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The Effect of Consumer Attitudes and Beliefs on Sensory Perception and Liking of Chocolate
Milk

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ABSTRACT

It is known that beliefs and attitudes towards certain characteristics of food, e.g., fat content and sweetener type, affect sensory perception. Brodock et al. (2021) identified three segments of athletic adults – natural eaters, average consumers, and calorie conscious - that differed in their attitudes towards chocolate milk ingredients in an online survey. Here I aimed to reveal differences in acceptability and sensory perception for two different chocolate milks between two of those segments, the calorie conscious and natural eaters.

A group of athletic young adults (n=388) were segmented based on their responses to an online adaptive choice based conjoint analysis (ACBC) survey. Calorie conscious consumers (n=28) preferred chocolate milks with low-calorie sweeteners and low in fat content, while natural eaters (n=68) preferred chocolate milks products made with natural, caloric sweeteners and strongly disliked low-calorie sweeteners.

In a subsequent taste test, members of both groups evaluated two commercial low-fat chocolate milks for overall liking, and perceived intensities of creaminess, cocoa flavor, and sweetness. Both low-fat chocolate milks were presented alongside their nutritional label and with either a “This product was made with real sugar” (TruMoo) or a “This product was made with low calorie sweeteners” (CorePower) statement.

Several significant differences between the segments and samples were found ($p < 0.05$): As hypothesized natural eaters (n=34) liked the TruMoo sample significantly more than the calorie conscious (n=16), and while not significant, calorie conscious individuals liked the CorePower chocolate milk more than TruMoo. The calorie conscious segment perceived significantly less creaminess from the TruMoo than the CorePower milk, which could result

from a horns effect from negatively associating caloric sweetener with less creaminess. This creaminess rating difference was not hypothesized, but demonstrates the effect that consumer attitudes have on sensory perception of products.

Overall, we found that consumer attitudes and beliefs can significantly affect sensory perception and liking of food products.

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Chapter 1

Introduction

It is no secret that people differ in their food preferences. Groups of people that engage in similar hobbies, are of similar age, gender or health status can often be grouped as having similar preferences when searching for food products. Past research has indicated that consumers' attitudes towards certain characteristics of food, such as fat content affect the sensory perception associated with foods (Aaron et al., 1994).

A previous study conducted at Penn State (Brodock, 2021) identified three different consumer segments among athletic young adults ages 18-45, based on their preferences for characteristics of a chocolate milk product; these segments were termed calorie conscious, natural eaters and average consumers based on their stated preferences for certain characteristics of a chocolate milk product. The calorie conscious segment in this study was characterized by a preference for chocolate milk products with 0-4 grams of sugar (low sugar), disliked whole milk and preferred 1% (low fat) milk, and had no extreme disliking for a certain sweetener type. The natural eaters consumer segment preferred chocolate milk beverages with 0-4 grams of sugar (low sugar), sweeteners from natural sources (sugar cane, sugar beets, monk fruit and agave nectar) and had no strong preferences for a specific milk fat level. The average consumers preferred chocolate milk beverages made with sugar cane, was the only group who had positive feelings about chocolate milk made with more than 6 grams of sugar and preferred whole milk the most followed by 2% milk (Brodock, 2021).

These consumer segments were identified using an adaptive choice based conjoint analysis (ACBC) online survey. A conjoint analysis is a survey type that quantitatively evaluates and balances what attributes consumers look for in products that they buy (Louviere, 1994). This allows producers to create products that more closely align with the needs and desires of consumers. An ACBC survey consists of different products, systematically varying in the pre-defined attributes and levels within each attribute. In the study by Brodock (2021), the ACBC survey evaluated the effects of sweetener types, added sugar content, milk fat content, protein content, and label text on consumer choice, where each attribute had between 4 to 7 levels.

Similarly, in my thesis research an ACBC was run using the same attributes to separate consumers into segments based on what they look for in chocolate milk products. These segments then tasted two different chocolate milks to see if their desire for certain attributes in a product affected their sensory experience with the product.

The target demographic for this ACBC survey was athletic young adults. The rationale for this was based on findings by Brodock (2021) that reported that chocolate milk is widely consumed post workout. Here, physical activity was determined in two ways – number of exercise events per week (only individuals who exercised more than three times a week were allowed to complete the ACBC) and via the Rapid Analysis of Physical Activity (RAPA) survey. The RAPA is a tool created to assess the activity level of older adults (over the age of 50) (Topolski et al., 2006). Despite that the RAPA tool was used to quantify the activity level of participants as it has two measurement scales: RAPA 1, which accesses a participants' aerobic physical activity level and RAPA 2, which accesses a participants' strength and flexibility physical activity level (Topolski et al., 2006).

The RAPA scale provides simple definitions and examples of three levels of activity intensity with the intensity levels being light, moderate and vigorous (see also Appendix A, pg. 62). Light activities are those where a participant's heart beats slightly faster than normal, but they can still talk and sing while doing the activity. Moderate activities are those where the participants' heart beats faster than normal, and they can talk, but not sing while doing the activity. Lastly vigorous activities are those where the participants' heart beats fast and the participant is unable to talk or sing continuously. Participants are asked when filling out the RAPA questionnaire a series of questions regarding how often they exercise at each of the three intensities in a week. The RAPA 1 score ranges between 1-7 based on the amount of exercise a person completes each day with scores below 6 considered sub-optimal. The RAPA 2 score ranges from 0-3, depending on how participants answer two questions about frequency of strength training, flexibility training, or both in a week (Topolski T.D., et al. 2006).

In addition to asking participants about their physical activity level, participants also completed the Teruel Orthorexia Scale (TOS) questionnaire, which helps determine an individuals' level of orthorexia nervosa (OrNe) and healthy orthorexia (HeOr) tendencies. Orthorexia nervosa is associated with an obsession or an extremely strict diet regarding healthy eating, resulting in negative physical or psychological consequences. Healthy orthorexia on the other hand is a non-obsessive interest in healthy eating. The TOS questionnaire (see also Appendix A, pg. 64) provides statements about what drives participants' healthy food choices and about their mindset when they eat healthy versus "unhealthy" foods. Participants are asked to rate their agreement with each statement on a 5-point scale from completely disagree to completely agree. From the 17 questions the two sub-scales (OrNe and HeOr) are calculated (Barthels et al., 2019).

The goal of my thesis was to explore differences in sensory responses to chocolate milk samples that differed in their ingredients, comparing calorie conscious consumers to natural eaters. The chocolate milk samples differed in their sweetener type, namely, one was made with caloric sweeteners from natural sources (e.g. cane sugar or beet sugar) while the other one was made with non-nutritive sweeteners (e.g. monk fruit, stevia extract, sucralose, sugar alcohols, etc.). The United States Department of Agriculture (USDA) defines non-nutritive sweeteners as “[sugar] alternatives that contain zero or very low amounts of carbohydrates or energy” (USDA, n.d.). For the remainder of this thesis “non-nutritive sweeteners” will be referred to as “low-calorie sweeteners” because this is a more easily understood and consumer centric term. The sweetener sources for the chocolate milk beverages used in the taste test were highlighted with the statements “This chocolate milk was made with real sugar” and “This chocolate milk was made with low calorie sweeteners”. This experiment is an adjustment and extension of a Masters thesis (Brodock, 2021) that during the COVID-19 pandemic was unable to recruit sufficient participants for a sensory experiment and obtain statistically significant data.

I hypothesize that the calorie conscious segment will have higher overall liking scores for the CorePower chocolate milk because it is made using low-calorie sweeteners, while the natural eaters segment will have higher liking scores for the TruMoo chocolate milk because it is made with cane sugar. Additionally, I hypothesize that there will be no significant differences in creaminess, sweetness or cocoa intensity ratings between the samples tested because the main difference between them is the different types of sweeteners used. It is most likely that although the type of sweetener is different the chocolate milks will have very similar sweetness intensity ratings because products are formulated to have a level of sweetness desirable to consumers. Both milks are formulated with 1% fat milk, so creaminess ratings should be similar and from

preliminary tasting both products have relatively similar cocoa flavor intensities. Between segments there is not expected to be significant differences in creaminess, sweetness or cocoa intensity ratings because both segments are tasting the same products, and it would be expected that two groups would yield similar results.

Chapter 2

Materials and Methods

This study included two parts, (1) an online survey to determine participants' food choices and exercise habits, followed by segmentation into three segments, and (2) a central location test (CLT) with participants from two of the three segments.

Physically active participants were recruited to complete an online survey through messaging in group chats for different organizations (e.g., Penn State Club Cross Country and Penn State Food Science Club), fliers hung in campus buildings and a flier hung in a local running store. Participants were incentivized with the possibility of being compensated with \$10 if they qualified for the chocolate milk taste test. The survey can be found in Appendix A.

The online survey was set up in Sawtooth (version 9.14.2, Provo, UT, USA) and conducted to gather data on participant's food choice and exercise habits. The survey started with screener questions, where participants were terminated if their answers did not meet inclusion criteria. Qualifying participants needed to be between the ages of 18 and 45, be in good general health (self-declared), speak English, not have a dairy or chocolate intolerance, have normal taste and smell function, not be taking any medicine that may alter taste or smell function, not be pregnant, not have a history of choking or difficulty swallowing, drink milk at least once a month, generally like chocolate, and exercise at least three to four times a week.

Qualified participants completed the adaptive choice-based conjoint analysis by answering a series of questions to determine their preference for chocolate milk products varying in the attributes sweetener types, added sugar content, milk fat content, protein content, and label

text. There were 4-7 levels for each of the attributes evaluated using the ACBC. Each attribute and its levels are summarized in Table 1.

Table 1. Attributes and levels evaluated in the Adaptive Choice Based Conjoint Analysis (ACBC) survey.

