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The University of Southern Mississippi

Awareness of biological mechanisms of artificial sweeteners and the effects of increased awareness via video media on intent to change dietary habits in traditional college-age students

by

Cassie Mahler

A Thesis
Submitted to the Honors College of
The University of Southern Mississippi
in Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science
in the Department of Biological Sciences

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Abstract

In the past, artificial sweeteners have been touted as weight loss solutions because they theoretically do not interact with the body's metabolism. However, new research is being done to test this theory, but what is the public awareness of these compounds' interactions with the body? The purpose of this study is threefold: to assess the current awareness of the biological mechanisms of artificial sweeteners in traditional college-age individuals; to assess the effectiveness of video education in increasing this awareness; and to assess how the increase of this awareness might lead to intentions to change dietary habits. The study consisted of a short survey using the pre-test/post-test model. The pre-test evaluated prior awareness of artificial sweeteners and demographic information. Then, a short informational video was shown. Finally, the post-test evaluated new awareness, comprehension, and future dietary habit intentions. The results of this study showed that awareness of artificial sweeteners is low but can be increased with video education. However, intent to change dietary habits was not definitively affected by the video. The majority of participants did report a positive likelihood of investigating other compounds interactions with the body, indicating that video education can be an effective media for increasing health literacy.

Key Terms: artificial sweetener, awareness, interaction, health literacy, video education

Dedication

For Tanner Shaw:

I wouldn't want you to go to the Honors College banquet alone.

Thanks for always being my motivation.

Acknowledgements

I would like to thank my advisor, Dr. Jennifer Regan, for being so patient and for allowing me to work so independently. I would also like to thank Dr. Eric Platt for his dedication to my success in Honors Keystone.

Finally, I would like to thank my parents for believing in me and encouraging me to never give up.

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Introduction

Health deservedly occupies the minds of Americans, as evidenced by the numerous fad diets, exercise regimens, supplements, magazines, etc. In order to determine personal health needs, an individual must be knowledgeable about their body. However, according to the 2000 US Census, only 5.6% of the United States population is employed in a healthcare occupation that would require a high level of knowledge of the biological mechanisms of the body (Fronczek and Johnson 2003). This percentage does not, of course, account for the unemployed members of US society trained to work in these fields or others with profession-independent knowledge, but nevertheless indicates that a very small percentage of the population is aware of how compounds work in the body. A survey given by the International Food Information Council Foundation in 2012 shows almost all participants surveyed are trying to improve their health, but a large majority believes that determining the proper diet to do so is difficult due to constantly evolving information. The survey also found that taste was valued over health when choosing foods to eat. The survey directly evaluated participant's perceptions of artificial sweeteners. A slight minority (46%) reported general consideration of artificial sweeteners in food choices, but nearly 30% try to *restrict* or *avoid* artificial sweeteners. One third of the participants additionally reported that they were not knowledgeable about artificial sweeteners. (IFICF 2012).

The lack of health literacy in Americans can be attributed to the complicated terminology used in health education materials (Ferguson 2012). Most research on improving health literacy uses the pre-test/post-test model to assess the effectiveness of improving knowledge and behavior on a variety of topics (Armstrong et al. 2010a,

Armstrong et al. 2010b, Cox et al. 2003, Ferguson 2012, Houts et al. 2005, Krawczyk et al. 2012, Kreuter et al. 2010, Murphy et al. 2000, Wilson et al. 2010). In this model, participants are given a questionnaire on demographic backgrounds, previous knowledge of the topic, and preexisting behavior involving the topic. The individuals are then presented with informative materials, either textual or audio-visual, and assessed on their knowledge and intended behavior given the new information. Participants may then be further questioned in the future about their knowledge and behaviors following the initial presentation of information.

The superiority of video or written media has been a popular area of research over a variety of topics. Video proved to be a more effective medium than written materials in improving participants' knowledge of sun protection measures (Armstrong et al. 2010). Similar results were also found in a study on atopic dermatitis: patient knowledge of the skin condition, as well as severity, was better improved through video education than through written materials (Armstrong et al. 2010). The use of video versus written material in asthma education revealed that while video use saw greater improvements in short-term retention and recall, written materials that patients were able to take home improved recall over longer periods of time (Wilson et al. 2010). A study on knowledge of the human papillomavirus determined that both video and written materials were able to increase participant knowledge of the sexually transmitted infection, as well as intentions to protect themselves against it, but neither more significantly than the other (Krawczyk et al. 2012). Video education is especially successful in individuals with low reading levels, as demonstrated in a study of patients with an average reading level of

grade seven/eight on knowledge of their sleep apnea (Murphy et al. 2000). This suggests one of the many benefits of video education: universality.

The type of video may also determine efficacy. Videos tend to be more effective than written materials when describing information about a method or process (Wilson et al. 2010). However, a 2010 study concluded that videos consisting of personal experiences were more effective than videos consisting of strictly factual information in encouraging a specific group of women to undergo mammography (Kreuter et al. 2010). A review authored by Houts et al. (2005) details the implication that pictures have on improving health education: the addition of pictures to a textual or oral message induces greater attentiveness to and remembrance of material (2005). Hence, video consisting merely of an individual delivering oral information can be made more effective if visual illustrations of the topic are introduced.

While previous literature commends the use of video media in attempts to improve health education, specific focuses on artificial sweeteners were not found. The consumption of artificial sweeteners is encouraged through advertisements presented by manufacturers such as the Cola-Cola Company, Pepsico, and Kraft Foods, Inc. Pepsi, Cola-Cola and other beverage companies continue to produce a variety of products containing artificial sweeteners in their diet labeled drinks, consumed by 20% of Americans in a given day (Fakhouri et al. 2012), despite controversy over their benefits. However, consumers may be unaware of how these substances interact with their bodies (IFICF 2012). Better-informed individuals predictably make better choices, as evidenced by participant improvements cited in the research above.

The U.S. Food and Drug Administration (2014) refers to artificial sweeteners as high-intensity sweeteners because they taste sweeter than natural sugar. The FDA has approved six high-intensity sweeteners: saccharine, aspartame, acesulfame potassium, sucralose, neotame, and advantame. Manufacturers of sugar substitutes capitalize on this enhanced sweetness, as well as the low cost of production and absence of dietary calories (Suez et al. 2014). Commonly branded as “sugar-free” and “diet”, foods containing artificial sweeteners are consistently advertised to induce the perception of being healthy. These low-calorie sweeteners have popularly been promoted as methods for weight loss and blood sugar management for individuals with diabetes, although the American Heart and American Diabetes Associations admit that scientific literature supporting these claims is limited due to the challenge of creating a reliable study (Gardner et al. 2012). Sucrose is natural sugar that is metabolized by the body to either be used as fuel or stored as fat. Theoretically, artificial sweeteners cannot be used for fuel or stored in the body as fat because only a small amount is required to achieve the sweetness of sugar and the body is unable to metabolize them (Roberts et al. 2000). However, several studies have been performed that indicate that artificial sweeteners may increase the risk of obesity and diabetes. Results from a study published by Suez et al. (2014) display the effects of artificial sweeteners on microbiota found in mice and human digestive systems in their ability to cause glucose intolerance. The series of experiments performed were prompted by the controversial nature of the consumption of non-caloric artificial sweeteners (NAS) and the knowledge that the diet affects the digestive microbiota, which can then cause changes in the metabolism of the host organism. Through analysis of the results of a series of experiments, the researchers were able to conclude that the intake of NAS

compositionally and functionally alters gut microbiota, which leads to detrimental changes in metabolism, particularly glucose intolerance. The researchers used the results to suggest a correlation of NAS consumption in humans to type 2 diabetes via the link between high concentrations of specific digestive bacteria and glucose intolerance. The functional changes in microbiota created new metabolic pathways for the breakdown of energy storing molecules, which the researchers say indicates a link between NAS ingestion and obesity. The authors concede that different individuals respond differently to NAS intake, which suggests that microbiota differ from person to person. (Suez et al. 2014). Simon et al. (2013) determined the effect of artificial sweeteners on the formation of fat tissues and inhibition of fat breakdown with respect to sweet taste receptors. This study found that artificial sweeteners can bind to sweet taste receptors to induce the creation of fat storage in the body (adipogenesis) while simultaneously preventing the decomposition of stored energy (lipolysis), as was expected from previous literature. However, the study also found that in the absence of sweet taste receptors, adipogenesis continued to be stimulated and lipolysis continued to be repressed. This suggests existence of an unknown receptor sensitive to artificial sweeteners that is yet to be discovered (Simon et al. 2013). Another study has shown that because the artificial sweeteners are able to bind to the same taste receptors as sucrose and other sugars, the body is still prompted to have the same reactions, even though the expected calories are not present. These reactions trigger hormones responsible for the feeling of hunger and energy storage in the form of fats (Swithers et al. 2010). However insufficient data prevents conclusive attribution of weight fluctuations to artificial sweeteners (Gardner et al. 2012). Researchers have thought that artificial sweeteners may cause the small

intestine to increase its absorption of glucose, but a study published by Ma et al. (2010) reported findings that refute this prediction. While artificial sweeteners have been used as no calorie sugar substitutes since their accidental discovery in 1879, they continue to be highly investigated. When presented to participants in video format, the above information should have a significant effect on the participants' pre-test/post-test score differential.

