which they indicated that this was an interesting and enjoyable exercise. This highlights the value of this particular hands-on demonstration in teaching about the connection between taste and tactile perception.

Key words: buzz button, Spilanthes acmella*, spilanthol, taste, touch, sensation, perception*

Since their emergence in the United States in mid-2000s, buzz buttons have "electrified" dishes across the country. These peculiar edible flowers were named Esquire's 'Cooking Ingredient of the Year' in 2007, on their annual list of 100 "remarkable people, things, ideas, and places that [they] think will be making an impact on our culture" (Esquire, 2007). Over the last decade, their popularity has surged, notably amplified by social media platforms like YouTube and TikTok, which have enabled near-instantaneous sharing of the buzz button's unique effects. For example, one of the higher profile uses of the buzz button is in the Verbena cocktail at The Cosmopolitan of Las Vegas' Chandelier Bar (Latham, 2019). Despite its removal from the official menu, the cocktail raked in a staggering $9.4 million in sales in 2019, a testament to its enduring success and notoriety (Ramirez, 2019). While the use of buzz buttons in American cuisine has remained largely experimental, they have found their way into diverse dishes across the country, such as featuring in the 'Blackberry Buzz Rita' cocktail at the nationwide chain TGI Fridays, and can even be purchased for home use via online retailers (Enjioli, 2023; Donnelly, 2015; "It's shocking, but you eat it", 2009; Rogers, 2010).

Buzz buttons (also known as electric buttons, electric daisies, or Szechuan/Sichuan buttons), derive their name from their striking effects on taste perception (Freeman, 2019). When consumed, they impart a grassy, pungent taste while inducing a tingling, numbing, and cooling sensation, along with heightened salivation (Freeman, 2019). Originating from the *Spilanthes acmella* plant (commonly known as *Acmella oleracea*; otherwise known as the toothache plant, eyeball plant, spot plant, paracress, or jambu), these small, cone-shaped yellow flowers are native to tropical and subtropical regions in South America and Asia, including Brazil and India (Barbosa et al., 2016; Dubey et al., 2013; Freeman, 2019; Vishwanathan et al., 2021). Despite their recent introduction to the United States and Europe, buzz buttons have regularly been used in traditional herbal medicine within their native countries for their pain-relieving, anti-inflammatory, anti-fungal, and gastroprotective properties (Dubey et al., 2013; Purushothaman et al., 2018). These therapeutic benefits are now being extensively studied (Abdul Rahim et al., 2021; Boonen et al., 2010; Dubey et al., 2013; Prachayasittikul et al., 2013; Vishwanathan et al., 2021) and there are currently a handful of products that use buzz buttons components on the market, including in oral analgesics and in anti-wrinkle/anti-aging products (Barbosa et al., 2016; Silveira et al., 2018).

The main bioactive compound in buzz buttons is spilanthol (also known as affinin; molecular formula: $C_{14}H_{23}NO_6$; IUPAC name: (2E,6Z,8E)-N-isobutyl-2,6,8-decatrienamide; Barbosa et al., 2016). While the exact mechanism of action remains unknown, research suggests that spilanthol might enhance perceived saltiness (Cayeux et al., 2023; Xu et al., 2019). For example, studies in mice suggest spilanthol potentially modulates salt taste receptors, possibly by inhibiting 2-pore-domain potassium (K2P) channels (Xu et al., 2019). This inhibition is believed to heighten sensitivity to salt, amplifying the perceived saltiness of food. Moreover, research on similar bioactive compounds (i.e., hydroxy-alpha-sanshool found in *Xanthoxylum* plants) suggests that they also have the ability to activate pain and touch receptors by inhibiting different types of potassium channels (e.g., pH-sensitive two-pore

KCNK channels; Bautista et al., 2008). This mechanism could account for the numbing sensations experienced when eating these types of compounds. Furthermore, recent research has revealed that spilanthol interacts with Transient Receptor Potential Vanilloid 1 (TRPV1) receptors, responsible for temperature and pain perception in sensory neurons, such as those in the trigeminal nerve (Nomura et al., 2013; Paolla Raimundo E Silva et al., 2023; Starkenmann et al., 2011). Spilanthol is believed to block this receptor, reducing the sensation of pain. Taken together, these studies shed light on spilanthol's impact on taste and somatosensory perception.