<i>Sweetener Type</i>	<i>Added Sugar (g/serving)</i>	<i>Milk Fat</i>	<i>Protein Content (g/serving)</i>	<i>Front of Package Message</i>
Stevia	0	Skim	8	Sports Recovery Drink
Monk Fruit	4	1% fat	16	Good Source of Protein
Agave Nectar	6	2% fat	20	Indulgent Dark Chocolate Milk
Sucralose	8	Whole	24	Premium Dark Chocolate Beverage
Corn Syrup	12		30	Contains Polyphenols
Sugar (from sugar beets)	16			Contains Real Cocoa
Sugar (from sugar cane)				

Additionally, participants completed the Rapid Assessment of Physical Activity (RAPA) questionnaire to determine their physical activity levels. Participants also completed the Teruel Orthorexia Scale (TOS) to evaluate their attitudes and compulsions towards healthy eating.

The completed survey answers were subjected to a hierarchical cluster analysis to segment participants into three segments based on their food choice habits, similar to procedures described in (Brodock, 2021): natural eaters (NE), calorie conscious (CC), and average consumers.

Participants from the calorie conscious and natural eaters groups were then invited to participate in a chocolate milk taste test, conducted as a blind taste test in the Sensory Evaluation Center (SEC) at Penn State. Participants were paid \$10 for completing the sensory test. During the test, participants were presented with two chocolate milks, namely, Fairlife Core Power (CP) chocolate flavored milkshake (Fairlife LLC, Chicago, IL) and TruMoo (TM) low fat chocolate milk (DFA Dairy Brands LLC, Kansas City, KS). These two chocolate milks were selected because of their similarity in fat content and differences in sweetener types. Both chocolate milks were low fat (1% fat), and the TruMoo chocolate milk is sweetened with cane sugar, while the CorePower chocolate milk is sweetened with low-calorie sweeteners including monk fruit juice and stevia leaf extract.

The chocolate milk test was conducted following good sensory practices (Lawless H. T. & Heymann, H., 2010b). For each sample, 2 ounces were presented in lidded, clear 4-ounce cups (Solo, Lake Forest, IL, USA), labeled with unique 3-digit blinding codes, and counter-balanced in serving order across participants. Participants were shown the nutrition facts panel for the respective chocolate milk alongside a statement of either “This product has been made with low calorie sweeteners” for the Fairlife Core Power or “This product has been made with real sugar” for the TruMoo sample. Both statements appeared above the nutrition fact panel as displayed in Figure 1. Participants were asked to taste each sample and rate their degree of liking on a 9-point hedonic scale (Peryam, D.R. & Pilgrim, F.J., 1957), as well as perceived cocoa flavor intensity, sweetness intensity, and creaminess intensity on an unstructured 100-point line scale, with anchor labels at 0 of “none” and 100 of “A lot”. Numbers were not presented to participants, only lower and upper extremes. All data was collected electronically in Compusense 20 (Compusense, Guelph, ONT, Canada). Participants were asked to cleanse their palates with

water (Dasani bottled water) before tasting each sample. The questionnaire used during the taste test can be found in Appendix B.

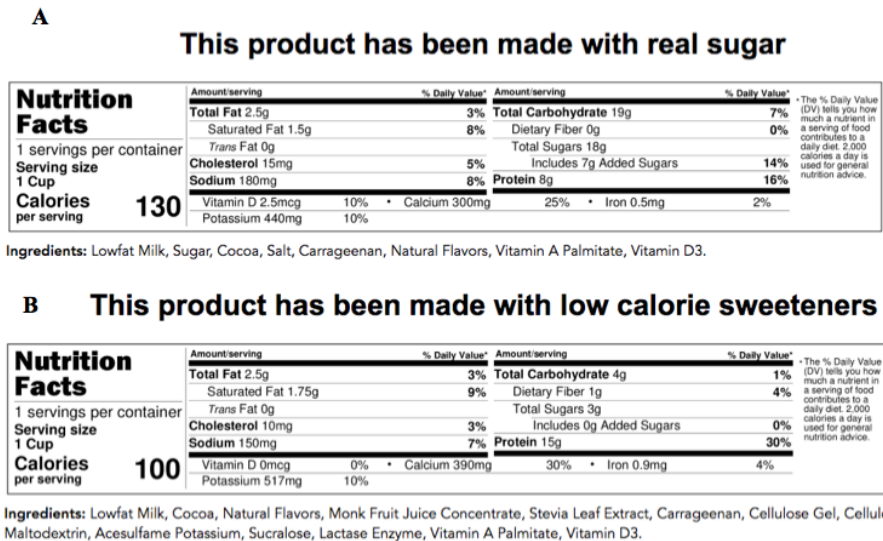


Figure 1. Nutrition labels presented to participants during the chocolate milk taste test

Chapter 3

Results

Subsection 1 – Results of Online Survey

A total of 388 people completed the initial ACBC survey (**Figure 2**), of which 207 were initially screened out because they did not meet the required criteria. The 181 participants who completed the survey were then divided into three main consumer segments based on their responses to the ACBC survey following a hierarchical clustering approach as detailed in (Brodock, 2021). Similar to Brodock (2021), we found consumers that could be characterized as calorie conscious (CC) consumers (n=28), average consumers (n=85), and natural eaters (NE) (n=68). Only CC and NE consumers were invited to the subsequent taste test.

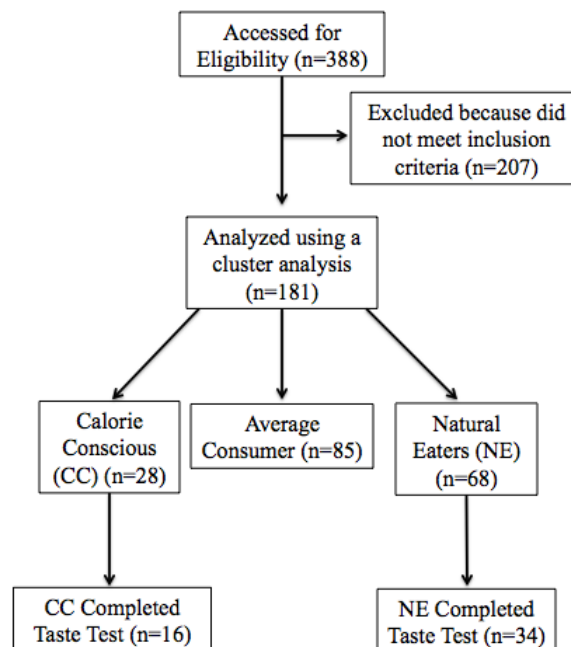


Figure 2. Flow chart detailing the inclusion/exclusion and subsequent segmentation of Adaptive Choice Based Conjoint (ACBC) survey participants

Figure 3 summarizes the utility scores of each segment for their preferences of sweetener type, sugar content, milk fat content and protein content of chocolate milk products. Sweetener type was the attribute with the biggest differences in preferences between consumer segment as indicated by the large range of utility scores on the vertical axis (ranging from -100 to +100). Sugar content was the attribute with the second largest difference in utility scores between segments with a vertical axis utility score range of -60 to +60, closely followed by milk fat content, which had a vertical axis utility score range of -50 to +50. Protein content had the smallest difference between consumer segments with a vertical axis utility score range of only -40 to +30.

Similar to Brodock (2021), participants completing the ACBC survey segmented into three main consumer segments. The largest cluster (cluster 1) (n=85) had the highest preference for cane sugar (utility score of +32.7), closely followed by a preference for stevia (utility score of +24.3) and monk fruit (utility score of +23.1). This cluster showed a strong avoidance of corn syrup with a utility score of -68.4. When looking at the utility scores for added sugar, cluster 1 showed an inversion preference for added sugar and strongly preferred the lowest amount of added sugar (= 4 g/serving) with a utility score of +45.8, followed by 6 g/serving (utility score of +21.0) and 8 g/serving (utility score of +11.5). A big drop in utility scores (-29.8) was observed for 12 grams of added sugar. Cluster 1 had a preference for the medium milk fat level of 2% (utility score of +17.2), while avoiding skim (utility score of -3.8) and especially whole milk (utility score of -16.7). This segment also showed a strong preference for higher protein content with 30 g of protein per serving having the highest utility score of +25.2 and 8 g of protein having the lowest with -38.0. Based on these preferences, cluster 1 was similar to the

preferences reported for the *average consumer* in Brodock (2021), based their lack of a strong preference for sweetener type.