Many surveys have shown a gap in knowledge about artificial sweeteners despite high levels of consumption. Video education has also previously been proven an effective method of increasing health literacy, but it has not been documented for use with artificial sweeteners. This study will fill this gap in the health literature and may need to be repeated as new discoveries are made about artificial sweeteners and their interactions with the human body. The results of the study are expected to show that awareness of artificial sweeteners is low but can be increased with video education, which will then lead to intentions to change dietary habits. As opposed to the scientific community, this study is predicted to have a greater impact on general society. Increasing awareness of artificial sweeteners may encourage individuals to increase their knowledge of other dietary components to make better-informed health choices. It may also influence the way health information is presented by healthcare companies and professionals.

Methods

While prior research shows the effects video education can have on perception and health choices, documentation of video education of artificial sweeteners is lacking. Most Americans have little knowledge of artificial sweeteners, but prior studies of

general awareness of artificial sweetener metabolism have not been recorded. Americans are consistently concerned with obesity and health, yet likely know very little about the way compounds work in the body (IFICF 2012). Traditional college-aged individuals (defined as age 18 to 25) in America are influential to both younger and older generations, and thus were the focus group of this study.

This study attempted to accurately assess the awareness of artificial sweeteners and measure the effectiveness of video education on increasing that awareness and intention to modify dietary habits. The procedure to be performed in this study was in survey format, consisting of a short pre-test evaluation, a brief video, and a post-test questionnaire. The survey was constructed through the use of Qualtrics, an online survey building and analyzing software. Several previous studies have had success in health education and perception research using the Qualtrics software (Weidenheft et al., 2013; Tierney, 2013; Monteiro et al., 2013). The distribution of the survey relied on the social media platform, Facebook, in hopes of obtaining a nationwide sample. Social media has been proven to be an effective method of recruitment for education based studies (Lohse 2013). The survey was allowed to circulate for four weeks. Incentive in the form of a drawing of gift cards donated by sponsors was offered to increase participation. No personal identification information collected for the survey drawing will be associated with the participants' responses, preserving the anonymity of the participant.

The pre-test survey consisted first of a preliminary screening question to determine eligibility within the age range parameters – 18 to 25 years of age. All others outside the target range of traditional college students were able to proceed with the survey. Once eligibility was determined, the participant answered a series of typical

demographic questions, such as race, gender, location, level of education, and secondary education area of study. This allowed for correlative data to be analyzed. Finally, an assessment of prior knowledge and consumption of artificial sweeteners was performed. Knowledge was assessed by participants' personal rankings of awareness of artificial sweeteners, general questions on the sweeteners themselves, and a few multiple choice questions on their metabolism. Consumption patterns were determined by questions on the quantity, frequency, and type of artificial sweeteners the participant had consumed in the last week, month, and six months. Participants were presented with reasons why they consumed those artificial sweeteners to determine motivation.

Next, the participants watched a five to seven-minute video providing first a general description of artificial sweeteners, then a simple explanation of the sweeteners metabolism in the human body. The video consisted of a PowerPoint presentation using text, images, and short animations to convey the concepts in a simple manner. The audio portion of the video corresponded to the visual aspect, without the narrator being shown. All appropriate acknowledgements and information was cited in a brief credit slide at the end of the video. Participants had to use a link to reach the YouTube website to view the video, and were instructed previously to use the "back" button in the browser to return to the survey. The participants indicated whether or not they were able to watch the entirety of the video. If the participant indicated that they had not watched the video, their results were not analyzed for increase in awareness or intent to change dietary habits.

The post-test questionnaire first tested the comprehension of information from the video. Next, the questions determined the participants' perceptions of artificial sweeteners in light of the information presented in the video. Finally, the survey ended

with a group of inquiries on the participants' intended artificial sweetener consumption in the future. Analysis of the results of this survey is expected to yield a significant increase in understanding of artificial sweeteners, a change in perception of artificial sweeteners, and a decrease in intended use of artificial sweeteners in the future.

Results

General Participation

At the end of the four-week period, 99 participant responses were reported via the Qualtrics software. After the partial and ineligible responses were removed from the sample, 43 responses remained. The participants' ages range from 19 to 24 years old, the distribution of which can be found in Figure 1.

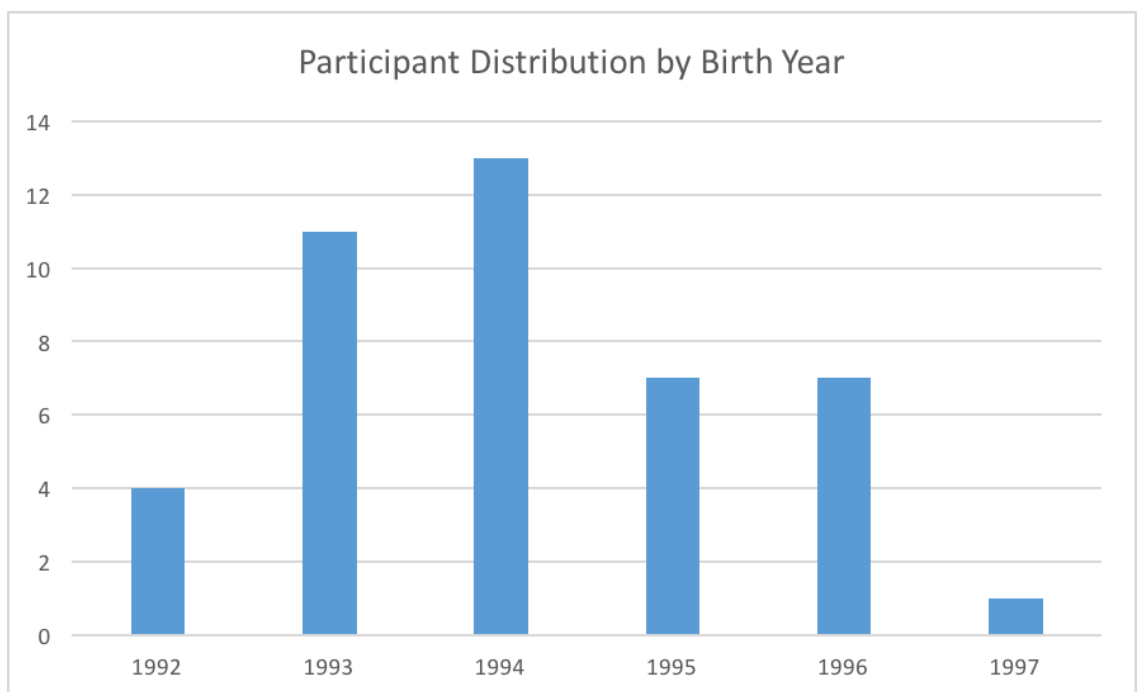


Figure 1. Participant Distribution by Birth Year

The majority (77%) of participants were female. All respondents reported to identify with the Caucasian ethnicity. Mississippi provided the most participants at 15 (about 35%). While most participants reside in the southeastern United States, a few responses were collected from the northeastern United States. The distribution of participants by state of residence can be found in Figure 2.

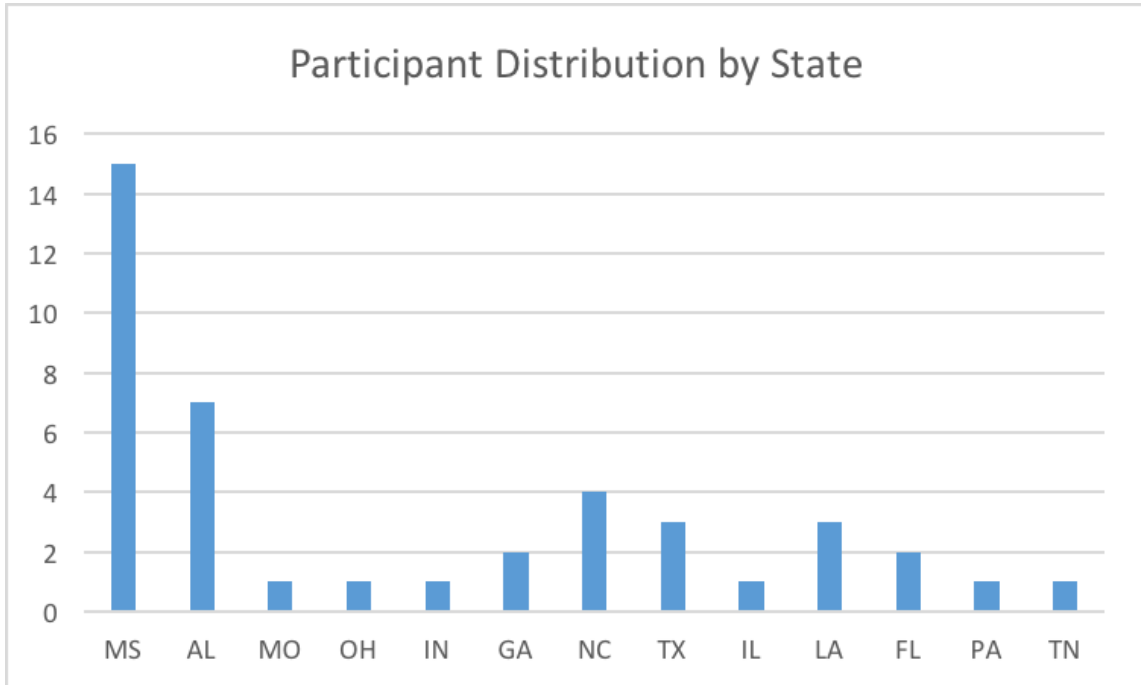


Figure 2. Participant Distribution by State

Sixty-seven percent of participants are currently enrolled in a university or have completed some college but have not yet earned a degree. Eleven participants had obtained a four-year degree, while only 2 had obtained a two-year degree. Only one participant reported having only a high school education. Of the participants that reported some level of secondary education, five did not provide a secondary education area of study. Reported areas of study were divided into groups based on the colleges they would be under at the University of Southern Mississippi (Table 1.). Distribution of this data is illustrated in Figure 3.