Relatedly, in a typical undergraduate Sensation and Perception course, food perception is often discussed as an interplay between smell and taste (e.g., retronasal olfaction; Wolfe et al., 2020). Somatosensory properties, however, such as pain, thermal and kinesthetic signals, which contribute to “mouthfeel”, also influence our perception of food and are discussed less frequently (Cayeux et al., 2023; Slocombe et al., 2016; Viana, 2011). These tactile components of food perception are carried by the trigeminal nerve (Cayeux et al., 2023; Viana, 2011). A meta-analysis by Braud and Boucher (2020) examined the relationship between tactile sensations (such as mechanical, thermal, chemical and pain signals) and taste perception, demonstrating their influence on gustatory components (such as tastant release, tastant detection, taste transduction and the trigemino-gustatory pathway). While they did not directly investigate buzz buttons, their findings underscore the significant impact of salivary conditions and cooling properties on taste, which are sensations experienced when consuming buzz buttons. Furthermore, research has shown that other cooling compounds, such as menthol, can change the perceived sweetness and sourness of yogurt (Koskinen et al., 2003). Thus, incorporating buzz buttons into a classroom experiment could serve as a novel illustration of these properties. Additionally, students often ask questions beyond what they learn about the five taste sensations (i.e., salty, sweet, bitter, sour, and umami), especially regarding the use of spices and other natural products in cooking (like capsaicin in chili peppers). Therefore, experimenting with buzz buttons may be an effective, hands-on way of discussing this topic with a substance that is likely to be unknown and unfamiliar to students (or only encountered via social media).

Moreover, other taste demonstrations in Sensation and Perception courses have been used to great success. For example, the Indian herb *Gymnema sylvestre* and the “Miracle Fruit” (or Miracle Berry) *Synsepalum dulcificum* have been regularly used to engage students in topics about taste perception as the bioactive compounds in these substances directly interact with taste receptors on the tongue (Lipatova & Campolattaro, 2016; Na & Morris, 2021; Schroeder & Flannery-Schroeder, 2005). *Gymnema sylvestre* contains compounds such as triterpene saponins (e.g., gymnemic acids, gymnemasaponins) and a polypeptide (gurmarin), known to block sweet (and possibly bitter) taste receptors, which cause sweet food to taste less sweet (Na & Morris, 2021; Tiwari et al., 2014; Schroeder & Flannery-Schroeder, 2005). Similarly, the miracle fruit contains the bioactive compound miraculin, a glycoprotein that binds to sweet taste receptors but is activated only in the presence of acidity, transforming sour tastes into sweetness (Lipatova & Campolattaro, 2016). Of importance, hands-on, active learning demonstrations like these are extremely valuable in undergraduate science courses, such as Sensation and Perception (for reviews see, Ramirez, 2020; Sandrone & Schneider, 2020). They not only decrease the achievement gaps for underrepresented students in science, technology, engineering and math (STEM) fields but also enhance learning outcomes and critical-thinking skills for all students (Theobald et al., 2020; Kontra et al., 2015).

Therefore, the purpose of this laboratory exercise was to demonstrate the complexity of food perception, especially with regards to the interplay between taste and touch. This article includes detailed instructions for the buzz button laboratory exercise used in a Sensation and Perception course at Worcester State University (WSU), as well as data from student subjects. Since Sensation and Perception is taught at an intermediate level (i.e., 200-level) at WSU (with the only prerequisite being Introductory Psychology), the focus of this activity was on student perceptions of the buzz buttons and a brief review of the neurobiology of taste and touch receptors. Additional activity questions and prompts related to a deeper understanding taste and touch receptors are outlined in the Results and Discussion section for other instructors to adopt depending on the level of course they are teaching.

MATERIALS AND METHODS

Participants

A total of 27 undergraduate students (9 males) enrolled in Sensation and Perception at Worcester State University during the fall 2023 semester completed the activity. This study was approved by the Worcester State University Institutional Review Board and informed consent was given prior data collection. One student elected to not consume the buzz button and, therefore, their data was excluded from the analysis.