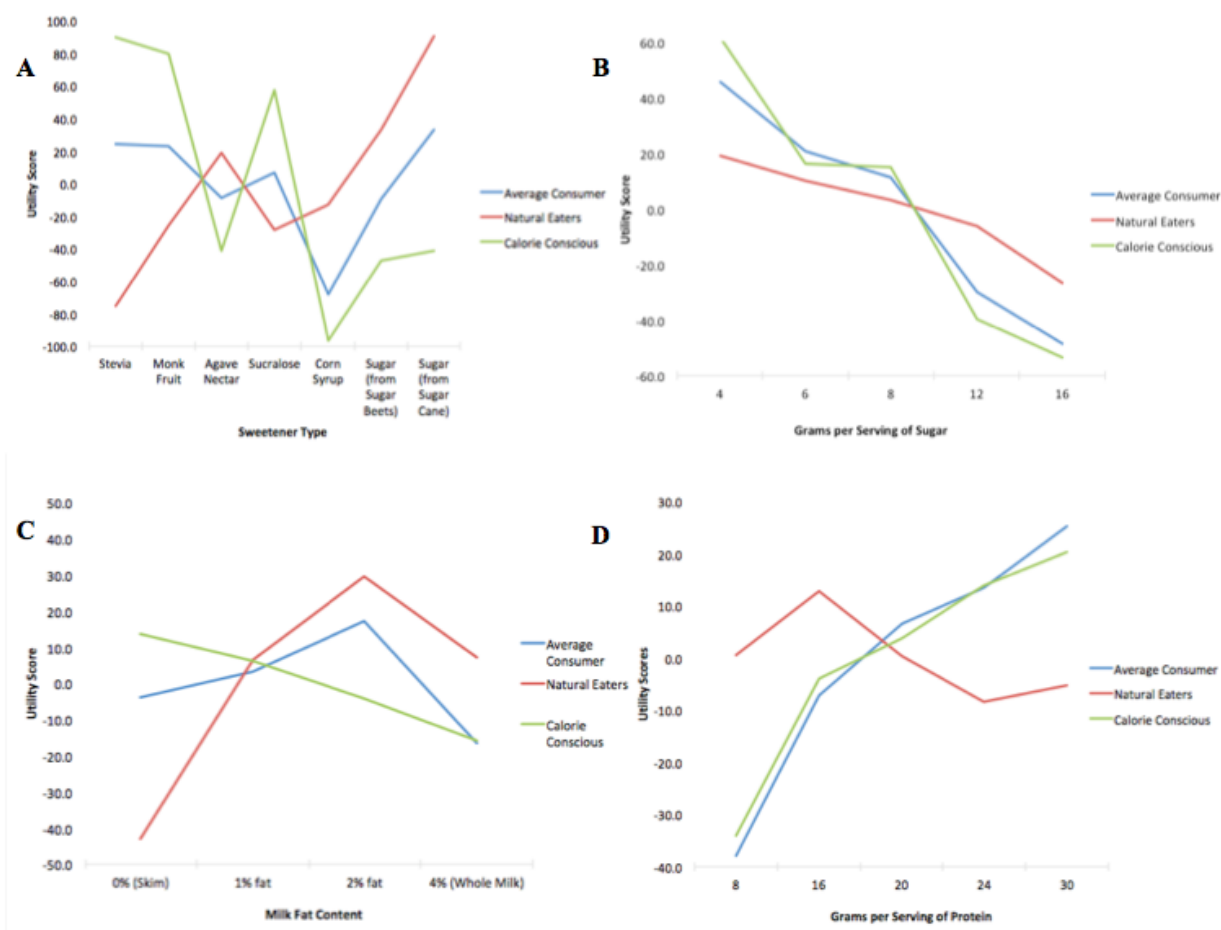


Figure 3. Summary of utility Scores of three consumer segments based on preferences for A) sweetener types, B) sugar content, C) milk fat content and D) protein content of chocolate milk products

The second-largest segment ($n=68$; cluster 2) showed negative utility scores for all low-calorie sweeteners (stevia -75.3, monk fruit -25.5, sucralose -28.6), along with corn syrup (-12.8), and strongly preferred cane sugar (utility score of +90.2), followed by beet sugar (utility score of +33.0) and agave nectar (utility score of +18.9). All sweeteners with positive utility scores for cluster 2 are derived from natural sources, although monk fruit and stevia, which are

also natural sweeteners, had negative utility scores. With regards to added sugar, cluster 2 utility scores decreased as the grams of sugar per serving increased, although this segment was the most tolerant of 16 g of added sugar per serving (-26.7), compared to cluster 1 (-48.5) and cluster 3 (-53.5). Cluster 2 preferred 2% milk (utility score of +29.4), and disliked skim milk (utility score of -43.0). Milk with 1% fat (+ 6.4) and whole milk (+7.1) milk showed similar positive utility scores. Cluster 2 preferred a chocolate milk with a medium to low protein content, with the 16 g/serving of protein showing the highest utility score of +12.8, and being more tolerant of the lowest protein level (8 g/serving) than cluster 1 and 3 (+0.6 vs. -38.0 for cluster 1 and -34.1 for cluster 3). This cluster had a strong avoidance of a chocolate milk with 30 g/serving of protein (-5.3) compared to cluster 1 (+25.2) and cluster 3 (+20.4). Taken together, this group was identified as the *natural eaters (NE)* segment because of their preference for natural sweeteners and dislike of high levels of added protein, similar to the NE segment reported in Brodock (2021).

For the last group (n=28; cluster 3), low-calorie sweeteners showed positive utility scores, with the strongest preference for stevia (+89.4), monk fruit (+79.4), and sucralose (+57.0), and strong avoidance (i.e., negative utilities) for caloric sweeteners, agave nectar (-41.1), corn syrup (-96.7), beet sugar (-47.1), and cane sugar (-40.9). Cluster 3 showed the strongest avoidance of added sugar, with positive utilities for the 4 (+61.8), 6 (+16.5) and 8 (+14.9) grams per serving of added sugar, and a large negative utility score for chocolate milks with 12 g/serving of sugar (-39.6). This preference pattern was similar to cluster 1 (the *average consumers*), with the big difference between these two groups being the preference for sweetener type. Cluster 3 also showed a strong preference for the lowest milk fat level (utility score of +13.7) and decrease in utility scores as the amount of milk fat increased, which was different

from clusters 1 and 2, which both preferred 2% milk over 1% and skim milk. For protein per serving levels, utility scores increased as the amount of protein per serving increased, ranging from -34.1 for 8 g/serving to +20.4 for chocolate milk with 30 g/serving of protein. In summary, cluster 3 showed strong similarities to the *calorie conscious* (CC) segment identified in Brodock (2021) due to their preference for low-calorie sweeteners and dislike of caloric sweeteners and higher fat milks.

Both the calorie conscious (CC) and natural eater (NE) segments had very similar RAPA 1 and RAPA 2 scores (Table 2). The natural eater consumer segment had a slightly higher average RAPA 1 score of 6.38 compared to the calorie conscious average of 6.07. This however was not significantly different ($p=.334$, $t=-0.98$), so the two segments were very similar in the amount of exercise they performed. Both consumer segments also had very similar RAPA 2 scores with no significant difference between the natural eaters and the calorie conscious segment (both having median scores of 3) ($p=.754$, $t=0.32$), indicating similar levels of strength and flexibility training among these two groups of physically active younger adults.

The calorie conscious (CC) segment had a significantly higher healthy orthorexia (HeOr) rating than the natural eaters (NE) segment (average values of 35.32 (CC) and 29.99 (NE), $p=.00$, $t=4.25$) (Table 2). This indicates that the calorie conscious segment has a larger focus on healthy eating without the compulsive habits usually associated with orthorexia nervosa than the natural eaters segment. In terms of orthorexia nervosa ratings, there was no significant difference between the two segments, with average values of 15.61 (CC) and 13.59 (NE) ($p=.151$, $t=1.46$). It should be noted that both the RAPA and TOS average values expressed are based on all of the survey participants, not only those who completed the taste test.

Table 2. Rapid Assessment of Physical Activity (RAPA) and Teruel Orthorexia Scale (TOS) scores for the calorie conscious (CC) and the natural eaters (NE) participants that completed the online survey. Reported are mean values \pm standard errors.

<i>Segment</i>	<i>RAPA</i>		<i>TOS</i>	
	1	2*	OrNe	HeOr
CC (n=28)	6.07 \pm 0.29	3	15.61 \pm 1.24	35.32 \pm 0.99
NE (n=68)	6.38 \pm 0.12	3	13.59 \pm 0.61	29.99 \pm 0.78

*RAPA 2 values are expressed as medians because they are calculated to either be 0, 1, 2 or 3 based on the amount of flexibility and strength training a participant completes.

Participants were also asked to rate how often they perform different exercises per week on a scale from 1-5 with 1 being 0 times per week, 2 being 1-2 times per week, 3 being 3-4 times per week, 4 being 5-6 times per week and 5 being daily. The calorie conscious segment had a slightly higher median score for amount of times they exercise per week with 3.5 compared to the natural eaters score of 3 (3-4 times per week). Other differences included that the natural eaters had a higher median of 4 (5-6 times per week) compared to a median of 3 (3-4 times per week) for the calorie conscious with how often they do outdoor activities (e.g. walking, hiking). Additionally, the calorie conscious segment had a higher median for how often they use cardio machines (2; 1-2 times per week) compared to the natural eaters (1; 0 times per week). Lastly the calorie conscious segment also had a higher median (3; 3-4 times per week) for the number of times a week they do strength training using free weights or body weight compared to the natural eaters (2; 1-2 times per week). The calorie conscious and natural eaters had identical medians for activities including swimming (1), strength training with machines (1), strength-based group fitness classes (1), cardio based group fitness classes (1), sports (1) and running (2). Overall, CC

and NE segments showed similar physical activity levels and intensities but differed in the type of physical exercise they do each week.

Subsection 2 – Results of Taste Test

Table 3 summarizes the results from the two-way analysis of variance (ANOVA) for sample and segment with the sample-by-segment interaction for all 4 measured sensory attributes (overall liking, sweetness intensity, cocoa flavor intensity, creaminess intensity), split by consumer segment and chocolate milk sample, alongside the Tukey Comparison groups for those attributes that showed significant differences.

Cocoa intensity and sweetness intensity values did not differ significantly between samples and consumer segments ($p > 0.05$). However, significant differences in overall liking and creaminess intensity were found between the two samples and the two segments:

For overall liking, the natural eater (NE) consumer segment rated the CorePower (CP) chocolate milk significantly lower than the TruMoo (TM) chocolate milk ($p=.005$, $t=-3.02$). Further the NE liking score for CP was also significantly lower than the overall liking scores from the calorie conscious (CC) consumer segment for both chocolate milks (CP: $p=.000$, $t=3.93$; TM: $p=.013$, $t=-2.60$).

Additionally, the calorie conscious (CC) consumer segment perceived significantly lower creaminess in the TruMoo (TM) chocolate milk compared to the CorePower (CP) chocolate milk ($p=.014$, $t=2.79$), while the natural eater (NE) segment found no significant difference between the two chocolate milks ($p=.903$, $t=-0.12$), and both NE ratings were not significantly different

from either CC ratings (NE CP to CC TM: $p=.172$, $t=-1.29$; NE TM to CC TM: $p=.189$, $t=1.34$; NE TM to CC CP: $p=.189$, $t=1.34$; NE CP to CC CP: $p=.172$, $t=-1.39$).

Table 3. Average Ratings and Tukey Comparison Groupings for overall liking, and perceived intensities for cocoa flavor, sweetness, and creaminess, split by consumer segment (calorie conscious (CC) and natural eaters (NE)) and chocolate milk (caloric-sweetened TruMoo (TM), low-calorie sweetened CorePower (CP)).