Table 1. Secondary Education Area of Study: Responses sorted into Colleges based on standards set by the University of Southern Mississippi

Science and Technology	Business	Arts and Letters	Health	Education and Psychology	Nursing
Biological Sciences	Marketing	History	Social Work	Education	Nursing
Biology	Business	Communications	Exercise Science	Psychology	Nursing
Biology	Accounting	Communications	Physical Therapy	Psychology	Nursing
Biology	Tourism Management	Communications	Physical Therapy	Elementary Education	
Biology	Administration	Communications	Kinesiotherapy	Family and Child Science	
Engineering	Fashion Design	Communications	Healthcare Marketing	Psychology	
Material Science		Photography	Social Work	Early Childhood Development	

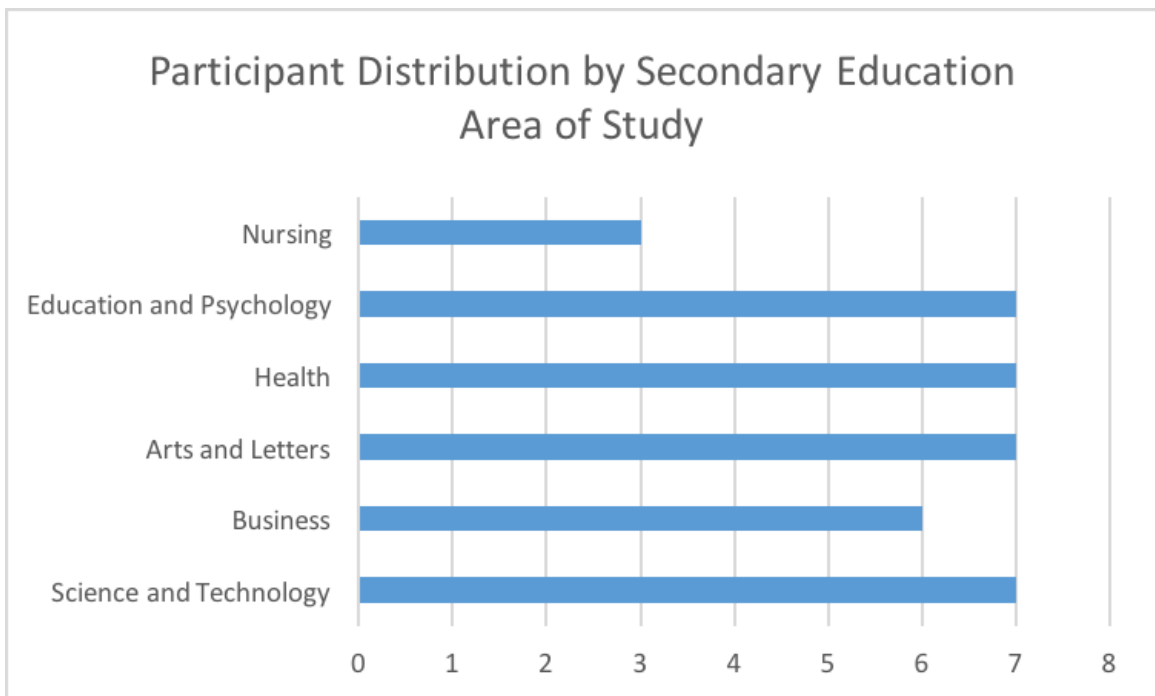


Figure 3. Participant Distribution by Secondary Education Area of Study

Artificial Sweetener Consumption

Participants provided a self-assessment of their artificial sweetener consumption over three time periods: the past week, the past month, and the past six months. The number of participants who reported consuming artificial sweeteners daily in the past week (10) was equal to the number of participants who reported only rarely consuming artificial sweeteners in the past week. Figure 4 illustrates this data.

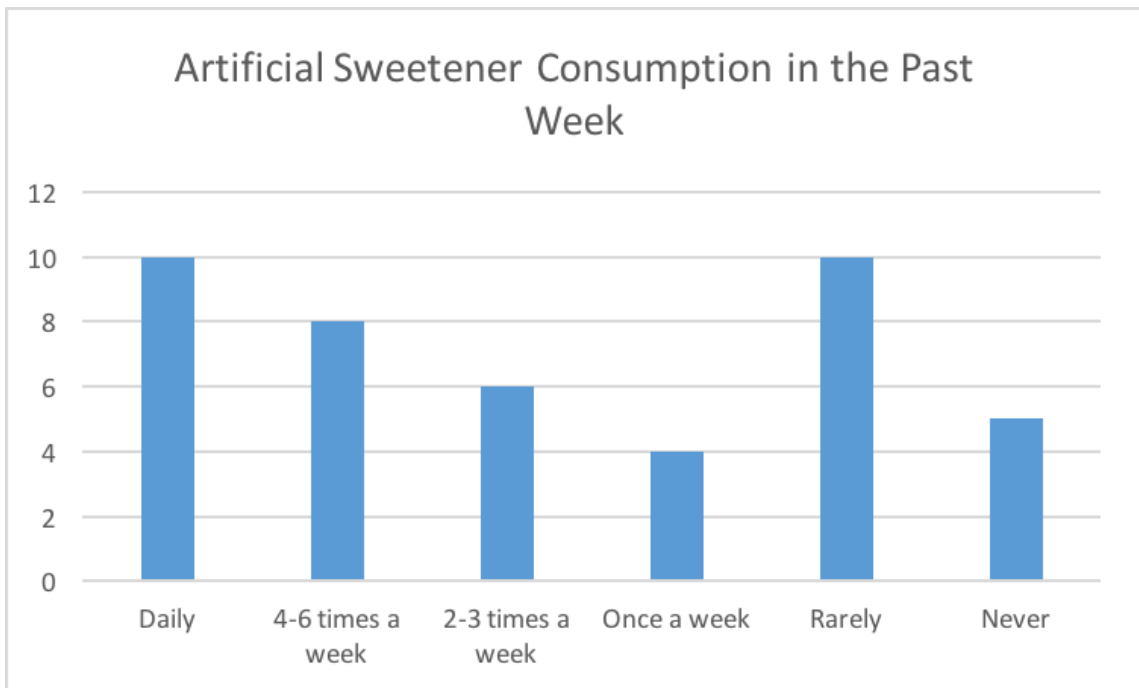


Figure 4. Artificial Sweetener Consumption in the Past Week

When considering the past month, less participants reported consuming artificial sweeteners daily; “most days” and “rarely” were the two most chosen answers making up 33% and 26% of responses, respectively. This data is illustrated in Figure 5.

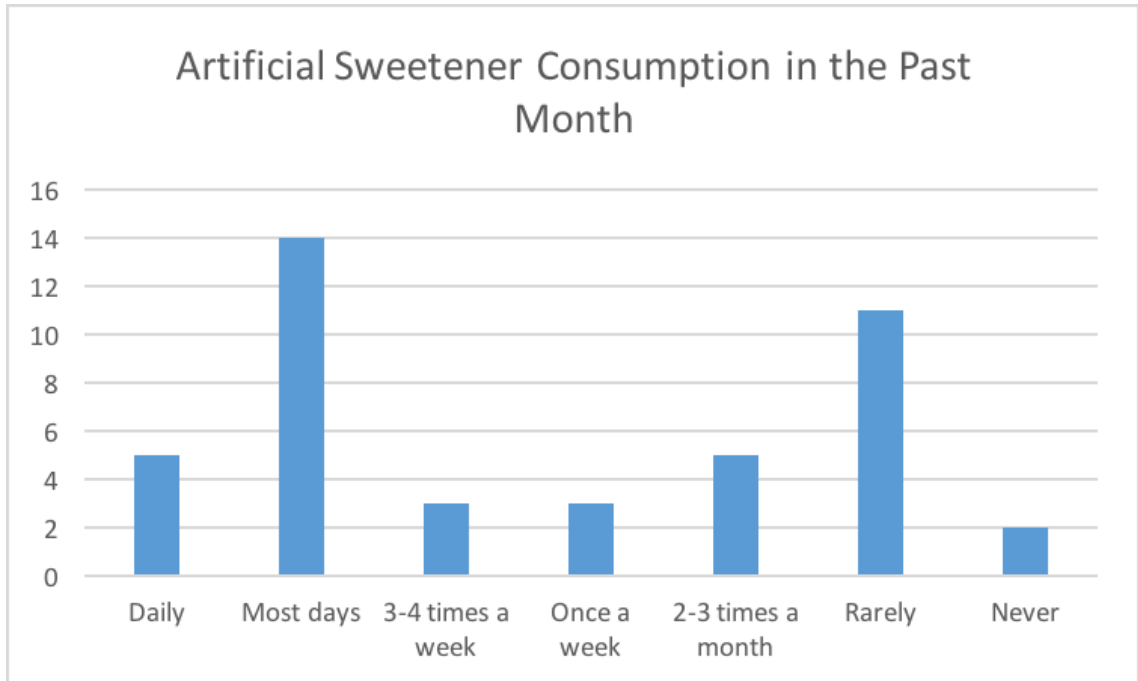


Figure 5. Artificial Sweetener Consumption in the Past Month

Finally, daily consumption over the past six months is the second least chosen answer behind “never”. Thirty-five percent of participants reported consuming artificial sweeteners most in the past six months, while 23% reported consuming artificial sweeteners only rarely. This data is illustrated in Figures 6. Forty-nine percent of participants reported that they try to limit or avoid artificial sweeteners.