Materials

Buzz Buttons

Buzz buttons can be purchased online from a variety of traditional sources, such as Amazon and Etsy, and also directly from restaurant retailers, like Marx Food (https://www.marxfoods.com/Sechuan-Buttons-Buzz-Button). They can be sold either freeze-dried or fresh. When ordering fresh flowers, be mindful of the packaging instructions regarding shelf-life and storage. The potency of a buzz button is quite strong (half of a fresh flower is enough to induce an effect). If using freeze dried flowers, half to one whole flower could be consumed to reach the desired effect. While potent, the effects of the buzz button do not last very long and can range, on average, between a few minutes to 15 minutes. [Author’s note: I purchased and compared the effects of both fresh and freeze-dried buzz buttons. Anecdotally, fresh flowers had more of an effect. I needed to consume a whole freeze-dried buzz button for the same effect as half of a fresh buzz button. For this reason, I chose to use fresh buzz buttons in the experiment detailed below.]

Additional Food Items and Supplies

To assess the impact of the buzz button on taste perception, four different food items were used to start the experiment: salt, sugar, lemon wedges, and broccoli florets (to mimic the four different taste sensations of salty, sweet, sour and bitter; this was based on previous taste demonstrations; Lipatova & Campolattaro, 2016). Additional food items, such as baking chocolate (100% cocoa) and pretzels were chosen for texture novelty and because it was unclear how bitter broccoli would be perceived (therefore, baking chocolate was used as an alternative). The students were also given paper plates and water (to cleanse their palates as needed between food items).

Allergy Risks for Buzz Buttons

Spilanthol is categorized as a flavoring agent according to the National Center for Biotechnology Information (NCBI; National Center for Biotechnology Information, 2023) and the European Food Safety Agency (EFSA; EFSA Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids, 2011) and both classify the levels of daily intake as safe (Freeman, 2019). Additionally, the Flavor and Extract Manufacturers Association (FEMA) recognizes Jambu oleoresin as a Generally Recognized as Safe (GRAS) flavoring agent (Smith et al., 2009). The European Union estimated an average daily intake of 24 µg/person/day for spilanthol, which is below the threshold of concern of 90 µg/person/day (EFSA Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids, 2011). Lastly, the Joint Food and Agricultural Organization of the United Nations (FAO)/World Health Organization (WHO) Expert Committee on Food Additives determined that there was no concern at current intake levels for spilanthol as a flavoring agent (Joint FAO/WHO Expert Committee on Food Additives, 2012).

There have, however, been few human studies on the use of buzz buttons in clinical settings. Therefore, as a precaution, individuals who are pregnant, have prostate cancer, have heart conditions, are using diuretics and/or who are allergic to the Asteraceae/Compositae/Daily family of plants should not consume buzz buttons (Freeman, 2019; Spilanthes acmella, 2022).

Procedure

Prior to beginning the laboratory exercise, the course instructor provided the students with a consent form along with an oral description of buzz buttons and their function (as detailed in the Introduction; students were also shown a fun TikTok® video of the Verbena cocktail in action to highlight the effects of the buzz button in an engaging way). Of importance, at WSU this activity was conducted during the last week of the semester, which meant that students had background knowledge of the neuroscience related to touch, smell and taste (e.g., receptor neurobiology, sensory pathways, etc.) Furthermore, students had already completed several laboratory-style homework and activities related to touch and smell (e.g., two-point threshold, hot and cold discrimination, haptic perception, smell discrimination, etc.). Therefore, the instructor only provided a brief reminder of these topics before introducing the buzz buttons.

In terms of safety, the instructor also provided the following information: “If you are pregnant, have heart problems or prostate cancer, are using diuretic medication and/or have any allergies to leafy plants, you should not eat a buzz button! This activity is completely voluntary, and the effects of the buzz button should last approximately 10 minutes.” Students were also given the nutritional information about all other foods being consumed (and could opt out depending on allergies).

Following the consenting process, the students were briefed about the exercise procedure (this procedure was based off of the one detailed in Lipatova and Campolattaro (2016) for their Miracle Fruit demonstration). Students started by tasting each of the food items and scored their taste perception on a 1-10 scale for salty, sweet, sour, and bitter taste sensations (where 1 was not intense and 10 was very intense; see Supplementary Material). Future iterations of this assignment could also include ratings for the umami taste sensation, as well as have students rate different tactile sensations (e.g., physical temperature, chemical temperature and texture; see the Results and Discussion section for additional information). Students were instructed to consume the items in the order listed on their evaluation sheet. To cleanse their palate, students were given water to rinse their mouth as needed.