Segment	Sample	Overall Liking		Cocoa Intensity		Sweetness Intensity		Creaminess Intensity	
		Average	Group	Average	Group	Average	Group	Average	Group
CC	CP	7.3	A	60.7	A	57.5	A	65.1	A
CC	TM	6.9	A	49.1	A	58.0	A	46.9	B
NE	CP	5.7	B	62.4	A	54.6	A	58.7	AB
NE	TM	7.0	A	53.0	A	56.5	A	59.2	AB

*Cocoa Intensity, Sweetness Intensity and Creaminess Intensity were all measured on a 0-100 point scale, while Overall Liking was measured on a 9-point hedonic scale.

The results from the ANOVA for Overall Liking indicate that sample, segment and the interaction all showed significant effects ($p < 0.05$). It was found that calorie conscious consumers differed significantly from natural eaters in overall liking ($F(1,96)=5.99$; $p = .016$). Liking scores also differed significantly between the TruMoo and the Core Power chocolate milk ($F(1,96)=1.79$, $p = .0184$). Lastly, overall liking also differed significantly due to an interaction between sample and consumer segment ($F(1,96)=7.60$, $p = .007$). For overall liking (Figure 4A), the Calorie Conscious segment showed similar liking scores for both chocolate milks ($M=7.3$ and 6.9 for Core Power and TruMoo), while liking mean scores differed by 1.3 on the 9-point hedonic scale between the two samples for the Natural Eater segment ($M=5.7$ and 7.0 for Core Power and TruMoo).

As displayed in Figure 4B, the calorie conscious consumer segment had a higher overall liking rating ($M=7.3$) for the CorePower chocolate milk than the natural eater segment ($M=5.7$), while overall liking ratings were similar for both segments for the TruMoo chocolate milk

($M=6.9$ and 7.0 for calorie conscious and natural eaters, respectively), indicative of a significant product-by-segment interaction.

This behavior was as I hypothesized as the natural eater segment liked the TruMoo chocolate milk significantly more than the CorePower because the TruMoo contained only cane sugar and other “natural” ingredients, compared to the CorePower milk. Similarly, I hypothesized that the calorie conscious would show higher liking for the CorePower milk presumably, because of the lower calorie content resulting from the use of low-calorie sweeteners in the CorePower milk. The data did not support this hypothesis: For the calorie conscious segment, liking ratings trended in the hypothesized direction, but there was no significant difference in overall liking for the two chocolate milks for the calorie conscious segment, most likely because of a small sample size ($n=16$).

The ANOVA found significant differences in creaminess intensity ratings between the two samples, CorePower and TruMoo ($F(1,96)=5.17, p=.025$). There was however no significant difference in creaminess intensity ratings between the two consumer segments ($F(1,96)=0.57, p=.452$). There was a significant interaction between the samples and segments ($F(1,96)=5.80, p=.018$). This was unexpected as both milks are made with low-fat milk. Figure 4C shows the means plot for the two samples and two segments. Figure 4D visualizes the significant interaction effect, showing that creaminess ratings differed significantly by 18.1 points on a 100-point scale between the two chocolate milk samples for the calorie conscious consumer segment only ($M=65.1$ and 47.0 for Core Power and TruMoo chocolate milks, paired t-test $p=.014, t=2.79$). For the natural eater segment, the difference in creaminess ratings for the two samples was only 0.5 points ($M=58.7$ and 59.2 for Core Power and TruMoo chocolate milks, paired t-test $p=.903, t=0.12$).

An ANOVA analysis found a significant difference in cocoa flavor intensity ratings between the CorePower and TruMoo samples ($F(1,96)=7.62, p=.007$), while there was no significant effect on cocoa flavor intensity by the consumer segments ($F(1,96)=.55, p=.460$), and the interaction between consumer segments and samples was also not significant ($F(1,96)=.09, p=.765$). Both consumer segments perceived large differences in cocoa flavor intensity for the two chocolate milk samples. The calorie conscious consumer segment had a significant difference of 11.6 points on a 100-point scale between the CorePower and TruMoo chocolate milk samples ($M=60.7$ and 49.1 for Core Power and TruMoo chocolate milk; $p=.034, t=2.33$), while the natural eater segment similarly differed significantly by 9.4 points between CorePower and TruMoo ($M=62.4$ and 53.05 for Core Power and TruMoo chocolate milks, $p=.029, t=2.29$). These results are summarized in Figure 4E.

Last, the ANOVA results for sweetness intensity indicate no significant differences between samples ($F(1,96)=.11, p=.745$) or consumer segments ($F(1,96)=.35, p=.553$). There was also no interaction found between consumer segments or sample ($F(1,96)=.04, p=0.848$). Sweetness intensity ratings (Figure 4F) were very similar for the calorie conscious segment for both chocolate milk samples ($M=57.5$ and 58.0 for Core Power and TruMoo chocolate milk). Sweetness intensity ratings were also very similar for both chocolate milk samples among the natural eaters segment ($M=54.6$ and 56.5 for Core Power and TruMoo chocolate milks).

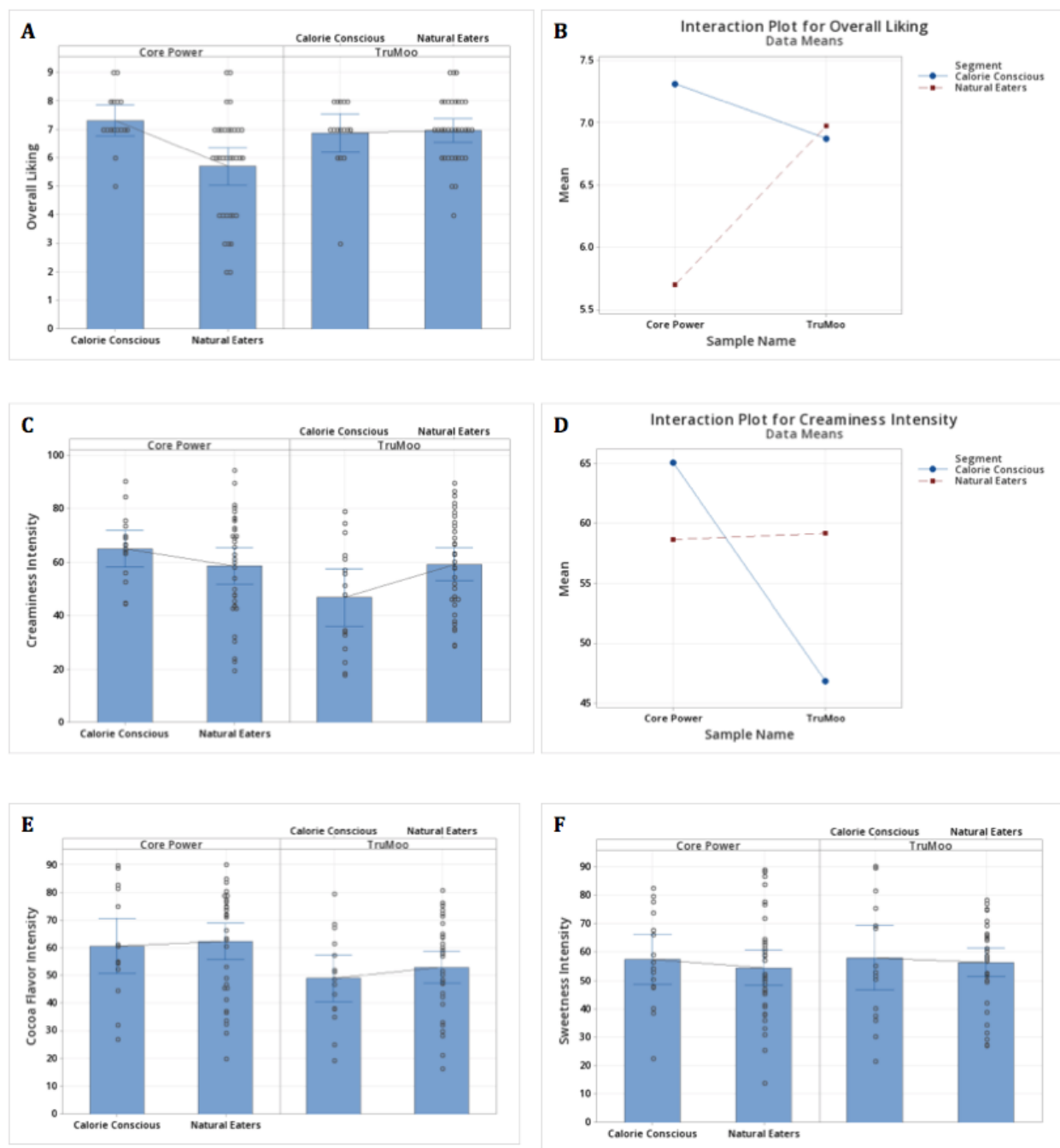


Figure 4. Mean scores for (A) overall liking, (C) sweetness intensity, (E) cocoa flavor intensity and (F) creaminess ratings for two chocolate milks, Core Power and TruMoo, split by consumer segments, Calorie Conscious and Natural Eaters. Individual scores are indicated as black circles. Shown are also the interaction plots for the two attributes that showed a significant interaction effect, (B) overall liking and (D) creaminess intensity.

Chapter 4

Discussion

Findings from this experiment support the hypothesis that the natural eaters would like the TruMoo chocolate milk significantly more than the CorePower chocolate milk. This was as expected because the natural eaters strongly prefer products made with natural sweeteners, such as cane sugar to low-calorie sweeteners.

There was however no significant difference in liking scores between the two samples for the calorie conscious consumer segment, which does not support the original hypothesis that the calorie conscious consumer segment would have significantly higher liking scores for the CorePower chocolate milk. It should be noted however that the calorie conscious consumer segment did have slightly higher liking ratings for the CorePower chocolate milk compared to the TruMoo, indicating that the data did trend in the hypothesized direction. It is possible that although the calorie conscious consumers may seek out products made with low-calorie sweeteners to decrease their calorie intake, they do not have a major sensory aversion to products made with caloric sweeteners, especially because these products are more prevalent in the chocolate milk market. Additionally, the calorie conscious consumer segment had less participants than the natural eaters (16 for the calorie conscious compared to 34 for the natural eaters), making it more difficult to achieve a statistically significant difference in ratings.