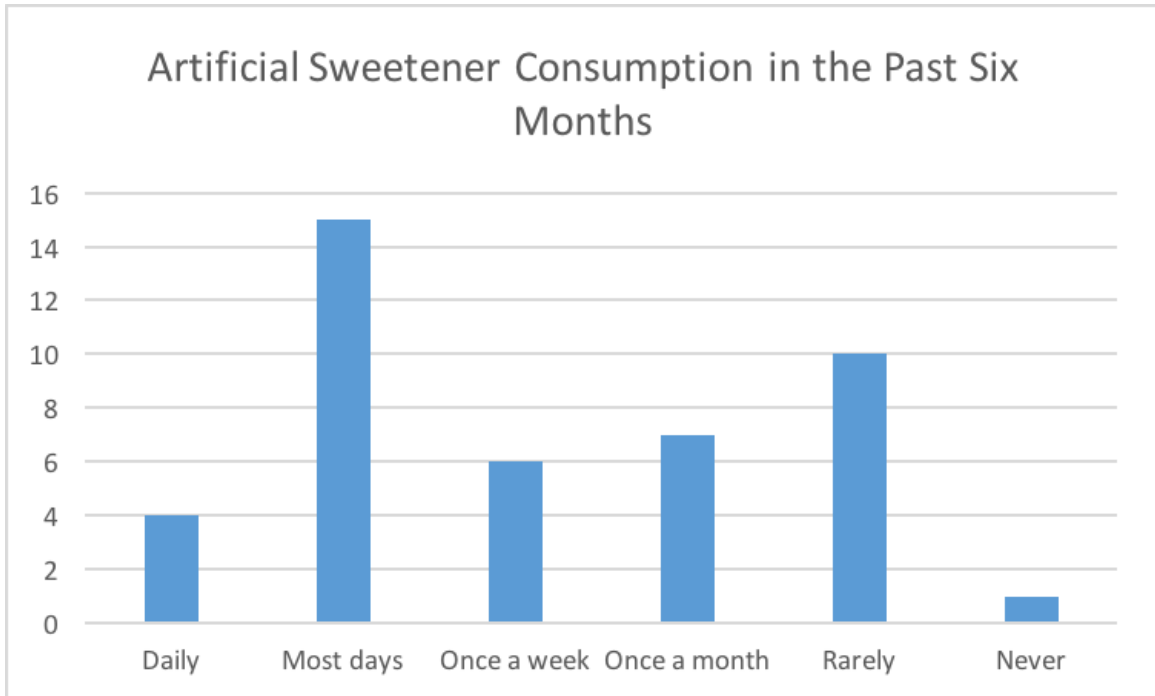


Figure 6. Artificial Sweetener Consumption in the Past Six Months

When the participants were asked which of the six approved artificial sweeteners they had consumed in the past six months (Fig.7), more than 50% said they were not sure. Some participants reported consuming a familiar artificial sweetener, but they also reported uncertainty about whether or not they had consumed others. The two most commonly consumed artificial sweeteners were aspartame (50% of participants) and sucralose (33% of participants).

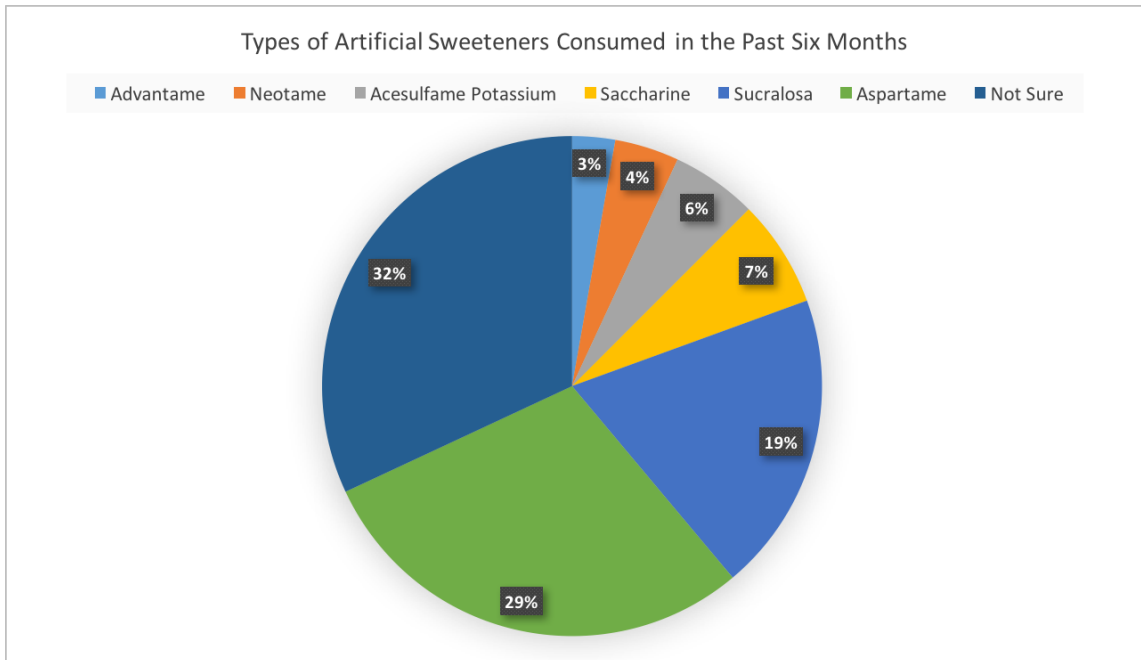


Figure 7. Type of Artificial Sweeteners Consumed in the Past Six Months

When asked the primary motivation for the consumption of artificial sweeteners (Fig. 8), eleven participants (26%) cited taste preference. The second most common answer was the reduction of calories at 21% of participants. Eleven participants chose “none” because they do not have a motivation for consuming artificial sweeteners.

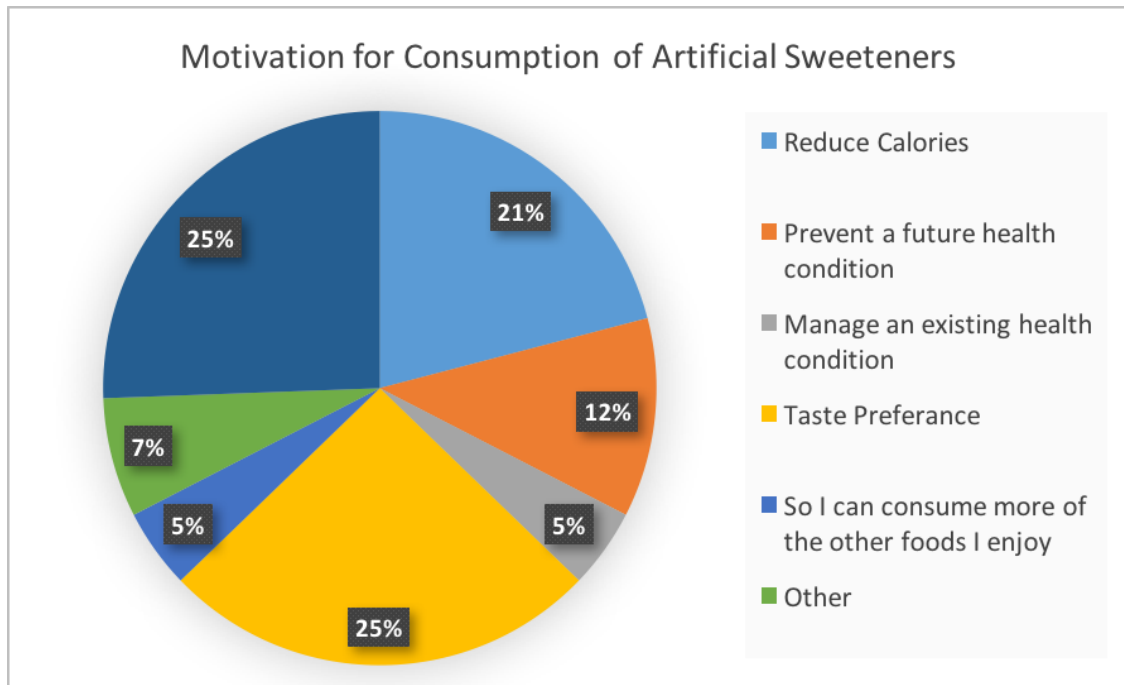


Figure 8. Motivation for Consumption of Artificial Sweeteners

Twenty-four percent of women cited calorie reduction as their primary motivation for artificial sweetener consumption, while only 10% of men cited this reason. A higher percentage of women (approximately 40%) reported consumption of artificial sweeteners on most days than men (10%), but a higher percentage of men (30%) report daily consumption than women (3-6%). Apart from these small facts, the consumption data did not yield any other strong demographic trends.