Next, the students consumed half of the fresh buzz button. The taste of the buzz button is pungent and herbal (similar to eating grass). While not the most pleasant taste, students were encouraged to chew the buzz button, rather than swallowing it whole, to achieve full effect (note: some students may want to consume more of the buzz button if they do not immediately start experiencing a sensation in their mouth).

Then, the students again ate a piece of each food item (in the same order as before). Following each item, they recorded the perceived taste intensity of each food in the data table prior to tasting the next food. Approximately 45 seconds elapsed between tasting of each food item.

Following data collection, students discussed their results with other members of the class and answered the post-activity survey (see Supplementary Material for the survey and discussion questions). In the survey, students completed three open-ended questions: 1) to detail their experience of the eating the buzz button, 2) to list one way the buzz button altered their food perception and 3) to explain one thing they learned from this activity. Students were also asked about their interest in the activity, whether they enjoyed the activity and if they thought the activity should be used when this class is taught again. These questions used a Likert-type rating scale with responses from 1 (strongly negative) to 5 (strongly positive). For example, for the question about students’ interest in the assignment, the rating scale was from 1 (not at all interested) to 5 (very interested), with 3 being neutral.

For the open-ended discussion questions, students were asked to think about the neurobiology behind these taste perceptions (e.g., what receptors were active) and to discuss individual differences between their group members. In total, this activity took about 30 minutes to complete.

Data Analyses

To assess how buzz buttons altered the taste intensities of different food items, two-tailed paired samples t-tests were performed on the pre- and post-buzz button mean taste ratings for the different taste sensations (e.g., salty, sweet, sour and bitter) for each food item (e.g., salt, sugar, lemon, broccoli, pretzel, and baking chocolate). To correct for multiple comparisons, we used a Bonferroni correction. To account for missing data (as some students did not have ratings for each taste sensation for each food item), we used a pairwise deletion when running the t-tests (this preserves as much data as possible, but means that there may be differing sample sizes for each test run).

Analysis of the quantitative student rating responses in the post-activity survey employed a nonparametric one-sample Wilcoxon signed-rank test, assuming a hypothetical median of 3 (neutral). This is in line with previous research on student learning activities (Bindelli et al., 2021; Stavnezer & Lom, 2019). For the qualitative open-ended questions, the corresponding author categorized student responses based on themes of their experience eating the buzz button, how their food perception was altered and lessons learning from the activity. This data is presented as a percentage of total comments for each category. Statistical analyses were performed using IBM SPSS Statistics (Version 28).

RESULTS AND DISCUSSION

Two-tailed paired samples t-tests on the before and after mean taste intensity ratings for each of the taste sensations for each food item revealed that the only significant changes in taste perception (after applying a Bonferroni correction) were: 1) a decrease in the perception of sweet for sugar ($t(24)=3.79$, $p<.001$) and 2) a decrease in the perception of sour for lemons ($t(23)=4.91$, $p<.001$; see Figure 1). All other comparisons were not significant (see Supplementary Material for the results without a Bonferroni correction).

These results are intriguing and, for the most part, unexpected. Although the exact mechanism of action for buzz buttons is unknown, studies in mice suggest that spilanthol (the main bioactive compound in buzz buttons) may heighten sensitivity to salt by inhibiting salt receptors on the tongue (Xu et al., 2019). We did not see any evidence to suggest that buzz buttons change sensitivity to salt in this study. In fact, these findings suggest that buzz buttons may interact with one's ability to sense sweet and sour substances (as shown by a decrease in the sweet intensity ratings for sugar and a decrease in the sour intensity ratings for lemon). That being said, these results are the first, to my knowledge, to investigate the impact that buzz buttons have on taste perception in humans. Interestingly, it has been found that menthol, another compound that similarly imparts a cooling sensation, also influences sweet and sour perception in humans (although, this research only used yogurt and they found an decrease in sweet perception and an increase in sour perception, which is different than our observed results; Koskinen et al., 2003). While some may view these results as disappointing since they did not replicate previous findings, I believe that this is a fantastic learning opportunity for students. For example, students could discuss the scientific process in more depth (especially with regards to comparing human and animal neuroscience research) and/or, depending on the course level and amount of time devoted to this activity, students