I did not hypothesize that there would be significant differences between the two segments in creaminess intensity scores between the two chocolate milk samples despite both chocolate milks being made with low-fat (1%) milk. The calorie conscious segment rated the TruMoo chocolate milk significantly lower in creaminess intensity than the CorePower chocolate

milk, while the natural eaters perceived very similar creaminess intensity from the TruMoo and the CorePower chocolate milk. It is possible that because the TruMoo chocolate milk was made with a caloric sweetener that the significant differences in creaminess ratings between the two samples perceived by the calorie conscious consumers only was impacted by a horns effect. A horns effect is when one negative attribute of a product causes participants to perceive another unrelated attribute negatively (Lawless H. T. & Heymann, H., 2010b). It is worth noting, however that although there was a significant difference in creaminess ratings of the CorePower and TruMoo chocolate milks among the calorie conscious segment, across the two samples the creaminess ratings were not significantly different between the two groups. It is possible that the difference in creaminess ratings was exaggerated by the small sample size in the calorie conscious segment (16 people). Future research is needed to replicate this study findings with a larger sample size to ensure that the data is consistent with a different population of people.

Additionally, the CorePower chocolate milk had almost twice the amount of protein per serving than the TruMoo chocolate milk (15 g/cup for CorePower compared to 8 g/cup for the TruMoo chocolate milk). The addition of excess protein to the CorePower chocolate milk could have made the product thicker than the TruMoo and, therefore, contributed to its creaminess. However, one would expect if that would be the case that this difference would be reflected in the creaminess intensity ratings of the natural eaters.

In the future I would recommend the use of chocolate milk samples that are either made by the same manufacturer or are formulated to differ only in the sweetener type. In this study two different commercial chocolate milk products were used, but only nutrition labels could be used to compare compositions, so it is likely that there were more differences between the chocolate milk samples than just the sweetener types.

I hypothesized that sweetness intensity and cocoa flavor intensity would not differ significantly between the sample and segments because these attributes should not be very affected by sweetener source. However, there was a significant difference in the cocoa intensity between the samples, likely resulting from the different formulations, such as greater cocoa content in the CorePower chocolate milk. There were no significant differences between sweetness intensity scores between either the segments or samples, as expected.

For this study I aimed to recruit physically active younger adults. The two consumer segments were very similar in their level of exercise as determined by the RAPA questionnaire, and both segments had mean RAPA 1 scores above 6, categorizing them as doing an optimal amount of physical activity. In the future, it could be beneficial to explore using different ways to measure physical activity levels of participants. The RAPA scale was developed as a reliable and quick tool to assess physical activity levels for older adults above the age of 50 and has been validated against the Community Health Activities Model Program for Seniors (CHAMPS) scale (Topolski et al., 2006). Although the RAPA survey has been used in several studies to measure physical activity levels of adults at all age levels anywhere from 18-70 (Aceijas, C. et al, 2016, Lesani, A. et al, 2016, and Salgado-Aranda, R. et al. 2021), it has not been validated for use in non-senior populations. It is very possible that another physical activity questionnaire would be more suitable for use in younger adults due to differences in common activities and lifestyles between young adults and the elderly. Despite these shortcomings, the use of the RAPA method to assess physical activity was a good choice for this study because this scale is quick and easy to use and can be self-administered (Strath, S., et al. 2013).

Similar to Brodock (2021), I also assessed healthy eating behavior of the study participants, using the Teruel Orthorexia Scale (TOS) scale, which measures orthorexia nervosa

(OrNe) and healthy orthorexia (HeOr). Across the online survey participants in the calorie conscious and natural eaters segments, I found differences between the two groups in one of the two measurements with the calorie conscious segment showing significantly higher HeOr scores than the natural eaters. This makes sense as higher HeOr scores indicate a greater non-obsessive interest in healthy eating and participants in the calorie conscious segment showed a strong preference for low-caloric sweeteners and preferred lower fat milk over whole milk and low levels of added sugar. As food choice habits are determined by people's attitudes towards food, a greater focus on healthy eating would influence which foods they choose to eat. There were no significant differences in OrNe scores between the two segments, which indicates that neither group had a great number of people who are compulsive about their healthy eating habits.

One strength of this study compared to the original design (Brodock, 2021) was that both consumer segments tasted both chocolate milk samples and received the corresponding information (nutritional label and statement). In the original design each participant only received one chocolate milk sample, and additionally, participants in each segment varied in the detail of information they were provided alongside the sample. Such as between-subjects design requires a much larger sample size to obtain statistically significant results. The within-subjects design of this study where all participants from both groups evaluated both chocolate milk samples is likely what contributed to finding significant differences, despite the small sample size (Lawless H.T. & Heymann H., 2010a).

Additionally, it could be interesting to probe more into the effect of both the types of physical activities that people perform and how their attitudes towards food choice affect their perceptions of chocolate milk products. For example, it is possible that people who primarily focus on strength training may perceive attributes of chocolate milk differently from those who

mostly focus on running or different cardio activities, even if they are in the same consumer segment. It could also be interesting to expand this research to other food products including yogurts, granola bars, meats with different types of treatments or different grain products. It should be noted that one major difficulty of this study is to recruit enough physically active young adults to qualify because participants must meet criteria to be segmented into the calorie conscious and natural eater consumer segments from survey data and be willing or able to sign up to complete a taste test.

Chapter 5

Conclusion

Results from my thesis demonstrate the strong effect that consumers attitudes about health and product choice have on their sensory perception and likeness of food products. Consumer segment, sample and the interaction between segment and sample had significant effects on the overall liking scores of chocolate milk products. Additionally, sample and the interaction of segment and sample had significant effects on creaminess intensity ratings. These results support the idea that consumers attitudes towards foods and their stated preferences towards certain product characteristics influence their perception of chocolate milk products. Overall liking results were consistent with the hypothesis that the natural eater segment would like the caloric-sweetened TruMoo chocolate milk significantly more than the low-calorie-sweetened CorePower chocolate milk. Although I similarly hypothesized that the opposite effect would be found for the calorie conscious segment, both chocolate milks were not significantly different in liking, although the CorePower chocolate milk had a slightly higher average hedonic rating than the TruMoo chocolate milk. It is possible that this is a result of the small sample size of the calorie conscious segment (n=16) or that although the calorie conscious segment seems to prefer products with low-calories sweeteners they don't have a large aversion to products made with caloric sweeteners.

Although not hypothesized, the calorie conscious segment perceived significantly lower creaminess intensity for the TruMoo chocolate milk compared to the CorePower chocolate milk, while there was no significant difference in creaminess between the two samples for the natural

eaters segment. It is possible that this significant difference in creaminess intensity ratings was the result of a horns effect caused by the calorie conscious segments' negative perception of caloric sweeteners, which caused them to perceive the calorically sweetened TruMoo chocolate milk as less creamy. One major limitation of this study was the small sample size, so it would be beneficial to replicate this study again to see if results are consistent with a larger sample size.

Appendix A

ACBC Survey

Welcome!

In this survey you will be asked to complete some choice based tasks and answer some short questions.

Next

Consent for Exempt Research

The Pennsylvania State University

Title of Project: The Effect of Consumer Attitudes and Beliefs on Sensory Perception and Liking of Chocolate Milk

Principal Investigator: Dr. Helene Hopfer

Address: 218 Food Science Building, University Park, PA 16802

You are being invited to volunteer to participate in a research study. This summary explains information about this research.

The objectives of this project are to explore differences in sensory responses for chocolate milk between consumers differing in physical activity and food choice. With your help, scientists will gain a better understanding of factors that are important for adult chocolate milk consumers.

Approximately 200 people will take part in this research study. You will be asked to complete an online survey where you have to choose between different chocolate milk options. After that, you may be asked to participate in a taste test in the Sensory Evaluation Center (SEC) at Penn State. Here, you will taste one or two chocolate milk samples and make ratings about how much you like the samples and the perceived intensity of sensory attributes (e.g., sweetness, chocolate flavor, etc.). You may stop at any time and you do not have to answer any questions you prefer not to answer.

This study is anticipated to include minimal risk, similar to those experienced in everyday life. There is a risk of loss of confidentiality if your information or your identity is obtained by someone other than the investigators, but precautions will be taken to prevent this from happening. The confidentiality of your electronic data created by you or by the researchers will be maintained as required by applicable law and to the degree permitted by the technology used. Absolute confidentiality cannot be guaranteed.

Efforts will be made to limit the use and sharing of your personal research information to people who have a need to review this information. Reasonable efforts will be made to keep the personal information in your research record private. A list that matches your name with your code number will be kept in a locked file or password protected file in the Erickson Food Science Building. Only the research team and the coordinator of the Sensory Evaluation Center will have access to this computer and the files on it. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Information collected in this project may be shared with other researchers, but we will not share any information that could identify you.

You will not be compensated for this test.

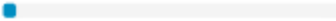
If you have questions, complaints, or concerns about the research, you should contact Helene Hopfer at 814-863-5572. If you have questions regarding your rights as a research subject or concerns regarding your privacy, you may contact the Human Research Protection Program at 814-865-1775.

Your participation is voluntary and you may decide to stop at any time. You do not have to answer any questions that you do not want to answer.

Your participation implies your voluntary consent to participate in the research.

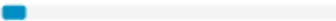
- I consent
- I do not consent

Next

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What is your age?

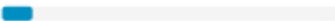
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I identify my gender as:

- Man
- Woman
- A gender not listed here

Next

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We would like to ask you about your race and ethnicity using the specific categories developed by the federal government (OMB Directive 15 guidelines):
Are you Latina, Latino or Hispanic?

- Yes
- No
- Decline to answer

Please select the one or more racial categories that best describes you (check all that apply):

- White or Caucasian
- Black or African American
- Asian including South Asian/Indian Subcontinent
- American Indian or Alaskan Native
- Native Hawaiian or other Pacific Islander
- Other
- Decline to Answer

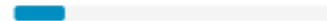
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Would you consider yourself to be in good general health?