Natural and Artificial Sweetener Biological Interaction Awareness

The participants ranked their current awareness of how both natural and artificial sweeteners interact with the body from “a great deal” to “none at all”. Participants tended to report more awareness of natural sweeteners’ interactions than artificial sweeteners’ interactions. Forty percent of participants ranked their natural sweetener interaction awareness as “a moderate amount”. The next most common rankings were “a little”

(33%), and “none at all” (14%). The distribution of participants’ responses is illustrated in Figure 9.

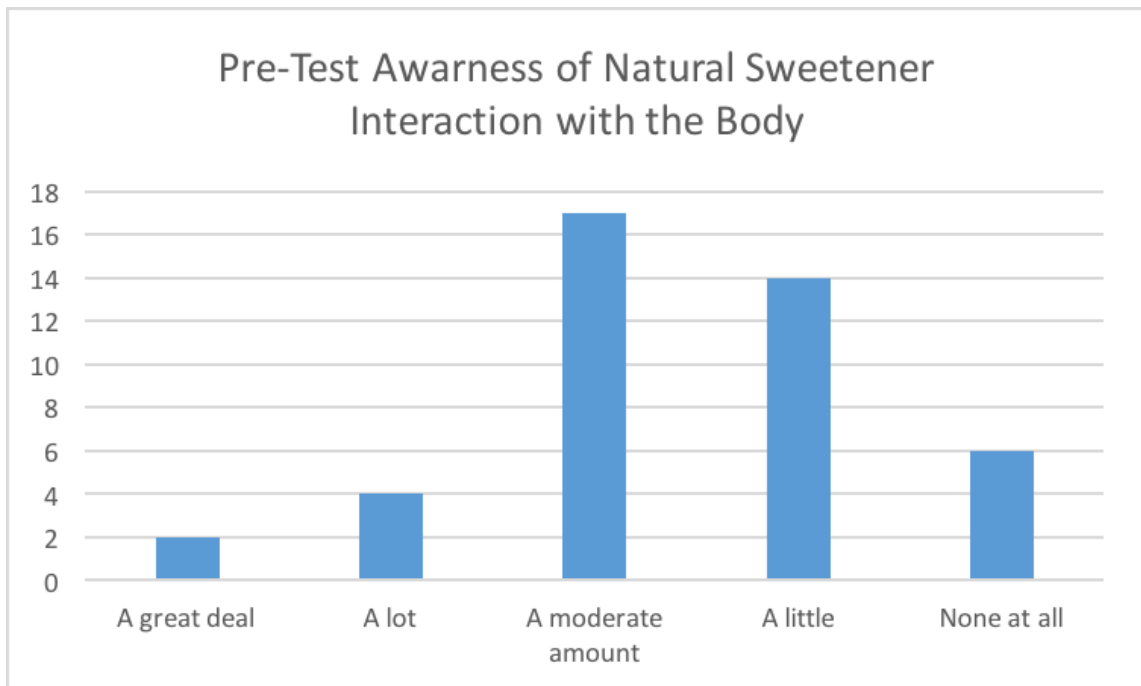


Figure 9. Pre-Test Awareness of Natural Sweetener Interaction with the Body

For artificial sweetener interaction awareness, only 33% of participants reported a “moderate amount” of awareness; 37% reported having only “a little” awareness of the interactions of artificial sweeteners with the body. These results are illustrated in Figure 10.

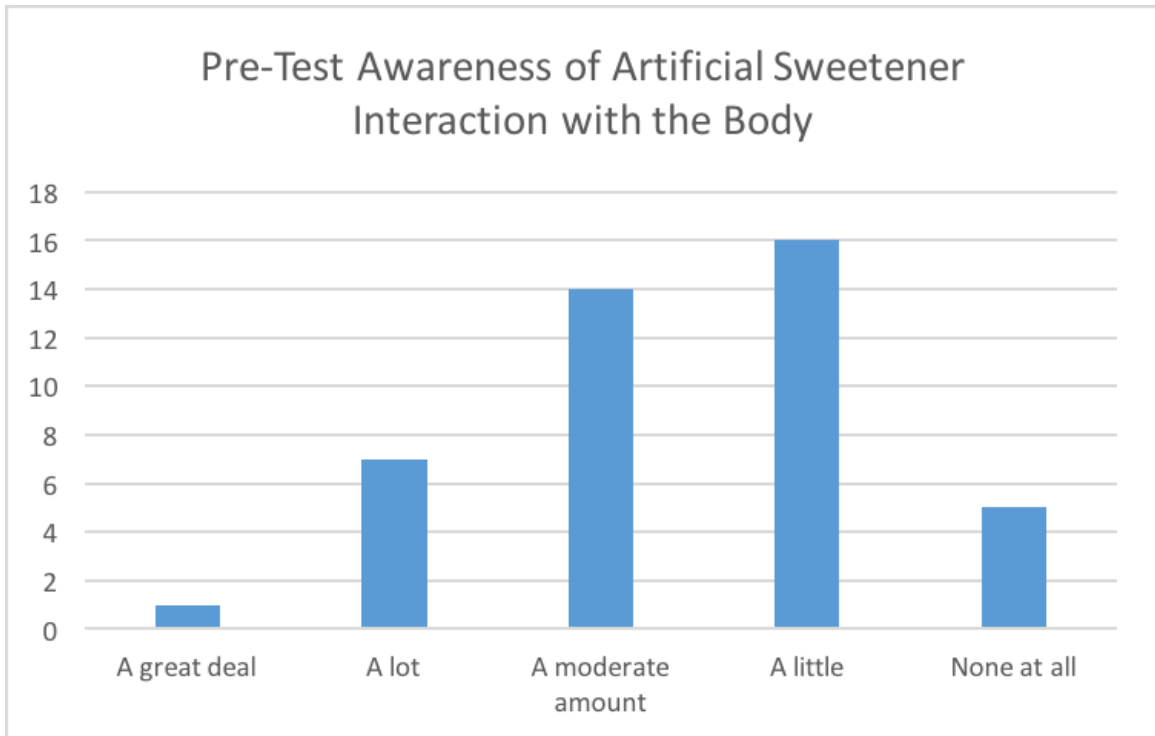


Figure 10. Pre-Test Awareness of Artificial Sweetener Interaction with the Body

After watching the informational video, participants again ranked their awareness in the same fashion as in the pre-test. Ten of the 43 participants reported an inability to watch the informational video intended to increase awareness, so their post-test results were not analyzed and were not compared to other participants' results nor to their pre-test results. In the post-test, 42% of participants who were able to watch the video reported a moderate awareness of natural sweeteners interactions with the body. An equal percentage of participants reported "a lot" of natural sweetener interaction awareness. These results are illustrated in Figure 11.

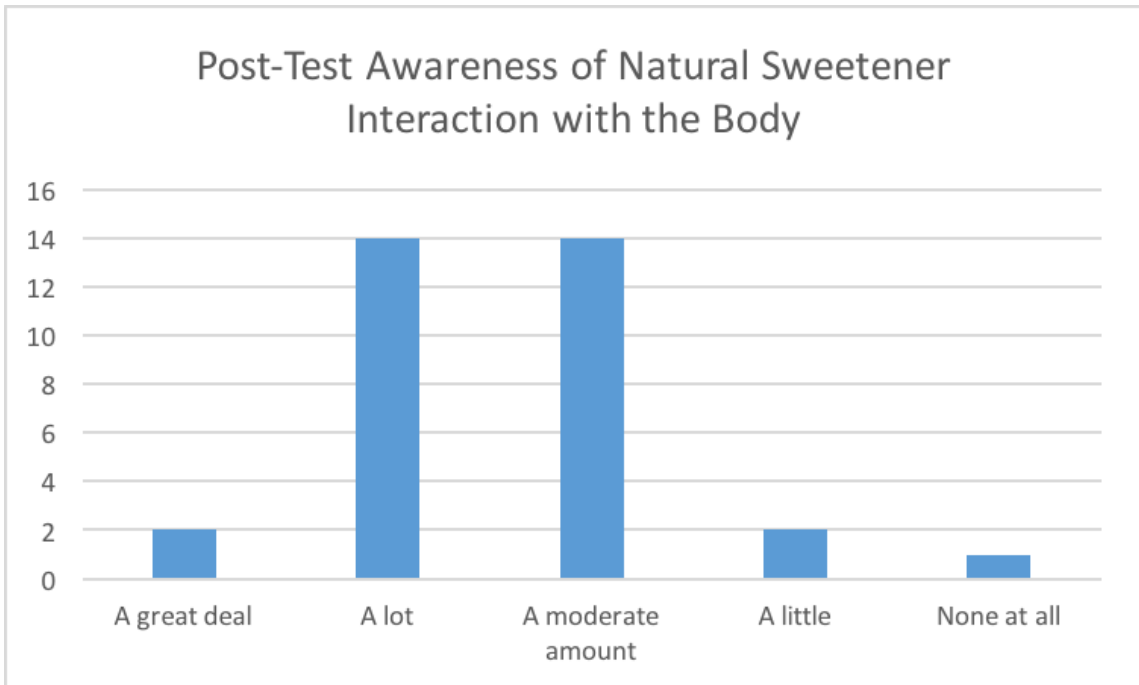


Figure 11. Post-Test Awareness of Natural Sweetener Interaction with the Body

For artificial sweetener interaction awareness, 33% of participants who were able to watch the video reported a “moderate amount”, 42% reported “a lot”, and 15% reported “a great deal”. These results are illustrated in Figure 12.

