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Overcoming Obesity in Adolescents: The Mere Exposure Effect and Sparkling Water

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ABSTRACT

This study examined how increasing exposure of sparkling water to adolescents would affect their preference for sparkling water, with the value in exploring a substitution to sugar sweetened beverages that highly contribute to the adolescent obesity epidemic. Currently, adolescents have received minimal exposure to sparkling water and continue to consume unhealthy beverages that present themselves in their everyday lives through their schools, home environments, and activities. This study aimed to fill the gap within the Mere Exposure Effect realm where studies have not been conducted on sparkling water as a stimulus with adolescents. Preference survey ratings from 30 subjects over a ten-day exposure period were collected to examine the effects that drinking one sparkling water daily had on participants' preference for them. The results from the preference rating showed that as a result of exposure, adolescents' preference of sparkling water experienced a statistically significant increase as a result of exposure. The results reinforced other studies' findings that the Mere Exposure Effect increases preference as a result of exposure and proved applicable to the new stimulus of sparkling water directed towards the population of American adolescents. The implications of exposure to sparkling water as a way to create healthier consumption habits for adolescents were discussed, with future research being directed towards finding which flavors would be most effective with implementation.

Introduction

Resulting from innovations and changes in technology, foods and beverages in America have been crafted with increased considerations for enjoyment and taste, neglecting important associated health factors. Following the creation of sugar-sweetened beverages in the nineteenth century and their surge in popularity throughout the twentieth century, many alternatives have been created with goals to retain satisfaction while simultaneously creating a healthier drink. In correlation to their surge in popularity, the craft of combining sparkling water with sugar-sweetened syrups has experienced an increase in the flavors of sodas. However, despite this increase, there has also been an increase in sparkling water consumption, along with the creation of various sugar-free flavors for them as a healthier alternative to their soda counterparts.

Literature Review

Throughout the twentieth century, both an increase in the development of the fast-food industry and unhealthy eating habits in America emerged. While impacting the nation as a whole, the obesity epidemic has unproportionally affected adolescents- anyone between the age range of 13-17. At the start of the 1900s, "good nutrition was part of the public-school curriculum" (Ruskin, 2003). Now, schools have been infiltrated with easy to access junk food through vending machines, and constant advertisements for products such as Pepsi, Mountain Dew, Snickers, and other similar unhealthy foods. The CDC reports that amongst children ages 2-19, the obesity rate has climbed from 5.2 percent in the

early 1970s to 19.3 percent in 2018 (Afful et al., 2020). The obesity epidemic in America has additionally furthered the problem of the diabetes epidemic, where it is currently predicted that 45 to 50 million Americans could have diabetes by 2050, with it specifically "striking younger and younger children" (Ruskin, 2003). The accountability for these nationwide health issues can be directed to many cultural shifts that occurred in the 1970s; lack of parental control, an increase of indoor over outdoor activities, and unhealthy food that benefits producers economically rather than children physically have all contributed to the rise in obesity (Ruskin, 2003).

One factor that plays into both the obesity and diabetes epidemic is sugar sweetened beverages (SSBs), most typically known as sodas or sweetened energy drinks. The CDC defines SSB's as "any liquids that are sweetened with various forms of added sugars" (Center for Disease Control and Prevention, 2021). Some examples of SSBs include regular soda, energy drinks, fruit drinks, and coffee or tea beverages with added sugars. In 2004, Walter Willett, professor of epidemiology and nutrition at Harvard, stated that high-sugar diets lead to the overworking of the pancreas through pumping increasing amounts of insulin, eventually leading to diabetes. His statements support Ruskin's claims on the increase in diabetes as a result of SSBs, and he also states that consuming calories from SSBs will lead to slow weight gain over time, increasing the risk of obesity (2004).

The long-term negative implications of SSBs can be seen amongst studies that focus on adolescent consumption of them. In one study conducted by Katan et al., a group of 641 children ages 4-11 were assigned to an experimental group to consume either SSBs or to the control group to consume similar non-sweetened beverages over 18 months daily. In comparison to the control group who consumed the unsweetened beverages, the children that consumed SSBs had gained more than 2 pounds of additional weight and accumulated increased fat (Katan et al., 2012). In another study taking place over a year, 224 overweight and obese adolescents were selected to participate; 110 of the adolescents were placed in the experimental group, where they consumed sugar-free sodas in substitution of SSBs. After the year had passed, it was found that the experimental group who replaced SSBs with sugar-free sodas in their consumption habits over a year were on average 4 pounds lighter than the control group (Antonelli et al., 2012). More dangerous than the caloric content in SSBs, the added sugar content makes them harmful, where added sugars range from 39-46 grams depending on size, creating concern for diabetes. While infrequently consuming SSBs is not deemed threatening, the National Library of Medicine reports that between 2011-2014, 63% of youth ages 2-19 consumed an SSB daily, accounting on average 143 calories of a child's daily caloric intake. Similarly, it was stated that 49% of adults of ages 20 and above consumed an SSB daily, contributing 145 calories towards an average adult's daily caloric intake. (Gahche et al., 2017a; Gahche et al., 2017b). Pairing these statistics with the experiments mentioned previously, the prevalence of frequent SSB consumption in America gives reason for concern.

SSB's arrived at their current product through innovation and cultural development. During the eighteenth century, mineral water was collected from hot springs to create sparkling water, and during the nineteenth and twentieth centuries, sparkling water was combined with flavor sweeteners to create soda (Schwartz, 1986). Now in the twenty-first century, sparkling water is being reintegrated into our society by substituting the sugar-sweeteners with sugar-free flavoring and has resulted in a high variety of flavors across brands (Smith, 1990). Popular examples of these unsweetened sparkling beverages (USB) brands include LaCroix, Bubly, and Perrier. To qualify as a USB, the beverage must be a typical sparkling water with the inclusion of only a sugar-free flavoring, where health labels present zero value in all nutritional sections, such as calories, sodium, sugar, and other additives. While USBs have grown in popularity, their target demographic is mainly adults. Adolescents have not received much exposure to these beverages, causing them to typically overlook them; as a result, adolescents continue to integrate SSBs into their diets and consume them frequently. In 2015, results from the National Youth Risk Behavior survey showed in a typical high school, 20.4% of students consume a SSB daily (Demissie et al., 2017). Between adolescent obesity rates and SSB consumption previously highlighted by Willet, there is concern that the current climate of adolescent SSB consumption has correlation with the obesity epidemic in America.