- Yes
- No

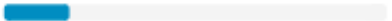
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Are you fluent in English?

- Yes
- No

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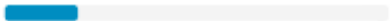
Do you have an allergy or insensitivity to dairy products (e.g. fluid milk, yogurt) or any other reasons that prevent you from consuming dairy products?

- Yes
- No

Do you have a chocolate allergy or sensitivity?

- Yes
- No

Next

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Are you currently taking any medication known to alter taste or smell function?

- Yes
- No

Do you have a history of choking or difficulty swallowing?

- Yes
- No

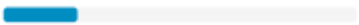
Do you have a normal taste or smell function?

- Yes
- No

Are you currently pregnant or breastfeeding?

- Yes
- No

Next

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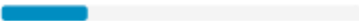
How often do you consume milk, flavored or unflavored?

- 2-3 times a week or more
- Once a week
- A few times a month
- Once a month
- Less often

When you eat solid chocolate, which do you typically consume?

- Prefer to eat milk chocolate
- Prefer to eat dark chocolate
- No strong preference, I eat both equally often
- I don't eat chocolate


Next

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How often do you exercise or workout for at least a 30 minute interval?

- I do not exercise or workout
- 1-2 times a week
- 3-4 times a week
- 5-6 times a week
- Daily

Next

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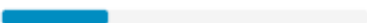
For the activities listed below, please indicate how often you perform these activities.

If you do not do the activity please select: " I do not perform this activity."

For the purposes of this survey we are defining physical activity as: activities where you move and increase your heart rate above its resting rate.

	I do not perform this activity	1-2 times a week	3-4 times a week	5-6 times a week	Daily
Running (outside or inside on a track)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Outdoor activities (walking, hiking, etc.) for at least 20 minutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports (Soccer, basketball, etc..)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cardio Machines (elliptical, stairmaster, etc..)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cardio based group fitness classes (Cycling, Zumba, etc..)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strength based group fitness classes (Yoga, Boot camp, etc..)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strength training primarily with machines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strength training primarily with free weights or body weight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Swimming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next


0%  100%

What is your current height in feet and inches? Enter them in the boxes below

	Feet (Ft)	Inches (In)
Height	<input type="text"/>	<input type="text"/>

What is your current weight in pounds (lbs)?

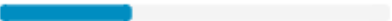
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Think about how you choose a **chocolate milk**. From the list below, for each feature, select your preferred option.

Feature	Select Feature
Sweetener Types	<input type="radio"/> Stevia
	<input type="radio"/> Monk Fruit
	<input type="radio"/> Agave Nectar
	<input type="radio"/> Sucralose
	<input type="radio"/> Corn Syrup
	<input type="radio"/> Sugar (from Sugar Beets)
	<input type="radio"/> Sugar (from Sugar Cane)
Milk Fat	<input type="radio"/> Skim
	<input type="radio"/> 1% fat
	<input type="radio"/> 2% fat
	<input type="radio"/> Whole Milk
Protein Content	<input type="radio"/> 8g per serving
	<input type="radio"/> 16g per serving
	<input type="radio"/> 20g per serving
	<input type="radio"/> 24g per serving
	<input type="radio"/> 30g per serving

Next


0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(1 of 8)

Sweetener Types	Sugar (from Sugar Beets)	Monk Fruit	Corn Syrup	Stevia
Added Sugar	12g per serving	0g per serving	8g per serving	0g per serving
Milk Fat	Skim	1% fat	Skim	Skim
Protein Content	24g per serving	8g per serving	8g per serving	16g per serving
Label Text	Premium Chocolate Beverage	Indulgent Chocolate Milk	Strength Training Recovery Drink	Contains Cocoa Polyphenols
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next


0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(2 of 8)

Sweetener Types	Sugar (from Sugar Beets)	Monk Fruit	Corn Syrup	Stevia
Added Sugar	12g per serving	0g per serving	8g per serving	0g per serving
Milk Fat	Skim	1% fat	Skim	Skim
Protein Content	24g per serving	8g per serving	8g per serving	16g per serving
Label Text	Premium Chocolate Beverage	Indulgent Chocolate Milk	Strength Training Recovery Drink	Contains Cocoa Polyphenols
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next


0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(3 of 8)

Sweetener Types	Sucralose	Sugar (from Sugar Cane)	Sugar (from Sugar Cane)	Corn Syrup
Added Sugar	0g per serving	12g per serving	8g per serving	16g per serving
Milk Fat	Skim	Whole Milk	Skim	1% fat
Protein Content	24g per serving	8g per serving	30g per serving	8g per serving
Label Text	Endurance Sports Recovery Drink	Contains Cocoa Polyphenols	Good Source of Protein	Premium Chocolate Beverage
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next

0%  100%

We've noticed that you've avoided products with certain characteristics shown below. Would any of these features be **totally unacceptable**? If so, mark the **one feature that is most unacceptable**, so we can just focus on products that meet your needs.

- Milk Fat - Skim
- Protein Content - 8g per serving
- Label Text - Endurance Sports Recovery Drink
- Added Sugar - 4g per serving
- Sweetener Types - Stevia

- None of these are totally unacceptable.

Next


0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(4 of 8)

Sweetener Types	Sugar (from Sugar Cane)	Stevia	Monk Fruit	Stevia
Added Sugar	4g per serving	0g per serving	0g per serving	0g per serving
Milk Fat	2% fat	2% fat	Skim	Whole Milk
Protein Content	8g per serving	16g per serving	8g per serving	16g per serving
Label Text	Contains Real Cocoa	Strength Training Recovery Drink	Endurance Sports Recovery Drink	Good Source of Protein
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next

0%  100%

We've noticed that you've avoided products with certain characteristics shown below. Would any of these features be **totally unacceptable**? If so, mark the **one feature that is most unacceptable**, so we can just focus on products that meet your needs.

- Sweetener Types - Stevia
- Protein Content - 8g per serving
- Label Text - Endurance Sports Recovery Drink
- Milk Fat - Skim
- Added Sugar - 4g per serving

- None of these are totally unacceptable.

Next

0%  100%

We don't want to jump to conclusions, but we've noticed that you've selected products with certain characteristics shown below. If any of these are an **absolute requirement**, it would be helpful to know. If so, please check the **one most important** feature, so we can just focus on products that meet your needs.

- Added Sugar - 4g per serving
- Sweetener Types - Stevia
- Protein Content - 8g per serving
- Milk Fat - Skim

- None of these are an absolute requirement.

Next

0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(5 of 8)

Sweetener Types	Sugar (from Sugar Cane)	Sucralose	Agave Nectar	Agave Nectar
Added Sugar	6g per serving	0g per serving	4g per serving	8g per serving
Milk Fat	Skim	Skim	Skim	1% fat
Protein Content	20g per serving	8g per serving	20g per serving	8g per serving
Label Text	Indulgent Chocolate Milk	Indulgent Chocolate Milk	Contains Cocoa Polyphenols	Premium Chocolate Beverage
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next

0%  100%

We've noticed that you've avoided products with certain characteristics shown below. Would any of these features be **totally unacceptable**? If so, mark the **one feature that is most unacceptable**, so we can just focus on products that meet your needs.

- Milk Fat - Skim
- Added Sugar - 4g per serving
- Label Text - Endurance Sports Recovery Drink
- Sweetener Types - Stevia
- Protein Content - 8g per serving

- None of these are totally unacceptable.

Next

0%  100%

We don't want to jump to conclusions, but we've noticed that you've selected products with certain characteristics shown below. If any of these are an **absolute requirement**, it would be helpful to know. If so, please check the **one most important** feature, so we can just focus on products that meet your needs.

- Sweetener Types - Stevia
- Added Sugar - 4g per serving
- Milk Fat - Skim
- Protein Content - 8g per serving

- None of these are an absolute requirement.

Next

0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(6 of 8)

Sweetener Types	Stevia	Agave Nectar	Stevia	Monk Fruit
Added Sugar	0g per serving	6g per serving	0g per serving	0g per serving
Milk Fat	Skim	Skim	2% fat	Skim
Protein Content	24g per serving	16g per serving	8g per serving	8g per serving
Label Text	Good Source of Protein	Contains Real Cocoa	Good Source of Protein	Premium Chocolate Beverage
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next

0%  100%

We've noticed that you've avoided products with certain characteristics shown below. Would any of these features be **totally unacceptable**? If so, mark the **one feature that is most unacceptable**, so we can just focus on products that meet your needs.

- Label Text - Endurance Sports Recovery Drink
 - Protein Content - 8g per serving
 - Added Sugar - 4g per serving
 - Sweetener Types - Stevia
 - Milk Fat - Skim
- None of these are totally unacceptable.

Next

0%  100%

We don't want to jump to conclusions, but we've noticed that you've selected products with certain characteristics shown below. If any of these are an **absolute requirement**, it would be helpful to know. If so, please check the **one most important** feature, so we can just focus on products that meet your needs.

- Sweetener Types - Stevia
 - Protein Content - 8g per serving
 - Added Sugar - 4g per serving
 - Milk Fat - Skim
- None of these are an absolute requirement.

Next

0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(7 of 8)

Sweetener Types	Agave Nectar	Sucralose	Sugar (from Sugar Beets)	Stevia
Added Sugar	16g per serving	0g per serving	16g per serving	0g per serving
Milk Fat	Skim	Whole Milk	Skim	1% fat
Protein Content	30g per serving	8g per serving	20g per serving	8g per serving
Label Text	Strength Training Recovery Drink	Strength Training Recovery Drink	Contains Real Cocoa	Strength Training Recovery Drink
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next

0%  100%

We've noticed that you've avoided products with certain characteristics shown below. Would any of these features be **totally unacceptable**? If so, mark the **one feature that is most unacceptable**, so we can just focus on products that meet your needs.