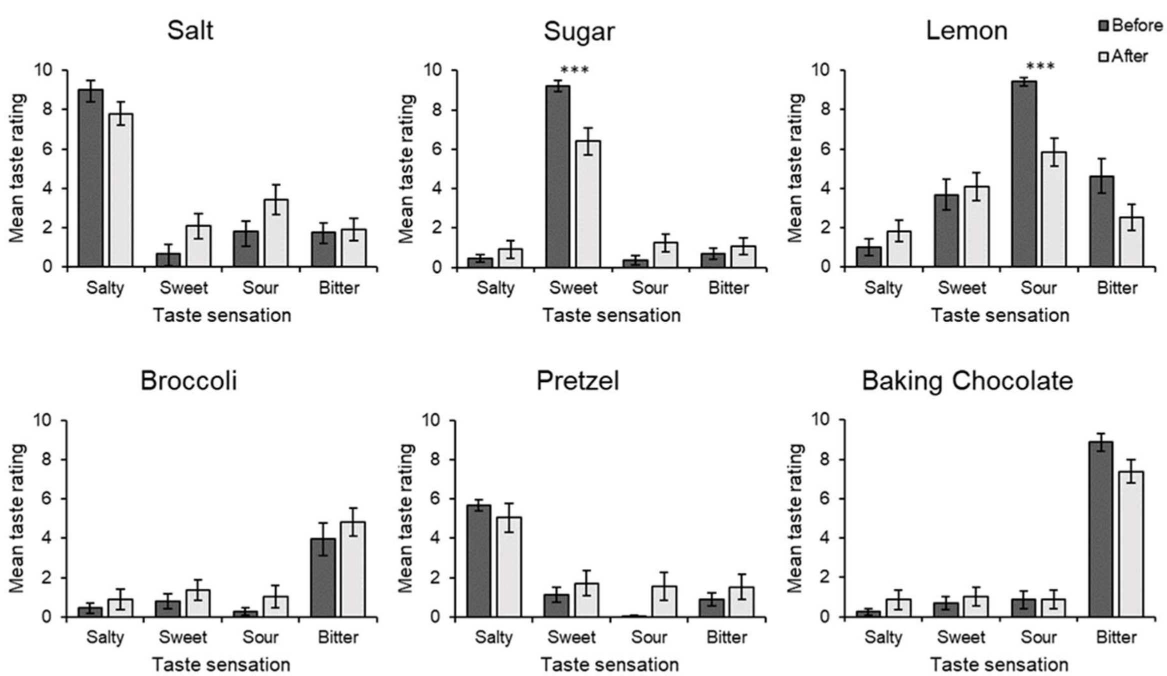

Figure 1. Mean (±SEM) taste ratings for salt, sugar, lemons, broccoli, pretzel, and baking chocolate before and after exposure to the buzz button. Students (n=26) were asked to rate each food item for sweet, sour, salt, and bitter on a scale of 0 (no sensation) to 10 (very intense). *** = $p<.001$; all other comparisons were not significant after a Bonferroni correction.

could also do their own research to form hypotheses about the neurobiology behind buzz buttons (e.g., this could either be done as a pre-activity homework or as part of a post-activity laboratory write-up).

With respect to our results, since this laboratory exercise was purely used as a novel end-of-the-semester learning activity in an intermediate-level undergraduate Sensation and Perception course, there were also some methodological limitations that could have influenced these findings. For example, students did not consume the same amount of each food item or the same amount of the buzz button, the food items themselves varied in texture, and students were not explicitly told to rinse their mouths with water in between every food item. Therefore, taste intensity ratings could have been impacted by both the amount/texture of the food item/ buzz button eaten and/or the previous food items consumed (for example, the roughness or smoothness of food can influence taste perception; Slocombe et al., 2016). Furthermore, the taste of the buzz button itself could have impacted the rating scores, as it has a pungent, grassy taste (in fact one student explicitly noted that “everything tasted off due to the strong bitter sensation”). Lastly, as spilanthol is not the only bioactive compound in buzz buttons (Boonen et al., 2010), it is possible that our observed effects are caused by these additional chemicals (leading to perceptual differences). Instructors who wish to adopt this activity and turn it into a full laboratory exercise may want to control for some of these limitations going forward or ask students to reflect on potential confounds for their own results.