The issue of SSB consumption has faced many attempted solutions to reverse the negative health implications imposed by large SSB companies. One of the most well-known solutions is the presence of similar but healthier alternatives in diet and sugar-free sodas. Other strategies include deterring consumers away from SSBs completely;

many countries have implemented per-unit SSB taxes, where revenue is used to cover externalities caused by unhealthy consumption (Allcott et al., 2019). Educating on the unhealthy nature of SSBs is an additional approach, where a correlation survey study conducted by Barragan et al. supports that "greater nutritional knowledge is negatively associated with SSB consumption" (2014). While these practices propose helpful solutions to America's unhealthy beverage consumption habits, they contain flaws: diet sodas have been controversial with their containment of chemicals, law regulations are tedious with enactment timing, and educating the entire nation is unfeasible. With a current lack of successful solutions to limiting SSB consumption, exploring alternative possibilities such as promoting USBs could be beneficial.

The Mere Exposure Effect (MEE) is a psychological phenomenon in which one's increased exposure and perceptual fluency to any stimuli elevates their comfortability and pleasantness with those stimuli (Bonnel et al., 1998). The phenomenon includes two neurophysiological processes: habituation, which involves rapid experiences that alter short-term preference, and conditioning, which "depends on the long-term changes in synaptic physiology" that develop throughout long periods and repeated exposure (Ballard et al., 2017).

Due to its high applicability, the MEE has been tested on its aspects of habituation and conditioning in numerous fields. With habituation, a standard MEE experiment was conducted by Monahan et al. at the University of Georgia to test the correlation between exposure to familiar and unfamiliar stimuli with their correlation to positive or negative physiological responses. This was done by introducing a series of graphic stimuli originally and later reintroducing them alongside a new series, measuring the participants' comfortability of them. Results showed the graphics that were shown received more comfortability from participants, enforcing that the MEE leads to increased preference (Monahan et al., 2000). Other habitual MEE experiments have been conducted in more specific fields, including ones involving fast food and infant music preference, supporting the positive correlation between exposure and preference, showing that the phenomenon is applicable in different fields with various stimulus (DeVoe & Zhong, 2010; Soley & Sebastián-Gallés, 2015).

In the other sector of conditioning MEE, studies involving conditioning are typically multiple days or weeks with ten insertions of stimulus exposure in length and predict positive linear or logistic growth in stimulus preference over time (Chmiel & Schubert, 2018; Ballard et al., 2017; Hausner et al., 2012). In the quasi-experimental study conducted by Ballard and Henningan from Stanford University, and McClure from Arizona State University, it was found that increased exposure to vegetable juice novelty drinks over ten days resulted in a positive correlation of preference and time (2017). These results propose the potential for conditioning and USB consumption with positive preference changes. In the other conditioning MEE study conducted by Hausner et al. at the University of Copenhagen involving baby food, it was found that in addition to experiencing increased preference in relation to exposure, both a three- and six-month post-test gauging preference revealed the babies that received exposure to an artichoke puree initially maintained higher preference than babies that did not (2012). These results suggest that repeated exposure to a stimulus will result in a maintained preference for the stimulus after an exposure period.

With USBs being highly advertised towards adults, it has left adolescents with minimal exposure to them. Creating alternatives to unhealthy SSBs has been a strategy to diminish the impacts they have on our society; however, USBs have not received enough attention for them to replace SSBs. Because the MEE and conditioning has been proven successful with other stimuli (Ballard et al., 2017; Hausner et al., 2012), the question is proposed: How can the Mere Exposure Effect change adolescents' preference for sparkling water?

Hypothesis

The previous research conducted on the MEE showed success throughout various fields, allowing for it to be hypothesized that when exposed to USBs, adolescents' preferences will increase over time. This research is relevant because it offers a potential solution to combating the current obesity epidemic and unhealthy habits that receive large contributions from SSB consumption.

Method

This research intended to explore adolescent consumption habits and the impacts the MEE had on them. Before the experiment, it was hypothesized that with increased exposure to USBs, adolescents would develop an increased preference towards the specific beverage they had been consuming. To yield the most sufficient results of how the Mere Exposure Effect can affect adolescents' preference for sparkling water, a quantitative quasi-experiment with a survey was utilized. This method was used to study a group of adolescents that proportionally reflected the US adolescent population based on reported SSB consumption habits. The population of the United States adolescents' demographic was selected based on the concern their unproportionally high obesity rates explained previously (Afful et al., 2020).

Participants

Participants were gathered through a school-wide Email regarding interest. To determine the 30 participants, stratified random sampling was applied; subjects were initially divided into two categories based on their current SSB consumption habits, and then randomly chosen. To accurately represent the US adolescent population, statistics from the CDC regarding adolescent SSB consumption were used. In the data, it was shown that 20.4 percent of high school adolescents consumed at least one SSB daily (Demissie et al., 2017). To accurately represent the population, a sample where ~20.4 percent of participants consume SSBs daily was ideal. Additionally, participants that were overqualified due to having previous exposure levels relative to the ones in the experiment or outside the adolescent age range were ineligible for participation. These parameters provided increased accuracy of the experiment in reflecting the overall population of US adolescents

This study measured the independent variable of USB preference over the dependent variable of days, similar to the one conducted by Ballard et al. involving novelty drinks and Hausner et al. involving baby food (2017; 2012). 30 adolescents participated in the experiment ranging from ages 14-17, where twenty percent (n=6) represented daily SSB consumers and eighty percent (n=24) represented non-daily SSB consumers. A preliminary survey was held to allow for accurate sampling where the definitions of SSBs and USBs were given. Subjects were sorted based on their answer to the question, "On average, I consume more than or equal to one sugar-sweetened beverage daily", which was similar to the survey question from the CDC article mentioned previously (Demissie et al., 2017). Those who answered "Agree" were sorted as daily SSB consumers and those who answered "Disagree" were sorted as non-daily SSB consumers. Additional questions were, "I am within the age range of 13-17." and "I consume more than or equal to one unsweetened sparkling beverage daily." If a subject responded with "Disagree" to the second question or "Agree" to the third question, respectively, they would be deemed ineligible to the experiment. Once the sample had been selected and parental and subject IRB approved consent forms had been completed, the experiment began.