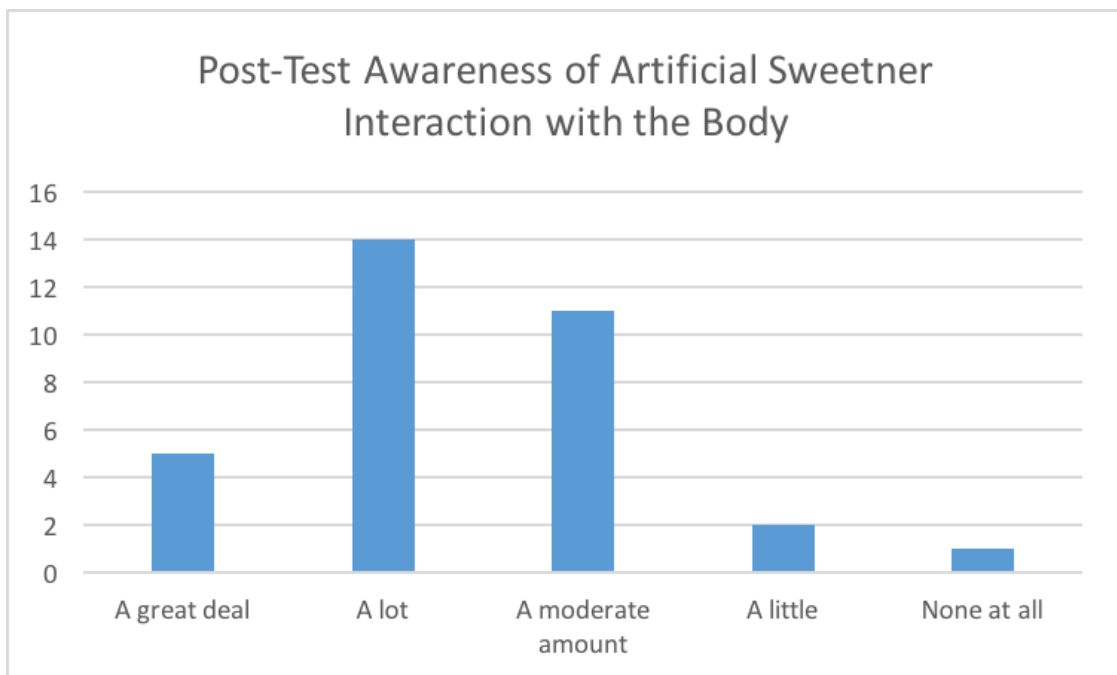


Figure 12. Post-Test Awareness of Artificial Sweetener Interaction with the Body

Of the participants who were able to watch the video, 58% reported an increase in natural sweetener interaction awareness and 70% reported an increase in artificial sweetener interaction awareness.

Concept Scores

Two questions were included in the pre-test and post-test to assess the participants' previous knowledge of artificial sweeteners interactions with the body. For both questions, multiple answers could and should have been selected. For each question, the participant could receive a maximum score of one.

Participants were first asked why artificial sweeteners are often referred to as “low-” or “no calorie” sweeteners. Forty-seven percent of participants responded that they were unsure, 37% chose the answer “artificial sweeteners cannot be metabolized by the body”, and only 14% chose the answer “only a small amount of artificial sweeteners is required to obtain the same sweetness as sugar”. Participants who selected both the “...metabolized...” answer and the “...same sweetness...” answer were awarded a full point. Participants who only selected one of these two answers were only awarded 0.5 points. Participants who chose “not sure” were given a question mark. Forty-seven percent of the participants received a question mark, and 51% were given 0.5 points. The same scoring system was followed for the same question in the post-test. Again, responses of participants who did not watch the video were not analyzed or used for comparisons. Of the participants who watched the video, only 3% were given a question

mark, 79% were given 0.5 points, and 15% received the full point. Fifty-eight percent of participants' scores for this improved after watching the video.

The next question asked participants to select the ways artificial sweeteners interact with the body. Again, a high percentage (49%) of participants selected that they were not sure. "Stimulation of sweet taste receptors" was the next most common answer, chosen by 37% of participants. "Digestive bacteria" and "hunger hormone stimulation" were both chosen by 12% of participants, and "glucose absorption" was chosen by 14%. Participants who selected "digestive bacteria", "hunger hormone stimulation", or "sweet taste receptors" were awarded 0.33 points. Those who selected two of the three were given 0.67 points. Those who selected "glucose absorption" received zero points because this is a false answer. Again, those who selected "not sure" received a question mark. In the pre-test, 47% received question marks, 37% received 0.33 points, 5% received 0.67 points, and 5% received 1 point. However, none of the participants who received the full one point failed to select "glucose absorption". In the post-test, 18% received question marks, 55% received 0.33 points, 9% received 0.67 points, and 12% received one point. The same phenomenon occurred as in the pre-test regarding the additional "glucose absorption" selection. Forty-five percent of participants' scores improved after watching the video, but 6% of participants' scores actually decreased after watching the video.

Artificial Sweetener Perception

Participants' perception of artificial sweeteners was assessed with a question asking them to choose all of the statements they believe to be true about artificial

sweeteners. This question appeared in both the pre-test and the post-test. The general results of this question can be found in Figure 13.

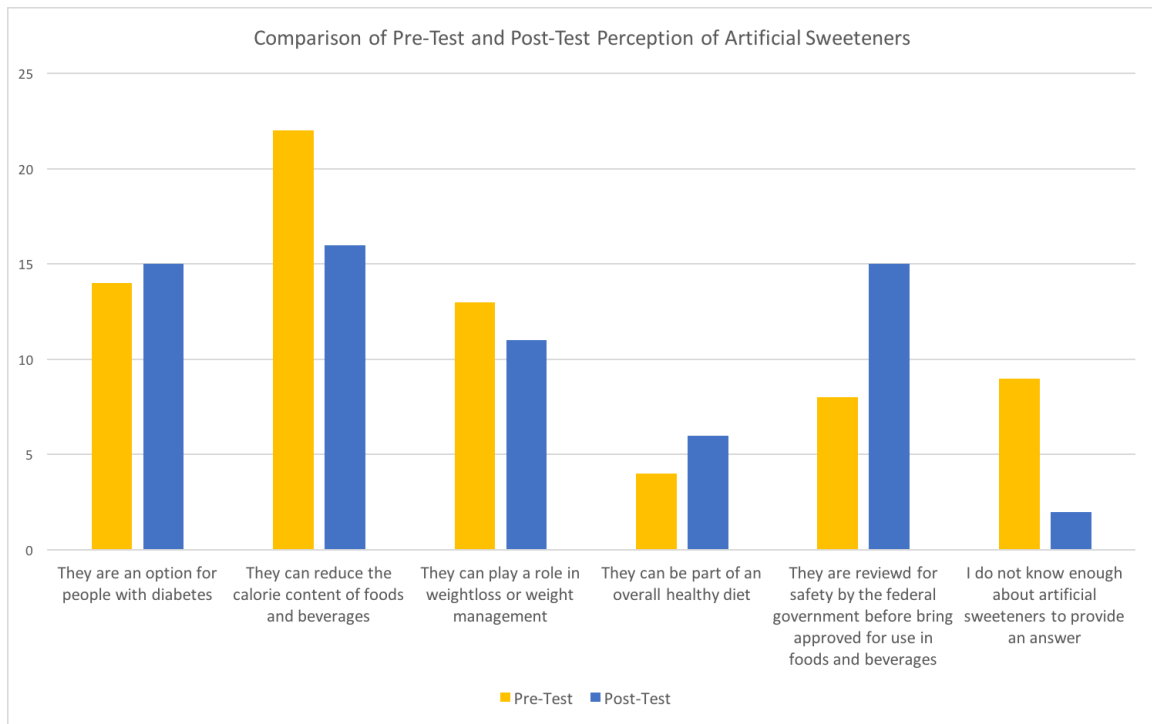


Figure 13. Comparison of Pre-Test and Post-Test Perception of Artificial Sweeteners

Before watching the video, 22% of participants felt that they did not know enough about artificial sweeteners to provide an answer. After watching the video, this was reduced to only 7%. Of the participants who were able to watch the video, 61% changed their answer after the video. Most changed their answer to include more of the statements, and some changed their answer completely; only a few participants subtracted statements from their original answer.

Future Behaviors

Only responses of participants who were able to watch the video were analyzed for this section. The results of the likelihood of participants to consume artificial sweeteners in the future can be found in Figure 14.