There were also other interesting findings from the students’ qualitative responses to the open-ended questions of “what sensations did you experience when you tasted the buzz button?” and “tell me one thing about how your perception of the food items changed after eating the buzz button?” (n=25; 96% of students who participated in the activity completed these questions). Thirty-six percent of students (n=9 of the total respondents) mentioned that their taste sensations were “enhanced” or “stronger” or “heightened”. As noted previously, we did not actually observe this in our results, as there was a significant decrease in intensity ratings post eating the buzz button. Only 12% (n=3) of students mentioned that their overall experience of the taste sensations “decreased” or were “less intense”. The qualitative data about the specific taste sensations, however, was mixed. In particular, 28% (n=7) of students mentioned that their sour perception changed (5 of these students thought food items were less sour), 24% (n=6) of students mentioned that their sweet perception changed (5 of these students thought food items tasted sweeter), 24% (n=6) of students said their bitter perception changed (with 5 of these students thinking that the food items were more bitter), while only 8% (n=2) of students thought that their salty perception changed (1 student thought that the food items were saltier). From these qualitative ratings, it is clear that students were picking up on changes to their sweet and sour taste perceptions overall (which does align with our quantitative results).

Although, it is still unclear what students meant when they said that the buzz buttons “heightened” their perception of the food, as this was not observed in our quantitative findings (that is, we did not see in increase in taste sensitivity ratings after eating the buzz buttons). It is possible that when students mention the words “heighten” or “enhance” they are indicating that they are paying more attention to what is happening to the tactile sensations their mouth due to the buzz button’s effects (and not necessarily focusing on the specific changes in taste sensations). For example, one student wrote that they were, “really focused on the feeling in [their] mouth and not the taste.” Relatedly, the majority of students (72%, n=18) mentioned that their mouths were “tingling” or “buzzing” after eating the buzz button, while 28% of students (n=7) indicated the buzz buttons led to a numbing or cooling sensation in their mouth (e.g., tongue or lips) and 12% (n=3) said that they had an increase in salivation. One student stated that eating the buzz button “tasted like a dandelion on fire”. Therefore, students could have been more aware of these somatosensory effects instead of the taste sensations.

In terms of the class discussion regarding the neurobiology behind buzz buttons, this was intentionally more open-ended, as the exact mechanism of action is unknown, and because the current activity was used as a fun review opportunity for students at WSU (as it took place at the end of the semester, after students had already learned about touch, smell and taste). When asked about what receptors students thought were impacted when consuming the buzz buttons, many students mentioned potential changes to their sweet and sour receptors based on their individual results. This allowed for a nice refresher on how these receptors worked and provided a brief opportunity to think about how the buzz buttons might change receptor function (e.g., spilanthol may block or alter them). Anecdotally, only a handful of students mentioned that buzz buttons may also potentially influence the touch receptors in their mouths, and they primarily fixated on the cooling and tingling sensations that they experienced. For example, students indicated they felt that eating the buzz buttons was similar to eating pop rocks candy. Interestingly, it is thought that carbonation, like that produced by pop rocks candy, is mediated by sour receptors (Chandrashekar et al., 2009; Liu, 2019). While this observation allowed for a similar brief overview of touch receptor neurobiology (e.g., discussing the receptors related to hot/cold and pain perception and the sensory pathways that bring information from the mouth to the brain), it was not the primary focus of the current activity at WSU. With that in mind, in the future, I would add tactile ratings (e.g., hot/cold, hard/soft, rough/smooth, etc.) to this activity, as well as incorporate food items that looked at these components (e.g., beverages of different temperatures, crunchy chips, etc.). Instructors who wish to adopt this activity may also want to spend more time reviewing the neuroscience behind touch and taste either before or after consuming the buzz buttons.