Survey

Throughout the experiment, daily surveys were given to subjects regarding their experience with the USBs. The ten-day duration was used because it provided a long enough period to assess relative behavioral change (Ballard et al., 2017; Hausner et al., 2012). Surveys were utilized for their value to create numeric data for individuals' experience with the drinks to measure their overall change in preference over the ten-day experiment period. Using surveys through this method was used in part of Ballard et al.'s experiment, where results showed measurable differences between subjects' preference of the drinks from the initial to the final day of the experiment; Ballard et al.'s method proved successful in measuring preference change, so this study utilized a similar survey with the same timeline to best achieve accurate results (2017). Additionally, by using these surveys, firsthand information from subjects regarding their preferences was given, providing accurate data to answer the portion of the research question involving adolescents' individual preferences towards USBs.

The survey featured two questions that were asked each day repeatedly to accurately measure the subject's change in preference of the USB. These two questions were selected as they appeared in Ballard et al.'s study and provided a consistent measurement of preference throughout their experiment; throughout days 1-10 of the experiment, the questionnaire asked participants the question, "I wanted to consume the beverage" before consuming the USB, and "I enjoyed the beverage" after consumption (Ballard et al., 2017). Subjects responded on a 13-point Likert scale from [-6, +6], which provided data of preference that would allow for clear results to be drawn based on subjects' preference change throughout the experiment.

In addition to the survey questions from Ballard et al.'s experiment, the question, "I prefer to consume Unsweetened Sparkling Beverages over Sugar-Sweetened Beverages" was asked before the experiment and on the final day of the experiment. Additionally, on the final day of the experiment, the question, "It is likely that I will continue to consume Unsweetened Sparkling Beverages on a regular daily basis similar to the one in the experiment" was asked. These questions were added to fulfill the value in the study's objective to find a potential solution to providing adolescents with a healthier alternative to SSBs and were asked on the same Likert scale. While Ballard et al.'s questions provide insight on change in preference, the additional questions in this study measure how effective the experiment would be and measure the sought-out implications regarding the improvement of adolescents' consumption habits.

The survey replicated most of the aspects present in Ballard et al.'s experiment, however, the scale was adjusted to provide more accurate feedback. Throughout the novelty drink survey, subjects were asked to respond on a Likert scale which had the range of [-6, +6]. Attached were two anchor points stating, "Not at all", and, "Very Much", at both extremes. Although the wide range was useful, and other conditional MEE experiments also utilize them, both only include response descriptions on their extreme and neutral points, leaving multiple selection points blank (Ballard et al., 2017; Chmiel & Schubert, 2018). To increase the accuracy of responses while retaining the beneficial aspects of a large scale, additional descriptions throughout the scale were added. Responses were labeled on points [-6, -4, -2, 0, +2, +4, +6]. They included the descriptions, "Strongly Disagree", "Disagree", "Somewhat Disagree", "Neither Agree nor Disagree", "Somewhat Agree", "Agree", and "Strongly Agree", respectively. With more descriptions, subjects experienced increased ability to relate to the rating points, allowing for the reliability achieved through the large scale to be retained while also increasing accuracy from subject responses.

Procedure

Participants were given ten USBs to consume over the course of the ten-day experiment period; the exposure period reflected ones used in other conditioning MEE experiments (Ballard et al., 2017; Hausner et al., 2012). The USBs given to participants were the flavors "Piña Fraíse (Strawberry Pineapple)", "Ceríse Limón (Lemon Cherry)", and "Múre Pepino (Blackberry Cucumber)" of LaCroix. These USBs all followed the definition stated previously in the literature review and were 12oz to represent an average USB. While subjects were given different flavors, each participant received ten of the same flavor of the LaCroix, and would only respond to survey questions on behalf of their assigned flavor. Although the flavor varied between participants, the nature of the MEE regards one's specific preference relative to one stimulus allowed for nonuniform flavor consumption. Additionally, this allowed for analysis regarding specific USB flavors to discover potential differences in preference change amongst them. Participants were instructed to consume one of their beverages daily and to complete the survey explained previously without being given explicit background information on the MEE phenomenon.

Data Analysis

To measure and visualize response data from participants, Microsoft Excel software was used. The process of graphical analysis followed the format from Ballard et al.'s novelty drink and Hausner et al.'s baby food experiments (2017; 2012). This strategy was utilized because it accounted for all subjects' preferences reported from the surveys and gave

information that allowed for accurate conclusions to be drawn. Equation 1 provided the average preference response by finding the mean responses for the survey questions "I wanted to consume the beverage.", and "I enjoyed the beverage." Once the mean for each day's response was calculated, the p-value between the initial and final ratings was calculated using paired *t*-test equation 2. By using the paired *t*-test, a statistical conclusion could be drawn to test the hypothesis for a potential measurable preference change during the experiment.

$$u = \sum X / N \textbf{ (Equation 1)} \qquad t = \frac{\sum d}{\sqrt{\frac{n(\sum d)^2 - (\sum d)^2}{(n-1)}}} \textbf{ (Equation 2)}$$