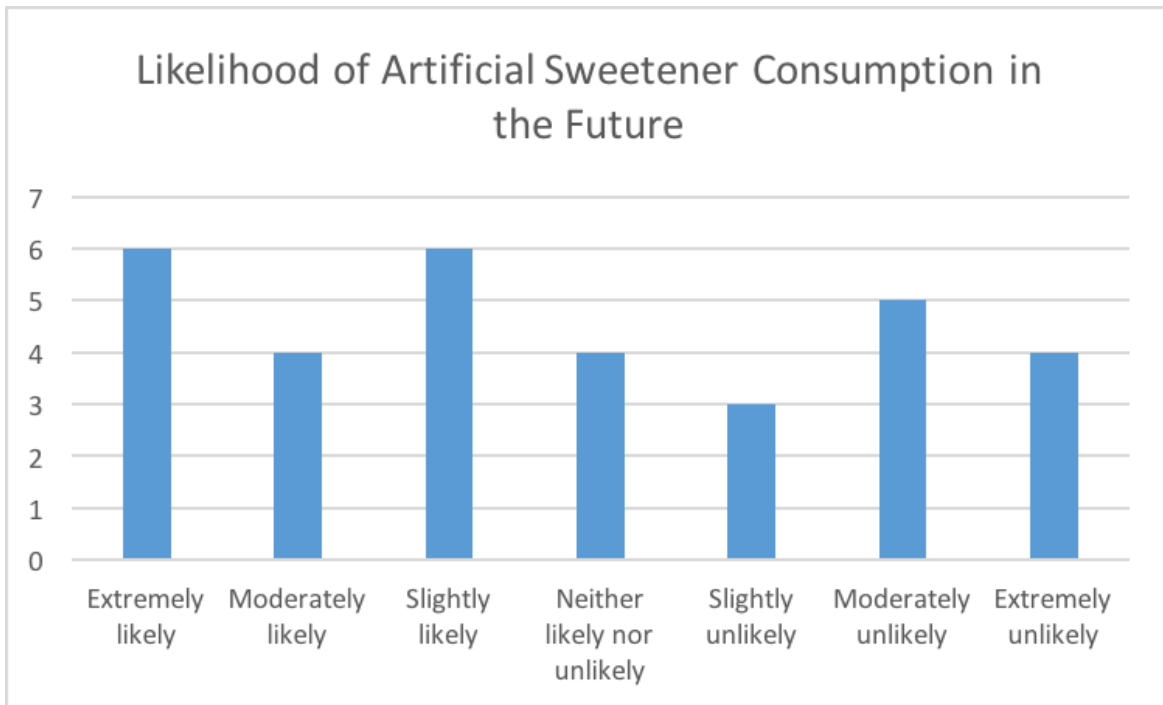


Figure 14. Likelihood of Artificial Sweetener Consumption in the Future

The results are all fairly similar; not one answer was chosen significantly more than the others. The average answer selected was neutral: “Neither likely nor unlikely”. The results of the likelihood of participants to investigate other compounds’ interactions with the body can be found in Figure 15.

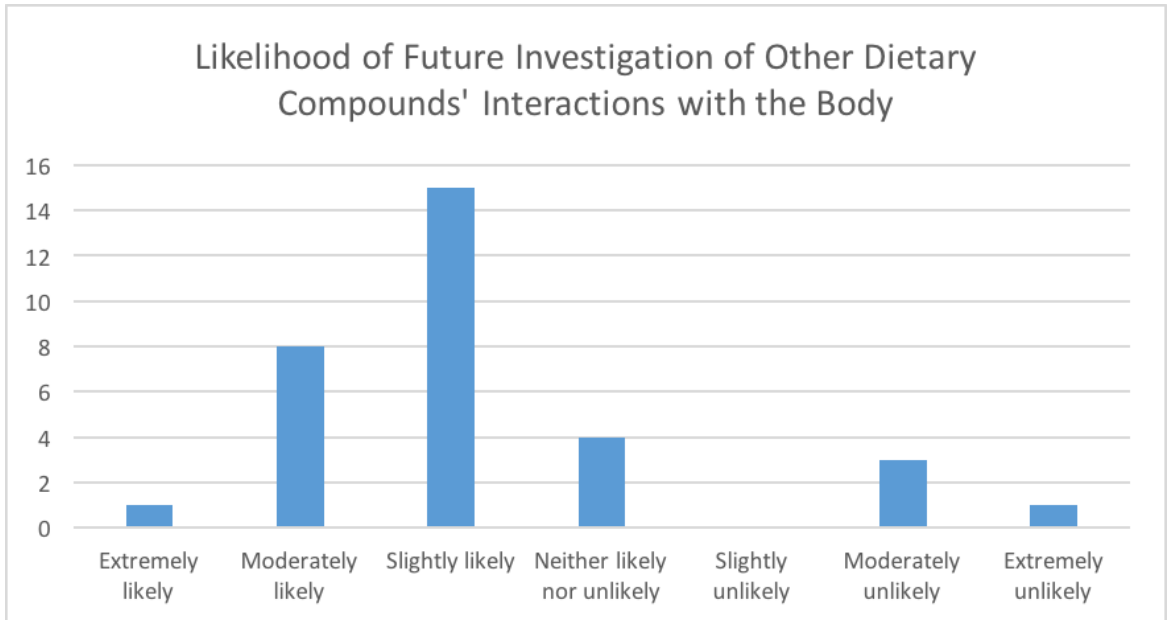


Figure 15. Likelihood of Future Investigation of Other Dietary Compounds' Interactions with the Body

These results show a more obvious trend, as opposed to the previous question. Seventy-five percent of participants chose a positive answer: slightly likely, moderately likely, or extremely likely to investigate other compounds interactions with the body. The average answer chosen was “slightly likely”.

Discussion

Research Questions and Hypotheses

What is the typical artificial sweetener consumption for traditional college age individuals? The trend for this sample was that most individuals either consume artificial sweeteners in fairly large amounts or fairly small amounts, with very few individuals reporting a moderate intake. This indicates that participants already have a specific opinion formed about artificial sweeteners. Because about half of participants reported that they try to limit or avoid artificial sweeteners and the other half was mostly

indifferent, the opinion of artificial sweeteners seemed to be generally negative. Forty-two of the 43 responses reported at least some consumption of artificial sweeteners per month, yet more than 50% of participants were not sure of the types of artificial sweeteners they consumed. Because more participants cited taste preference than those who cited calories reduction as their primary motivation for artificial sweetener consumption, it may be concluded that individuals in this age range value taste over calorie content when making dietary choices.

What is the current awareness of artificial sweeteners' interactions with the body of traditional college age students? Self-assessment of participants' awareness of the interactions of natural sweeteners with the body served as a kind of control for the study. All participants were expected to have a moderate to high level of awareness of natural sweetener interactions due to the content of elementary science and high school and college biology courses. This was found to be somewhat true, as 75% of participants felt that their natural sugar interaction awareness was either moderate or low. Participants' awareness of artificial sweetener interactions with the body was expected to be low, and this hypothesis was also only partially supported; 49% of participants felt their awareness was low to none, while 33% felt their awareness was moderate. However, these results combined with the low average concept scores and high percentage of participants who answered "not sure" to the concept questions supports the hypothesis that artificial sweetener interaction is low in this age group.

Is video education an effective tool for increasing awareness of artificial sweetener interaction with the body in traditional college age individuals? While ten of the 43 participants reported they were unable to watch the video, a high percentage of

participants that were able to watch the video saw improvements in all four categories: natural sweetener interaction awareness, artificial sweetener interaction awareness, and both concept scores. Increase in natural sweetener interaction awareness occurred in 58% of participants, and 70% of participants demonstrated an increase in artificial sweetener awareness after watching the video. Concept scores increased and concept uncertainty decreased after participants watched the video, with an average of 50% of participants seeing improvement. This evidence points clearly to video education as an effective media for improving artificial sweetener awareness in traditional college age individuals.

Does increased awareness of artificial sweeteners' interactions with the body lead to intent to change dietary habits in traditional college age individuals? Because there was no trend to either the positive or negative side of this question and the average answer was neutral, the hypothesis that increased awareness of artificial sweetener's interactions with the body will lead to intent to change consumption habits was not supported. This evidence may have been more conclusive if the question had been posed differently. The change in the results would have been easier to visualize if the question had asked, "What is your intended artificial sweetener consumption in the future?" The answer choices to this question would have been "more than in the past", "same as in the past", or "less than in the past".

Will participating in this survey inspire individuals to investigate other dietary compounds' interactions with the body? The final question of the survey that assessed the participants' intent to investigate compounds' interactions with the body yielded distinctly positive results. The majority of participants (75%) expressed some likelihood

of investigating other compounds. This finding indicates that individuals of this age group are likely to want to improve their health literacy.

Limitations and Directions for Future Research

The primary limitation to drawing conclusions from the results presented is that the research sample is not generalizable to the United States population. The primary reason for this is the ethnicity demographics. Because the only individuals who participated in the survey were Caucasian, the research sample is not representative of the demographics of the United States. Further, the ratio of males to females surveyed is much smaller than the ratio of males to females in the United States population (Howden and Meyer 2010). A good sample would contain an approximately equal number of males and females. Because this sample does not correspond with the US population, reliable predictions about how other individuals in this age range will answer are not possible. Furthermore, the small sample size also prevents the results from being generalizable. Sample size probably would have increased if the video had been viewable directly in the questionnaire. Because the participant had to view the video by clicking on a link, then returning to the survey manually, many participants did not return to the survey; thus, their responses were only partial and had to be deleted. Allowing the survey to be live for a longer amount of time and establishing more aggressive distribution procedures would have also increased the sample size to a more reliable level, which would probably also increase the diversity of the participants in gender, ethnicity, residence, and level of education. Obtaining this participant diversity would allow potentially interesting demographic trends to be analyzed and reported.