- Label Text - Endurance Sports Recovery Drink
 - Added Sugar - 4g per serving
 - Protein Content - 8g per serving
 - Sweetener Types - Stevia
 - Milk Fat - Skim
- None of these are totally unacceptable.

Next

0%  100%

We don't want to jump to conclusions, but we've noticed that you've selected products with certain characteristics shown below. If any of these are an **absolute requirement**, it would be helpful to know. If so, please check the **one most important** feature, so we can just focus on products that meet your needs.

- Added Sugar - 4g per serving
 - Protein Content - 8g per serving
 - Milk Fat - Skim
 - Sweetener Types - Stevia
- None of these are an absolute requirement.

Next

0%  100%

Here are a few **chocolate milks** you might like. For each one, indicate whether you would possibly purchase it or not.

(8 of 8)

Sweetener Types	Sugar (from Sugar Beets)	Stevia	Corn Syrup	Stevia
Added Sugar	6g per serving	0g per serving	4g per serving	0g per serving
Milk Fat	2% fat	Whole Milk	Skim	Skim
Protein Content	8g per serving	30g per serving	8g per serving	20g per serving
Label Text	Contains Cocoa Polyphenols	Indulgent Chocolate Milk	Endurance Sports Recovery Drink	Premium Chocolate Beverage
	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me	<input type="radio"/> A possibility <input type="radio"/> Won't work for me

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(1 of 10)

Sweetener Types	Monk Fruit	Stevia	Corn Syrup
Added Sugar	0g per serving	0g per serving	4g per serving
Milk Fat	Skim	Skim	Skim
Protein Content	24g per serving	20g per serving	8g per serving
Label Text	Contains Real Cocoa	Premium Chocolate Beverage	Endurance Sports Recovery Drink

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(2 of 10)

Sweetener Types	Stevia	Corn Syrup	Agave Nectar
Added Sugar	0g per serving	4g per serving	4g per serving
Milk Fat	Skim	Skim	Skim
Protein Content	20g per serving	8g per serving	20g per serving
Label Text	Premium Chocolate Beverage	Endurance Sports Recovery Drink	Contains Cocoa Polyphenols
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(3 of 10)

Sweetener Types	Corn Syrup	Agave Nectar	Sucralose
Added Sugar	4g per serving	4g per serving	0g per serving
Milk Fat	Skim	Skim	Skim
Protein Content	8g per serving	20g per serving	8g per serving
Label Text	Endurance Sports Recovery Drink	Contains Cocoa Polyphenols	Indulgent Chocolate Milk
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(4 of 10)

Sweetener Types	Agave Nectar	Sucralose	Sugar (from Sugar Cane)
Added Sugar	4g per serving	0g per serving	6g per serving
Milk Fat	Skim	Skim	Skim
Protein Content	20g per serving	8g per serving	20g per serving
Label Text	Contains Cocoa Polyphenols	Indulgent Chocolate Milk	Indulgent Chocolate Milk
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(5 of 10)

Sweetener Types	Sucralose	Sugar (from Sugar Cane)	Sucralose
Added Sugar	0g per serving	6g per serving	0g per serving
Milk Fat	Skim	Skim	Skim
Protein Content	8g per serving	20g per serving	30g per serving
Label Text	Indulgent Chocolate Milk	Indulgent Chocolate Milk	Good Source of Protein
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(6 of 10)

Sweetener Types	Sugar (from Sugar Cane)	Sucralose	Stevia
Added Sugar	6g per serving	0g per serving	0g per serving
Milk Fat	Skim	Skim	1% fat
Protein Content	20g per serving	30g per serving	30g per serving
Label Text	Indulgent Chocolate Milk	Good Source of Protein	Contains Cocoa Polyphenols

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(7 of 10)

Sweetener Types	Sucralose	Stevia	Corn Syrup
Added Sugar	0g per serving	0g per serving	12g per serving
Milk Fat	Skim	1% fat	2% fat
Protein Content	30g per serving	30g per serving	8g per serving
Label Text	Good Source of Protein	Contains Cocoa Polyphenols	Contains Real Cocoa

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(8 of 10)

Sweetener Types	Stevia	Corn Syrup	Stevia
Added Sugar	0g per serving	12g per serving	0g per serving
Milk Fat	1% fat	2% fat	Whole Milk
Protein Content	30g per serving	8g per serving	30g per serving
Label Text	Contains Cocoa Polyphenols	Contains Real Cocoa	Indulgent Chocolate Milk

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(9 of 10)

Sweetener Types	Corn Syrup	Stevia	Sugar (from Sugar Beets)
Added Sugar	12g per serving	0g per serving	6g per serving
Milk Fat	2% fat	Whole Milk	2% fat
Protein Content	8g per serving	30g per serving	8g per serving
Label Text	Contains Real Cocoa	Indulgent Chocolate Milk	Contains Cocoa Polyphenols
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

0%  100%

Among these three products, which is the best option? (I've grayed out any features that are the same, so you can just focus on the differences.)

(10 of 10)

Sweetener Types	Stevia	Sugar (from Sugar Beets)	Stevia
Added Sugar	0g per serving	6g per serving	0g per serving
Milk Fat	Whole Milk	2% fat	1% fat
Protein Content	30g per serving	8g per serving	8g per serving
Label Text	Indulgent Chocolate Milk	Contains Cocoa Polyphenols	Strength Training Recovery Drink
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

0%  100%

Do you pay attention to protein content on nutrition labels?

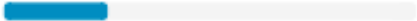
- Yes
- No

Next

Do you track your daily protein intake?

- Yes
- No

Next

0%  100%

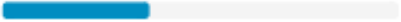
Which do you believe is the most appropriate amount of protein to eat per day?

- 0.8 g/kg of body weight
- 1.6 g/kg of body weight
- 2.2 g/kg of body weight
- 2.6 g/kg of body weight
- Unsure

If you weight train, are you currently:











- Bulking
- Maintaining
- Cutting
- I do not engage in cutting/bulking cycles

Next

0%  100%

Physical activities are activities where you move and increase your heart rate above its resting rate, whether you do it for pleasure, work, or transportation. The following questions ask you about the amount and intensity of physical activities you usually do. The intensity of the activity is related to the amount of energy you use to do these activities

Examples of physical activity intensity levels:

<p>Light activities</p> <ul style="list-style-type: none"> • your heart beats slightly faster than normal • you can talk and sing 	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Walking Leisurely </div> <div style="text-align: center;">  Stretching </div> <div style="text-align: center;">  Vacuuming or Light Yard Work </div> </div>
<p>Moderate activities</p> <ul style="list-style-type: none"> • your heart beats faster than normal • you can talk but not sing 	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Fast Walking </div> <div style="text-align: center;">  Aerobics Class </div> <div style="text-align: center;">  Strength Training </div> <div style="text-align: center;">  Swimming Gently </div> </div>
<p>Vigorous activities</p> <ul style="list-style-type: none"> • your heart rate increases a lot • you can't talk or your talking is broken up by large breaths 	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Stair Machine </div> <div style="text-align: center;">  Jogging or Running </div> <div style="text-align: center;">  Tennis, Racquetball, Pickleball or Badminton </div> </div>

For each row please select the answer that most accurately describes you in regards to how physically active you are.

	Yes	No
I rarely or never do any physical activities	<input type="radio"/>	<input type="radio"/>
I do some light or moderate physical activities, but not every week.	<input type="radio"/>	<input type="radio"/>
I do some light physical activity every week.	<input type="radio"/>	<input type="radio"/>
I do moderate physical activities every week, but less than 30 minutes per day or less than 5 days a week.	<input type="radio"/>	<input type="radio"/>
I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week.	<input type="radio"/>	<input type="radio"/>
I do 30 minutes or more a day of moderate physical activities, 5 or more days a week.	<input type="radio"/>	<input type="radio"/>
I do 20 minutes or more a day of vigorous physical activities, 3 or more days a week.	<input type="radio"/>	<input type="radio"/>

I do activities to increase muscle strength, such as lifting weights or calisthenics, once a week or more.

I do activities to improve flexibility, such as stretching or yoga, once a week or more.

Next



For each row please select the answer that most accurately describes you.

	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree
I mainly eat foods that I consider to be healthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that the way I eat is healthier than that of most people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My interest in healthy food is an important part of the way I am, of how I understand the world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I spend a lot of time buying, planning and/or preparing food so my diet will be as healthy as possible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel good when I eat healthy food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to convince people from my environment to follow my healthy eating habits.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't mind spending more money on food if I think it is healthier.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer to eat a small quantity of healthy food rather than a lot of food that may not be healthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thoughts about healthy eating do not let me concentrate on other tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel overwhelmed or sad if I eat food that I consider unhealthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If, at some point, I eat something that I consider unhealthy, I punish myself for it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My concern with healthy eating takes up a lot of my time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel guilty when I eat food that I do not consider healthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My social relations have been negatively affected by my concern about eating healthy food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I avoid eating with people who do not share my ideas about healthy eating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I am concerned about the possibility of eating unhealthy foods.



Next

0%  100%

Would you be willing to participate in a taste test at the Sensory Evaluation Center at Penn State in the next few weeks?

Yes

No

Please enter your email address below so that we may contact you to schedule a time for this upcoming taste test.

Next

0%  100%

Please enter your email address below if you are interested in being contacted about other taste tests in the Penn State Sensory Evaluation Center (SEC) in the future.

Next

0%  100%

Thank you for completing this part of the survey. If you provided your email address and qualify for the upcoming taste test, we will contact you with time slots you could sign up for.

Powered by Sawtooth Software

0%  100%

Appendix B

Taste Testing Questionnaire

Welcome to the Penn State

Sensory Evaluation Center!

Please **silence and put away your cell phone for the duration of the test** and remember to be courteous to those around you!

Click the **next** button to begin.

Next

Consent for Exempt Research The Pennsylvania State University

Title of Project: The Effect of Consumer Attitudes and Beliefs on Sensory Perception and Liking of Chocolate Milk
Principal Investigator: Dr. Helene Hopfer
Address: 221 Food Science Building, University Park, PA 16802

You are being invited to volunteer to participate in a research study. This summary explains information about this research.