Figures and Analysis

To analyze the effects of the MEE on subjects' preference and desire to drink their USBs, 30 adolescents responded to the Likert scale questionnaire daily, of which 80 percent (n=24) were daily SSB consumers, and 20 percent (n=6) were non-daily SSB consumers. Graphical analysis was used to measure the change in the daily average survey responses, which were plotted on the line graphs. Every day, participants' Likert scale responses on the scale of [-6, +6] were averaged to create a mean rating for each day's consumption using equation 1. Using equation 2, the paired *t*-test was used to determine statistical differences amongst the initial and final ratings; if the p-value resulted in or below the commonly accepted alpha value of 0.05, it would be considered statistically different. The paired *t*-test serves to compare a start and final set of data and analyze their difference and was used in this study to measure the differences between the initial and final preference ratings. It was hypothesized that as a result of the MEE, the first and last day subject preference ratings would show a significant measurable difference.

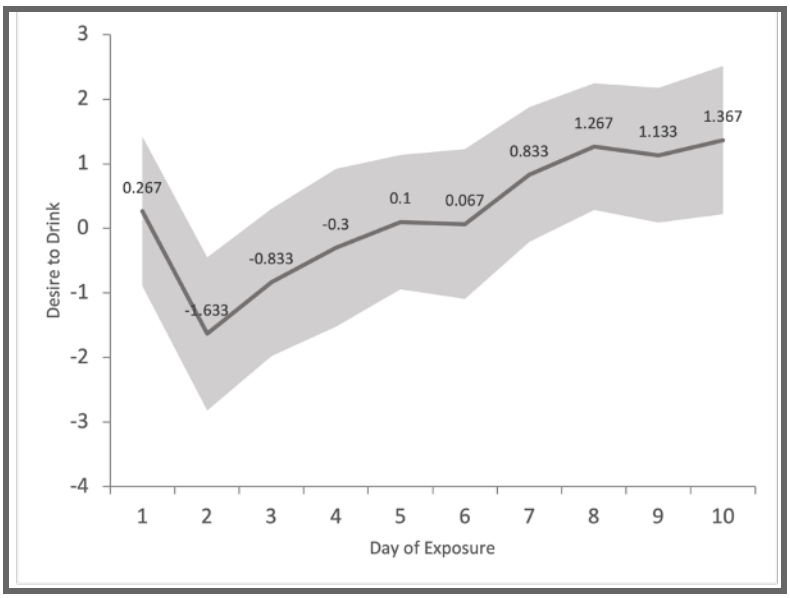

Figure 1. Desire to Drink / Day of Exposure

Figure 1 displays the mean ratings from participants from days [1,10] in response to the question, "I wanted to consume the beverage." The ratings show a positive increase from the initial survey to the final survey, with areas of slight decreases seen in day six and nine. To analyze the change in subjects desire to drink the USB, a paired *t*-test was used involving ratings from days [2,10]. The ratings from day 1 were deemed insignificant because subjects rated the drink before they had consumed it, making their ratings inaccurate compared to days [2,10] where ratings were based on exposure of the stimulus after consumption. From days [2,10] there was an increase of 3 desire to drink rating units, with a $p = 0.0006$, showing statistically significant results as the p-value is less than 0.05

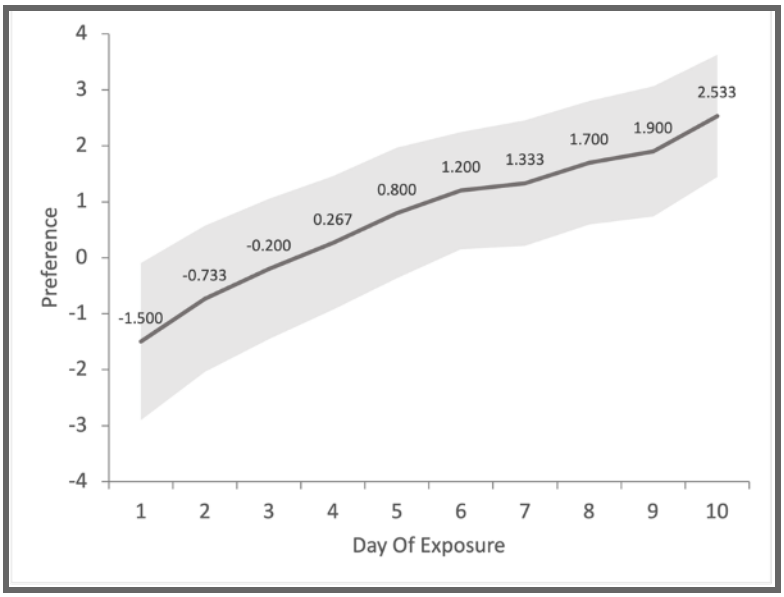

Figure 2. USB Preference / Day of Exposure

Figure 2 displays the mean ratings from participants from days [1,10] in response to the question, "I enjoyed the beverage." The ratings show a positive increase from the initial survey to the final survey, with a steady increase from days [1,6] and relatively slowed increase from days [7,9]. From day 1 to day 10, there was an increase of 4.033 preference, with $p < 0.0001$ derived from equation 2, which shows statistically significant data from day one to ten as the p-value is less than 0.05.