The concept questions were the most difficult questions in the survey, but most participants' scores probably could have been higher had the question been more explicit in the ability to select more than one answer. However, many participants did select the wrong answer on both questions, so the results probably still reflect the general trends in knowledge gained from the video.

As in any survey, the results are entirely dependent on participant honesty. All conclusions drawn from the data obtained from the survey rely on the assumption that participants answered all the questions honestly and watched the entirety of the video. The narration provided information essential to understanding the information presented with images in the video, but some participants may have watched the video with audio disabled. Results probably would have shown a greater increase in awareness and concept scores if all participants had watched the video with sound enabled. However, participant honesty is nearly impossible to measure; when drawing conclusions from the data, researchers must assume participant honesty.

Conclusion

Despite the small sample size and potential participant dishonesty, this study yielded some promising results that may lead to further research and better research methods in this area of study. For this sample, 42 out of 43 participants reported consuming artificial sweeteners at least once in the month previous to participation in the study, most consuming them at least once a week. Participants were generally unaware of the types of artificial sweeteners they were consuming. A little less than half of participants said they try to limit or avoid artificial sweetener consumption, but when

they do consume them, the primary motivations were taste preference and calorie reduction.

The pre-test awareness of artificial sweetener interaction with the body, as well as natural sweetener interaction with the body, was relatively low. Concept scores were also low, and a large percentage of participants reported being unsure of the answers (rather than guessing). Participants that were able to watch the video (33 out of 43 total participants) saw a significant increase in natural and artificial sweetener interaction awareness, and their concept scores also increased accompanied by a decrease in uncertainty. Most participants reported a change in perception of artificial sweeteners, but the data was not conclusive enough to reveal specific trends. On average, participants reported a neutral response to the likelihood of artificial sweetener consumption in the future but a positive response to the likelihood of further dietary compound investigation.

Overall, this study demonstrated the effectiveness of video education on increasing health literacy and future interest in increasing health literacy in the sample. Further studies will need to be conducted to obtain a large enough sample to be generalized to the US population for this age range. However, this study shows that video education has the potential to increase health literacy over a variety of topics and to increase patient accountability for preventative healthcare.

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Appendices

Appendix A: Institutional Review Board Approval Letter



INSTITUTIONAL REVIEW BOARD

118 College Drive #5147 | Hattiesburg, MS 39406-0001

Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 16020405

PROJECT TITLE: Awareness of Biological Mechanisms of Artificial Sweeteners of Traditional College-aged Individuals and the Effect of Video Education to Increase this Awareness and Intent to Change Dietary Habits

PROJECT TYPE: New Project

RESEARCHER(S): Cassie Mahler

COLLEGE/DIVISION: College of Science and Technology

DEPARTMENT: Biological Sciences

FUNDING AGENCY/SPONSOR: N/A

IRB COMMITTEE ACTION: Expedited Review Approval

PERIOD OF APPROVAL: 03/03/2016 to 03/02/2017

Lawrence A. Hosman, Ph.D.

Institutional Review Board

Appendix B: Survey

Participant Consent:

Potential Participant:

Thank you for your interest in participating in this study. This study is a survey consisting of three parts.

Part one will present you with questions to assess your demographic information, your current consumption of artificial sweeteners, and your current knowledge of how artificial sweeteners interact with the body. This should take less than five minutes.

Part two will present you with a short video about the findings of recent research published on artificial sweeteners' interactions with the body.

Part three will present you with a few questions to assess your comprehension of the information in the video, as well as a few questions regarding your intentions for future artificial sweetener consumption. This should take less than five minutes.

The questions in this survey do not require any sensitive or private information, and there is no risk associated with your participation. Upon completion of the survey, you will have the opportunity to be entered into a drawing for a gift card.

Please understand that in proceeding with this survey, you are giving consent for your responses to be collected and analyzed for research purposes. Your responses will be collected anonymously.

Remember, your participation is completely voluntary, and you can choose to terminate your participation at any time. If you have any questions, comments, or concerns, please feel free to contact me, Cassie Mahler, at cassie.mahler@eagles.usm.edu.

This study has been reviewed and approved by the Institutional Review Board at the University of Southern Mississippi. Any questions or concerns about the study may also be directed to the IRB by phone at 601-266-5997 or by email at IRB@usm.edu.

Eligibility:

Year of Birth: (YYYY)

Pre-Test:

Demographics:

1. Gender
 - a. Male
 - b. Female
2. Ethnicity
 - a. White
 - b. African American
 - c. Hispanic or Latino
 - d. American Indian or Alaska Native
 - e. Asian
 - f. Native Hawaiian or Pacific Islander
 - g. Other

3. Zip code
4. Level of Education
 - a. Less than High School
 - b. High School Graduate
 - c. Some college
 - d. 2-year degree
 - e. 4-year degree
 - f. Professional Degree
 - g. Doctorate
5. Secondary Education Area of Study (if applicable)

Current Consumption of Artificial Sweeteners

1. How often have you consumed artificial sweeteners in the past week?
 - a. Daily
 - b. 4-6 times a week
 - c. 2-3 times a week
 - d. Once a week
 - e. Rarely
 - f. Never
2. How often have you consumed artificial sweeteners in the past month?
 - a. Daily
 - b. Most days
 - c. 3-4 times a week
 - d. Once a week
 - e. 2-3 times a month
 - f. Rarely
 - g. Never
3. How often have you consumed artificial sweeteners in the past six months?
 - a. Daily
 - b. Most days
 - c. Once a week
 - d. Once a month
 - e. Rarely
 - f. Never
4. Select all of the following artificial sweeteners that you have consumed in the past six months.
 - a. Saccharine
 - b. Aspartame
 - c. Acesulfame potassium
 - d. Sucralose
 - e. Neotame
 - f. Advantame
 - g. Not sure
5. To what extent do you try to consume or avoid artificial sweeteners?
 - a. Try to consume
 - b. Just try to be aware
 - c. Try to limit/avoid
 - d. Don't pay attention to
 - e. Not sure
6. What is the primary motivation for your consumption of artificial sweeteners?
 - a. To help reduce the total number of calories I consume
 - b. To prevent a future health condition
 - c. To manage an existing health condition
 - d. Taste preference
 - e. So I can consume more of the other foods I enjoy

- f. Other
- g. None – I do not try to consume low calorie sweeteners

Current Awareness of Artificial Sweeteners

1. Which of the following best describes your current awareness of how natural sweeteners interact with the body?
 - a. A great deal
 - b. A lot
 - c. A moderate amount
 - d. A little
 - e. None at all
2. Which of the following best describes your current awareness of how artificial sweeteners interact with the body?
 - a. A great deal
 - b. A lot
 - c. A moderate amount
 - d. A little
 - e. None at all
3. Why are artificial sweeteners often referred to as “low- or no-calorie” sweeteners?
 - a. They cannot be metabolized by the body.
 - b. Only a small amount is required to obtain the same sweetness as sugar.
 - c. The product packaging says so.
 - d. None of the above
 - e. I’m not sure
4. In which of the following ways do artificial sweeteners interact with the body?
 - a. Through alteration of the composition of bacteria in the digestive tract
 - b. Through stimulation of sweet-taste receptors
 - c. Through indirect activation of hormones that stimulate the feeling of hunger
 - d. Through stimulation of glucose absorption in the small intestine
 - e. I’m not sure
5. Which of the following, if any, do you agree with regarding artificial sweeteners?
 - a. They are an option for people with diabetes
 - b. They can reduce calorie content of foods
 - c. They can play a role in weight loss or weight management
 - d. They can be a part of an overall healthy diet
 - e. They are reviewed for safety by the federal government before being approved for use in foods and beverages
 - f. None of the above
 - g. I do not know enough about artificial sweeteners to provide an answer

Video:

Please watch the following video:

ATTENTION: After you click the link and watch the video, please use the "back" button in your browser to return to the survey.

https://www.youtube.com/watch?v=b_i9rxyqUtE

- a) I have watched the entirety of the video
- b) I was unable to watch the video

Post-Test:

Comprehension

1. Which of the following best describes your current awareness of how natural sweeteners interact with the body?
 - a. A great deal
 - b. A lot
 - c. A moderate amount
 - d. A little
 - e. None at all
2. Which of the following best describes your current awareness of how artificial sweeteners interact with the body?
 - a. A great deal
 - b. A lot
 - c. A moderate amount
 - d. A little
 - e. None at all
3. Why are artificial sweeteners often referred to as “low- or no-calorie” sweeteners?
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 - c. The product packaging says so.
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 - e. I’m not sure
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 - b. They can reduce calorie content of foods
 - c. They can play a role in weight loss or weight management
 - d. They can be a part of an overall healthy diet
 - e. They are reviewed for safety by the federal government before being approved for use in foods and beverages
 - f. None of the above
 - g. I do not know enough about artificial sweeteners to provide an answer

Future Behavior

1. How likely are you to consume artificial sweeteners in the future?
 - a. 1 – Not likely
 - b. 2
 - c. 3 – Neutral
 - d. 4
 - e. 5 – Very likely
2. How likely are you to investigate how other compounds interact with the body?
 - a. 1 – Not likely
 - b. 2
 - c. 3 – Neutral
 - d. 4
 - e. 5 – Very likely