- The objectives of this project are to explore differences in sensory responses for chocolate milk between consumers differing in physical activity and food choice. With your help, scientists will gain a better understanding of factors that are important for adult chocolate milk consumers.
- Approximately 100 people will take part in this research study. You will be asked to taste two chocolate milk sample and make ratings about how much you like the sample and the perceived intensity of sensory attributes (e.g., sweetness, chocolate flavor, etc.). You may stop at any time and you do not have to answer any questions you prefer not to answer.
- This study is anticipated to include minimal risk, similar to those experienced in everyday life.
The evaluated products contain all or some of the following ingredients: **milk**, sugar, cocoa, salt, carrageenan, natural flavor, monkfruit juice concentrate, stevia leaf extract, cellulose gel, cellulose gum, maltodextrin, acesulfame potassium, sucralose, lactase enzyme, vitamin A palmitate, vitamin D3.
Because you will be consuming chocolate milk, there is the risk that you may discover a previously unknown food allergy. With any food, there is a possibility you may uncover a food allergy or food sensitivity in that was not previously known. If you experience any type of reaction, please seek immediate medical care and inform the research team about the incident.
There is a risk of loss of confidentiality if your information or your identity is obtained by someone other than the investigators, but precautions will be taken to prevent this from happening. The confidentiality of your electronic data created by you or by the researchers will be maintained as required by applicable law and to the degree permitted by the technology used. Absolute confidentiality cannot be guaranteed.
- Efforts will be made to limit the use and sharing of your personal research information to people who have a need to review this information. Reasonable efforts will be made to keep the personal information in your research record private. A list that matches your name with your code number will be kept in a locked file or password protected file in the Erickson Food Science Building. Only the research team and the coordinator of the Sensory Evaluation Center will have access to this computer and the files on it. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.
- Information collected in this project may be shared with other researchers, but we will not share any information that could identify you.

- You will be compensated with \$10 for participating in this test.

If you have questions, complaints, or concerns about the research, you should contact Helene Hopfer at 814-863-5572. If you have questions regarding your rights as a research subject or concerns regarding your privacy, you may contact the Human Research Protection Program at 814-865-1775.

Your participation is voluntary and you may decide to stop at any time. You do not have to answer any questions that you do not want to answer.

Your participation implies your voluntary consent to participate in the research.

Next

Today you will be tasting two chocolate milk samples.

To begin, please pass your tag through the serving hatch to receive your samples.

Then, take a sip of water and cleanse your palate.

Click "Next" once you received your samples.

Next

Then read the following information regarding the product you will be tasting.

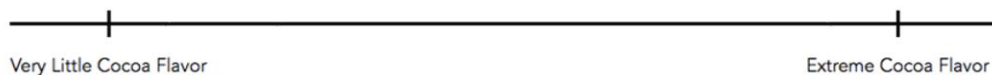
This product has been made with real sugar

Nutrition Facts	Amount/serving		% Daily Value*		Amount/serving		% Daily Value*	
	1 servings per container	Total Fat 2.5g		3%		Total Carbohydrate 19g		7%
Serving size 1 Cup	Saturated Fat 1.5g		8%		Dietary Fiber 0g		0%	
Calories per serving	Trans Fat 0g				Total Sugars 18g		14%	
	Cholesterol 15mg		5%		Includes 7g Added Sugars		14%	
130	Sodium 180mg		8%		Protein 8g		16%	
	Vitamin D 2.5mcg	10%	Calcium 300mg	25%	Iron 0.5mg	2%		
	Potassium 440mg	10%						

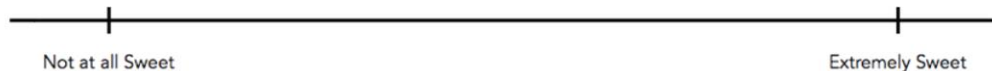
Ingredients: Lowfat Milk, Sugar, Cocoa, Salt, Carrageenan, Natural Flavors, Vitamin A Palmitate, Vitamin D3.

Please take a sip of sample **BC111** and swallow normally before making the following intensity ratings.

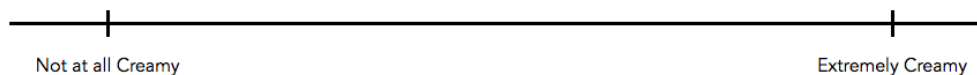
How would you rate the **amount of Cocoa Flavor** for this sample?



How would you rate the **amount of Sweetness** for this sample?



How would you rate the **amount of Creaminess** for this sample?



Next

Please take another sip of sample **BC111** and swallow normally before rating how much you **like** the sample.

How much do you **like** this sample overall?

Dislike Extremely Dislike Very Much Dislike Moderately Dislike Slightly Neither Like nor Dislike Like Slightly Like Moderately Like Very Much Like Extremely



Before you start, make sure to locate the sample cup labelled **BC111**.

Then read the following information regarding the product you will be tasting.

This product has been made with low calorie sweeteners

Nutrition Facts 1 servings per container Serving size 1 Cup Calories per serving 100	Amount/serving	% Daily Value*	Amount/serving	% Daily Value*	
	Total Fat 2.5g		3%	Total Carbohydrate 4g	1%
	Saturated Fat 1.75g		9%	Dietary Fiber 1g	4%
	<i>Trans</i> Fat 0g			Total Sugars 3g	
	Cholesterol 10mg		3%	Includes 0g Added Sugars	0%
	Sodium 150mg		7%	Protein 15g	30%
	Vitamin D 0mcg 0%	Calcium 390mg 30%	Iron 0.9mg 4%		
Potassium 517mg 10%					

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Ingredients: Lowfat Milk, Cocoa, Natural Flavors, Monk Fruit Juice Concentrate, Stevia Leaf Extract, Carrageenan, Cellulose Gel, Cellulose Gum, Maltodextrin, Acesulfame Potassium, Sucralose, Lactase Enzyme, Vitamin A Palmitate, Vitamin D3.

Please take another sip of the sample and swallow normally before making the following intensity ratings.

How would you rate the **amount** of **Cocoa Flavor** for this sample?

—————|—————|—————

Very Little Cocoa Flavor Extreme Cocoa Flavor

How would you rate the **amount** of **Sweetness** for this sample?

—————|—————|—————

Not at all Sweet Extremely Sweet

How would you rate the **amount** of Creaminess for this sample?

|-----|-----|

Not at all Creamy Extremely Creamy

Next

Please take another sip of sample **BC111** and swallow normally before rating how much you **like** the sample.

How much do you **like** this sample overall?

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Next

Thank you for completing this test!

**Please pass your used materials through the hatch, click finished, and
sign out (upper right corner) before exiting the booths.**

Finished

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ACADEMIC VITA

Rose Marie Spahn

Education:

The Pennsylvania State University – Schreyer Honors College - State College PA
BS: Food Science - Graduation: May 2022

Work Experience:

Saputo Dairy Foods USA, LLC

Starting July 2023

Incoming Research and Development Trainee

- Run analytical testing on milk and milk products to ensure products are meeting regulatory standards
- Conduct Research and Development trials both in pilot plants and as full-scale plant trials
- Assist in improving the efficiency of Saputo plants in the United States

The J.M. Smucker Company

May 2022 – August 2022

Sensory Intern

- Created and assisted with taste tests for a variety of products and a variety of panels
- Analyzed data and formulated reports of panel results
- Conducted a project related to defining a certain texture attribute and communicated results to leadership

Lactalis American Group

May 2021 – August 2021

Production Intern

- Updated Standard Operating Procedure (SOP's) and added Job Safety Hazards (JSH's) for 8 production lines
- Assisted with Research and Development trials, and conducted a two-week ingredient addition trial
- Completed data entry related to quality assurance and production output

Penn State Sensory Evaluation Center

November 2019 - Present

Sensory Lab Technician

- Execute the preparation of different taste tests imperative to companies to provide analytical data on products
- Communicate and work efficiently with a team to complete taste tests in a standardized manner

Research Experience:

Undergraduate Honors Thesis

January 2022 - Present

- Titled: The Effect of Consumer Attitudes and Beliefs on Sensory Perception and Liking of Chocolate Milk
- Conducting a survey to segment groups of athletic young adults based on their eating patterns
- Implementing a sensory test to examine differences in sensory perception by population segmentation

Related Extracurricular Activities:

Penn State Food Science Club

August 2019 - Present

Member

- Develop professionally while expanding network of food industry, business leaders and alumni

Gamma Sigma Delta Honor Society

Member

February 2023 - Present

- Foster relationships between scientists in the agricultural sciences and other disciplines
- Present honors thesis at Gamma Sigma Delta Research Expo

Other Extracurricular Activities:

Penn State Club Cross Country Team

August 2019 - Present

Captain (June 2022 – Present), Workout Chair (December 2020-December 2021)

- Organize social events for the team, attend daily practices and compete with the team
- Fundraise for Penn State THON childhood cancer charity

Certificates:

- Penn State Ice Cream Short Course Certificate **January 2023**
- ServSafe Certificate **November 2021**
- CITI Certification (IRB) Course **February 2022**

Honors and Awards:

Penn State Dean's List	Fall 2019 – Fall 2022
Penn State Provost Award	Fall 2019 – Spring 2023
John H Hetrick Food Science Scholarship	Fall 2022 - Spring 2023
Thevaos Honors Scholarship	Fall 2019 - Spring 2023
Academic Excellence Scholarship	Fall 2021 - Spring 2023
College of Ag Sciences Undergraduate Research Award	Spring 2022
Ag Alumni Society Internship Award	Spring 2023
National Association of Flavors and Food-Ingredient System Scholarship Award	Fall 2022
Haas Family Scholarship	Fall 2021 - Spring 2022
Riley Ridge Alumni Scholarship	Fall 2019 - Spring 2021
IFT Feeding Tomorrow Scholarship	Fall 2021
Keeney Food Science Department Head Fund Recipient	Fall 2019
Girton Food Science Scholarship	Fall 2019
Air Force Officers Spouse's Club Scholarship Recipient	Fall 2019