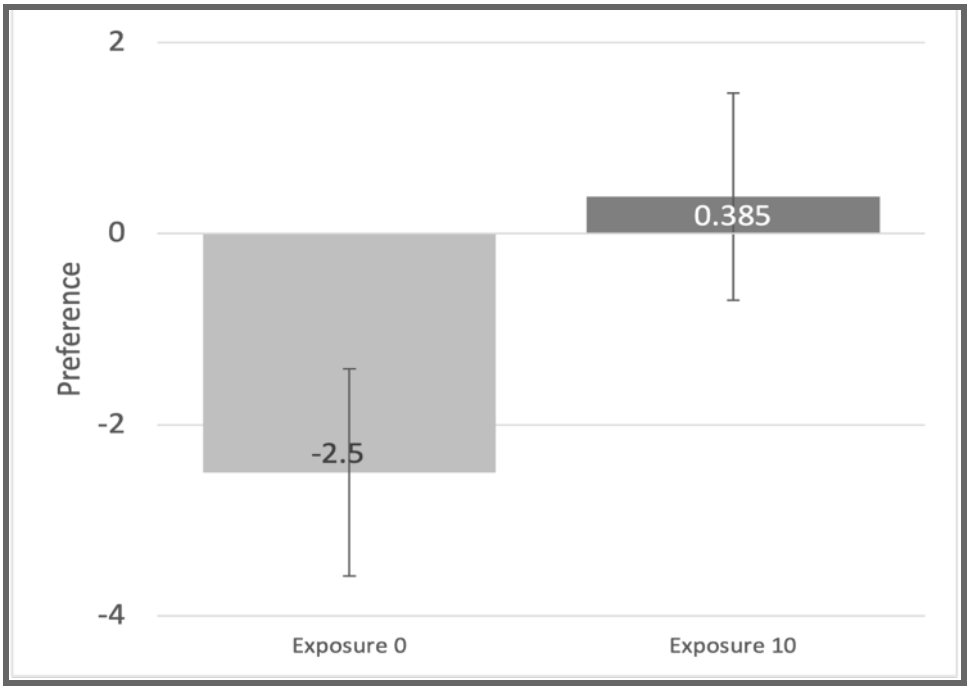

Figure 3. Preference of USB vs SSB preference / Day of Exposure

The change in USB preference over SSB preference is depicted in Figure 3. This graph shows the average response to the question, "I prefer to consume Unsweetened Sparkling Beverages over Sugar Sweetened Beverages." The survey question was asked prior to any exposure to their assigned USB to gauge their overall preference for USBs in comparison to SSBs initially. The question was then asked again to display their preference for USBs in comparison to SSBs after the 10 day exposure increase. The initial response has an average rating of -2.500, and the second response has an average of 0.385. The change in rating from before and after the 10 day exposure period is an increase of 2.885. The two sets of data have a
$p < 0.0001$, and because the value is less than 0.05, it shows a statistically significant difference between the two average responses.

Overall, when omitting the day 1 results from Figure 1, all graphs show significant increases in preference of USBs, and have a positive correlation between days of exposure and attitude towards the USB: The desire to drink the USB has an increase of 3 rating units ($p = 0.0006$) from days 2 to 10 of exposure, the USB preference has an increase of 4.033 rating units ($p < 0.0001$), and the USB preference over SSBs having an increase of 2.885 ($p < 0.0001$).

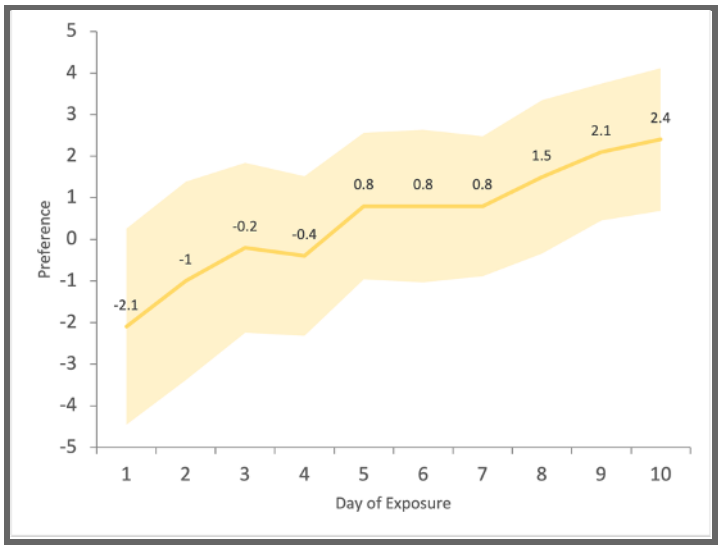

Figure 4. Piña Fraíse Preference / Day of Exposure

The preference of the "Piña Fraíse" USB experienced a positive increasing trend between the variables of exposure and preference. The average rankings for days 1-10 were: -2.1, -1.0, -0.2, -0.4, 0.8, 0.8, 0.8, 1.5, 2.1, and 2.4, respectively. The rankings increased steadily besides from the drops occurring from day 3 to day 4, zero change occurring from days 5 to 7. The rating increase from day 1 to day 10 is 4.5 ($p = 0.0008$). Because the p-value is less than 0.05, the ratings from day 1 and day 10 are statistically significantly different.

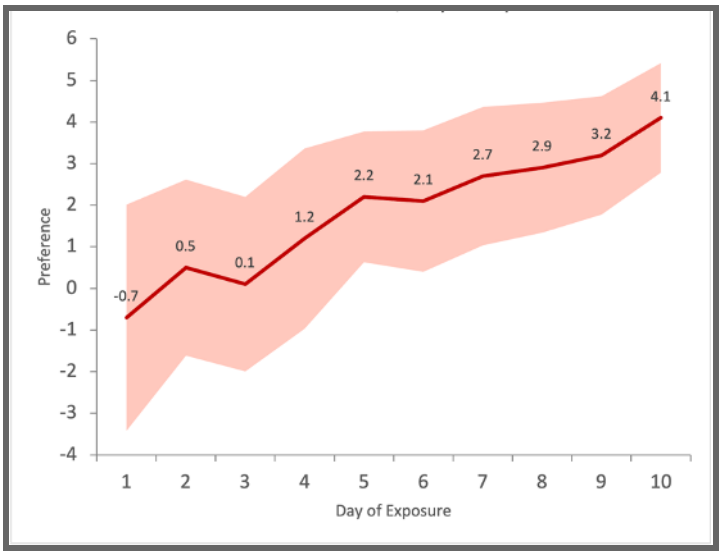

Figure 5. Ceríse Limón Preference / Day of Exposure

The preference of the "Ceríse Limón" USB experienced a positive increasing trend between the variables of exposure and preference. The average rankings for days 1-10 were: -0.7, 0.5, 0.1, 1.2, 2.2, 2.1, 2.7, 2.9, 3.2, and 4.1, respectively. The rankings increased steadily besides from the drops occurring from day 2 to day 3 and from day 5 to day 6. The rating increase from day 1 to day 10 is 4.8 ($p = 0.0023$). Because the p-value is less than 0.05, the ratings from day 1 and day 10 are statistically significantly different.