Despite the fact that this was not the primary focus of this activity, it is clear that it led to an understanding that tactile sensations (e.g., “mouthfeel”) can influence taste perception. For instance, as a response to the open-ended

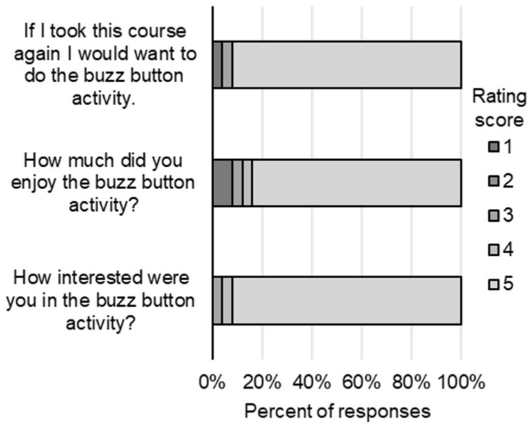

Figure 2. Percentage of student ratings from the self-report post-activity survey responding to their perceptions of the buzz button laboratory exercise (n=25).

question "What is one thing that you learned from this activity?", one student wrote that, "touch (feeling) also plays a part in our experience with taste." Furthermore, 46% of students (n=11 of the total respondents for this question) indicated that they learned that their taste perception could be "manipulated", "altered" or "changed". This connection between touch and taste components is a relatively understudied area of food perception, as the majority of research focuses on the interplay between olfactory and gustatory sensations (Cayeux et al., 2023; Viana, 2011). It is known, however, that the chemosensations carried by the trigeminal nerve can impact flavor (Braud & Boucher, 2020; Slocombe et al., 2016; Viana, 2011). In particular, this pathway carries information about touch, temperature and pain, which can be influenced by both mechanical forces as well as different chemicals (such as those found in a variety of spices). More specifically, transient receptor potential (TRP) channels (such as those modulated by spilanthol; Nomura et al., 2013; Paolla Raimundo E Silva et al., 2023; Starkenmann et al., 2011) and other ion channels located in trigeminal nerve endings have been found to play important roles in sending these somatosensory signals (Viana, 2011).

In addition to incorporating more tactile focused questions and ratings to future versions of this activity, I would also include a lengthier discussion about the role of spices in cooking, especially looking at: 1) how spices have a variety of sensory qualities (e.g., pungency/sharpness, cooling/numbing, burning/warming, itchiness, bubbliness, etc.), 2) how they can lead to different protective responses (such as coughing, tearing, salivation, sneezing, etc.) and 3) how culture may influence exposure to different sensory experiences (as different spices are used around the world). Relatedly, these discussions could also include a more expanded discussion about the role of individual differences in taste perception, such as in a multi-day lesson about taste that includes other experiments (such as using the Miracle Fruit or *Gymnema sylvestre* tea to modify specific taste receptors and how these items impact taste receptor function). Depending on the level of one's class, one could also expand on this activity by having students collect and analyze their own data in a lab report, such as by comparing and contrasting differences in taste intensity ratings for novel types of food items (e.g., comparing sour intensity ratings across different fruits). This buzz button activity could be further adapted to include questions about the food development and manufacturing process (e.g., the role of mouthfeel in consumerism), and how natural products are identified and used in pharmaceuticals (e.g., how spilanthol is being developed for toothpastes and other products).

Lastly, this activity was rated positively by students in the post-activity survey. In this survey, students used a Likert-type rating scale to self-report their perceptions of the buzz button experiment (n=25; 96% of students who participated in the activity completed the survey). To assess these questions, we compared the rankings using a one-sample Wilcoxon signed-rank test to a hypothesized median of 3 (the rating for neutral). Overwhelmingly, students indicated that they were interested in the activity (z=4.81, p<.001), that they enjoyed the activity (z=3.98, p<.001) and that this activity should be used in future Sensation and Perception classes (z=4.49, p<.001; see Figure 2). As this activity was relatively quick (it took ~30 minutes) and inexpensive to conduct (i.e., $40 for 50 fresh buzz buttons and approximately $50 for all other food items and paper goods), it could be incorporated easily into an existing lesson plan on taste perception. Taken together, this buzz button laboratory exercise was an educational, engaging and enjoyable activity that enhanced students' understanding of taste perception in an undergraduate Sensation and Perception course.

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Received December 11, 2023; revised April 27, 2024; accepted May 1, 2024.

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