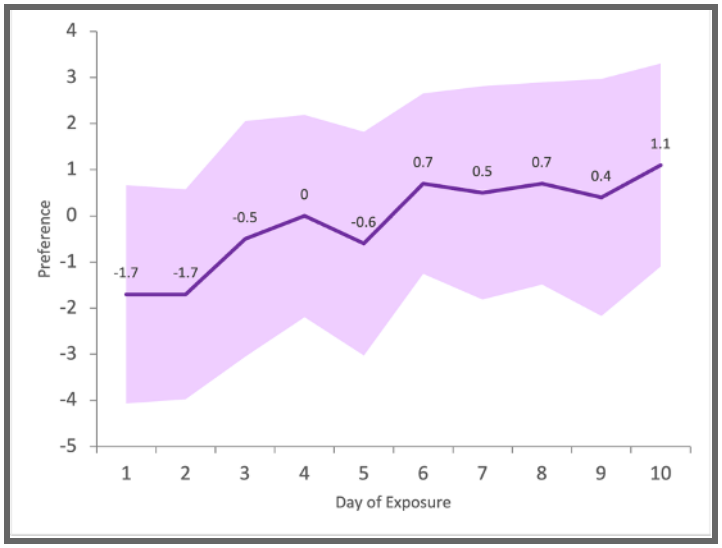

Figure 6. Múre Pepino Preference / Day of Exposure

The preference of the "Múre Pepino" USB experienced a positive increasing trend between the variables of exposure and preference. The average rankings for days 1-10 were: -1.7, -1.7, -0.5, 0.0, -0.6, 0.7, 0.5, 0.7, 0.4, and 1.1, respectively. The rankings increased steadily besides from the drops occurring from day 4 to day 5, day 6 to day 7, day 8 to day 9, and zero change from day 1 to day 2. The rating increase from day 1 to day 10 is 2.8 ($p = 0.0137$). Because the p-value is less than 0.05, the ratings from day 1 and day 10 are statistically significantly different.

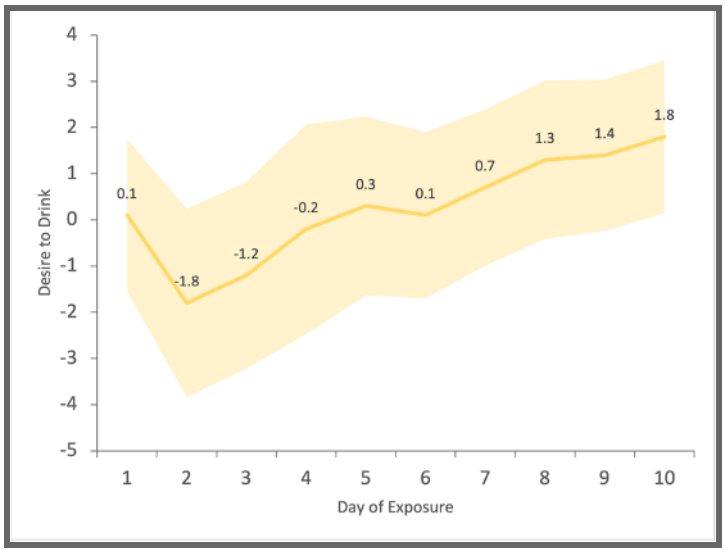

Figure 7. Piña Fraíse Desire to Drink / Day of Exposure

The desire to drink the "Piña Fraíse" USB experienced a positive increasing trend between the variables of exposure and rated desire to drink. The average rankings for days 1-10 were: 0.1, 1.8, -1.2, -0.2, 0.3, 0.1, 0.7, 1.3, 1.4, and 1.8, respectively. The rankings increased steadily besides from the drops occurring from day 1 to day 2, and day 5 to day 6. The rating increase from day 2 to day 10 is 3.6 ($p = 0.0023$). Because the p-value is less than 0.05, the ratings from day 2 and day 10 are statistically significantly different.

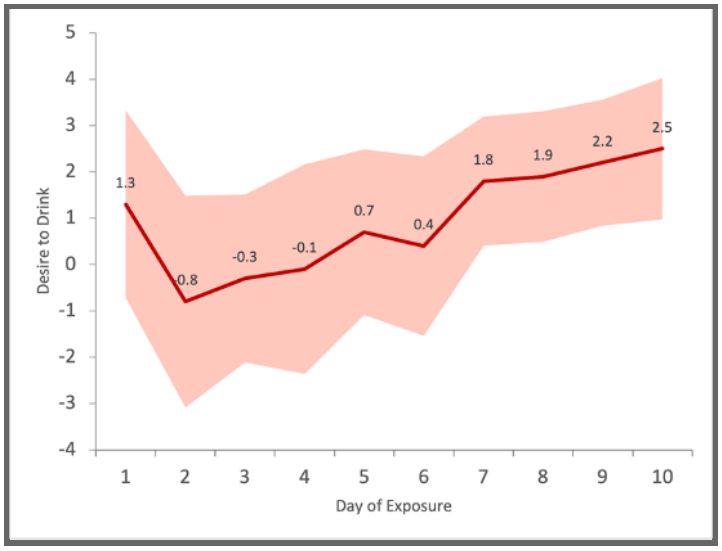

Figure 8. Ceríse Limón Desire to Drink / Day of Exposure

The desire to drink the "Ceríse Limón" USB experienced a positive increasing trend between the variables of exposure and rated desire to drink. The average rankings for days 1-10 were: 1.3, -0.8, -0.3, -0.1, 0.7, 0.4, 1.8, 1.9, 2.2, and 2.5, respectively. The rankings increased steadily besides from the drops occurring from day 1 to day 2, and day 5 to day 6. The rating increase from day 2 to day 10 is 3.3 ($p = 0.0032$). Because the p-value is less than 0.05, the ratings from day 2 and day 10 are statistically significantly different.

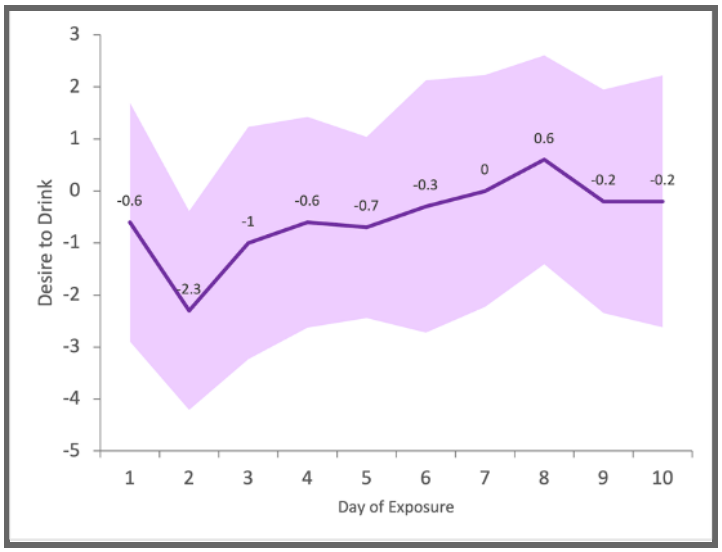

Figure 9. Múre Pepino Desire to Drink / Day of Exposure

The desire to drink the "Múre Pepino" USB experienced a positive increasing trend between the variables of exposure and rated desire to drink. The average rankings for days 1-10 were: -0.6, -2.3, -1.0, -0.6, -0.7, -0.3, 0.0, 0.6, -0.2, and -0.2, respectively. The rankings increased steadily besides from the drops occurring from day 1 to day 2, day 4 to 5, day 8 to day 9, and the zero change from day 9 to day 10. The rating increase from day 2 to day 10 is 2.1 ($p = 0.0059$). Because the p-value is less than 0.05, the ratings from day 2 and day 10 are statistically significantly different.

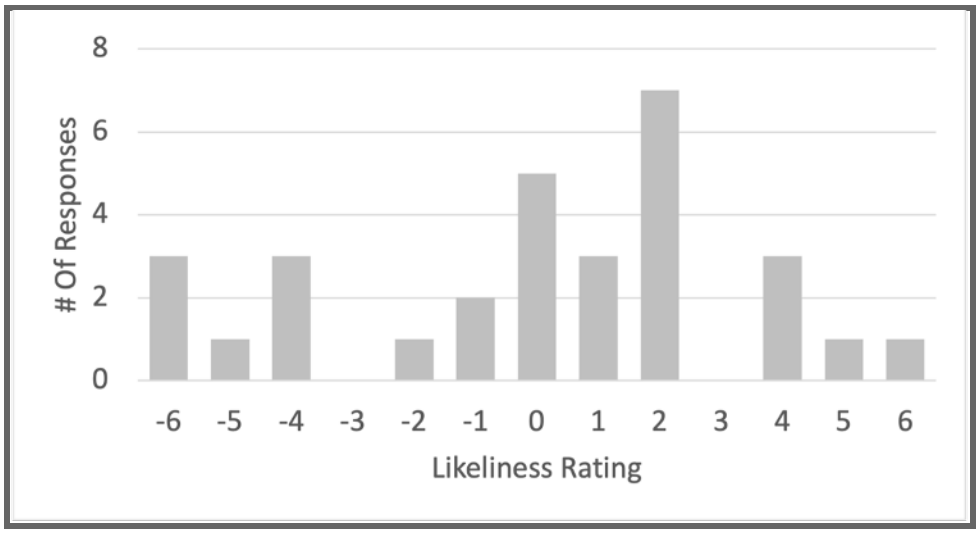

Figure 10. Likeliness to Continue Regular USB Consumption Post-Experiment

The "Likeliness to Continue Drinking" graph above displays the responses collected from subjects after their final USB consumption to the question, "It is likely that I will continue to consume Unsweetened Sparkling Beverages on a regular daily basis similar to the one in the experiment". The average of the responses is 0.077. 10 subjects answered in opposition to continue drinking (<0), 5 subjects answered with no preference (0), and 15 subjects answered in favor of continued consumption (>0).

Discussion

The results derived from the experiment allow for the acceptance of the alternative hypothesis that as subject exposure to USBs increases, their preference for the USB also increases; the acceptance is supported by Figure 2, where resulting from increased exposure to USBs over the ten-day experiment, the average preference also increased. From the first to last day of the experiment, preference increased by 4.033 and the mean rating was proved to be statistically significantly different, showing that the mean preference did significantly increase over the 10-day exposure period. This reinforces previous findings in both the conditioning and habitual fields of the Mere Exposure Effect, that preference for a stimulus is positively correlated to exposure (Ballard et al., 2017, DeVoe & Zhong, 2010; Hausner et al., 2012; Monahan et al., 2000; Soley & Sebastián-Gallés, 2015).

The results depicted in Figure 1 additionally show more situationally specific increases in preference for USBs relating to exposure. In Figure 1, it can be understood that over the exposure period from day 2 to day 10, the mean desire to drink experienced a significant increase of 3 rating units. The significant difference between the ratings of day 2 and day 10 demonstrate that with the increase in exposure of SSBs, subjects' attitude towards the drinks also increased. This finding is beneficial because it shows that subjects were more willing to consume the USB as exposure increased, conveying the idea that with continued exposure to USBs, one's willingness to consume the beverage will increase.

While independent preference for USBs is displayed in Figure 1 and Figure 2 the proposition of USBs feasibly replacing SSBs for adolescent health benefits and other value previously discussed can be examined in Figure 3. Results show that before and after the experiment, subjects ranked their preference of USBs over SSBs 2.885 higher. This information supports that in addition to USB individual preference increasing with exposure, USB preference in comparison to SSB preference also increases. Initially, subjects did not prefer USBs over SSBs (-2.5), and finally, subjects had a generally neutral preference with slight favor for USBs over SSBs (0.385), showing that exposure leads to increased preference for USBs over SSBs when both options are available. With adolescents having a more neutral preference for either beverage, the negative implications stemming from SSB consumption and added sugars regarding diabetes, pancreas failure, and adolescent obesity discussed by Willett and Ruskin could occur less frequently in individuals who chose to consume USBs instead of SSBs (2000; 2004).

The results generated from this experiment align with predicted outcomes from Ballard et al. and Hausner et al.'s experiments shown by the preference increase in Figure 2 (2017; 2012). Their experiments yielded similar results with an overall positive correlation between exposure and preference. The similarities between their study and the findings in this experiment reflect that the MEE can be applied to other stimuli when daily exposure occurs. Unlike their experiments, the other conditioning MEE study mentioned conducted by Chmiel and Schubert investigating music uniqueness concluded with conflicting results (2018). This discrepancy can be attributed to flaws in Chmiel and Schubert's methodology that were accounted for in this method. When the methodology from this study is juxtaposed to Chmiel and Schubert's, this study is more consistent with preference rating surveys, diffusion of exposure to stimulus, and times preference was measured. Chmiel and Schubert's inconclusive results reveal that to achieve the most reliable and credible results, consistency in stimulus exposure and measurement of preference is necessary.

As a result of exposure, preference amongst subjects for USBs increased overall. Most basically, the satisfaction achieved after consuming a USB increased in response to exposure (Figure 2), reinforcing the concept of the MEE that it is in which one's increased exposure and perceptual fluency to stimuli elevate their comfortability and pleasantness with those stimuli. The additional preference results from Figure 1 and Figure 3 convey the idea that with exposure to USBs, adolescents can become more open-minded and comfortable consuming these beverages over SSBs.

Conclusion

This study intended to discover if the Mere Exposure Effect could alter adolescents' preference towards Unsweetened Sparkling Beverages. Through statistical analysis of results from the quasi-experimental method utilized, it was determined that the results were conclusive, and that the Mere Exposure Effect can impact adolescents' preference for unsweetened sparkling beverages positively.

Limitations

Despite the conclusive results derived from the experiment, there are limitations present. In Figure 3, responses were based on subject thoughts when responding to the question, "I prefer to consume Unsweetened Sparkling Beverages over Sugar Sweetened Beverages." Accuracy of results could have been increased if subjects were presented with both beverages and given the opportunity to consume both, and then respond. Additional survey limitations are presented in the event a subject had awareness of the MEE topic being studied. Here, they may have experienced a placebo effect where their expectations of what they expected to happen influenced their survey responses, limiting the validity of the results. The final limitation is sample inaccuracy. While steps were taken to avoid this issue by utilizing stratified random sampling to achieve a sample that reflected the US beverage consumption habits, it is unfeasible to resemble the complex diet habits of the American adolescent population with 30 subjects. In future research, the impacts of these limitations can be made less severe through further attempts to represent the adolescent population through more specific sampling- taking into account consumption of SSBs by gender, age, and quantity of consumption- and reducing knowledge of the MEE phenomenon being inquired.

Implications

As a result of this research, many small-scale approaches can be utilized to benefit local adolescent health to overall create a healthier nation. These findings demonstrate the ability for one to develop a preference for USBs with as little as a few days of exposure. Because of this, schools around the nation that are plagued with promoting unhealthy beverages can slowly integrate USBs into their buildings to increase exposure to students for healthier consumption habits to form (Ruskin, 2003). Shown in Figure 3 within the results, adolescents slightly prefer USBs over SSBs after exposure, however, if they cannot access them as easily as SSBs, they will not likely be able to consume USBs to continue healthy consumption habits. After the experiment, half (n=15) were in positive favor of continuing regular USB consumption (Figure 10) and previous findings in the field of MEE show developed preferences can be retained months after the exposure period (Hausner, 2012). However, as adolescents, most of the drinks they are exposed to are influenced by natural encounters, such as their parents' purchases, school vending machines, or restaurants. To effectively continue adolescents who are exposed to the USBs consumption, they must be given the opportunity to choose them; without this ability, they will most likely resume their regular consumption habits.

Call for Future Research

Future research should be directed towards discovering the most effective flavors that can be used to increase adolescents' viewpoints of USBs. Throughout this study, three flavors were utilized, and each had different increases in preference over the experiment and different starting preferences. All experienced statistically significant differences from the initial exposure to the final exposure; The flavor to experience the largest increase in preference was Cerise Limón, followed by Piña Fraíse, and Múre Pepino (Figures 4, 5, 6). Cerise Limón also had the highest day 2 and final desire to drink, followed by Piña Fraíse, and Múre Pepino (Figures 7, 8, 9). By distributing flavors that will be more appealing to an irregular sparkling water consumer, the likelihood of them trying and continuing to consume that

flavor increases, as they will be more likely to continue drinking, opposed to disliked flavors. Additionally, future research could be conducted to understand how preferences of USBs are retained after the exposure period to further support or challenge the current retention concepts (Hausner, 2012). Future research in specific USB flavors in conjunction with the MEE could provide better insight into pushing USBs to become a more accepted substitute for SSBs and allow better consumption habits throughout the adolescent population to combat the impacts of the adolescent obesity epidemic.

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