UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Plant Based Diets: The Influence of Popularity, Nutritional and Price Perceptions on Choice of Milk Beverages Alex (Hangzhong) Li, Si Qi (Becky) Mai, Kendra Arsadjaja, Nicole Yu University of British Columbia PSYC 321 Food, Wellbeing

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Abstract

The objective of this study is to help our client better understand UBC students' preference and perception on milk beverages and suggest ways to encourage undergraduates to consider trying other plant-based milk beverages. We conducted an online questionnaire to investigated UBC students' current preference on milk beverage and whether they will be open to trying other milk alternatives after either a popularity, nutritional or price intervention. We hypothesize that by providing information on popularity, nutritional and price of milk beverages as in intervention, people will be more opened to trying other milk products. However, after a chi-square data analysis from the data, we concluded that our interventions were not effective in influencing participants' choice of milk beverages.

Keywords: milk, perceptions, milk alternatives,

The Influence of Popularity, Nutritional and Price Perceptions on Choice of Milk Beverages

Cow's milk has been popular in the world for centuries as a source of protein. However, with several issues such as lactose intolerance, environmental impacts, and milk allergies related to cow's milk, plant-based milk alternatives are in high demand in recent years (Vanga & Raghavan, 2017). In Vanga and Raghaven's (2017) research about milk alternatives they cited that 15 to 75% of adults are lactose intolerance. Lactose is type of sugar that exclusively exits in mammalian milk and requires lactase enzyme to digest (Bhatnagar & Aggarwal, 2007). Lactose intolerance occurs when people have insufficient enzymes in their body to digest cow's milk.

Additionally, milk allergies have been contributing to the popularity of milk alternatives. As indicated by Vanga, Singh, Vagadia & Raghavan (2015), milk allergies are most prevalent among infants. With these issues in cow's milk, milk beverage companies introduced plant-based milk alternatives, such as almond, soy, and coconut milk. Since the introduction of plant based milk beverages, their market sales has been successful.

Current studies on milk alternatives question how well these plant-based milk can nutritionally compensate cow's milk. Vanga and Raghaven (2017) noted that soy milk is the best alternative for cow's milk nutritional-wise. Additionally, almond milk is also considered to be a suitable plant-based alternative as it is better in flavor, has less calories compared to soy milk, and is more nutrient dense (Vanga & Raghavan, 2017).

Additional studies questioned whether milk alternatives are appropriate for chronic kidney disease (CKD) patients since cow's milk contains high phosphorus and potassium content (Kung, 2010). Excessive phosphorus weakens CKD patients' bones and results in soft tissues calcification (Kung, 2010). Tarantola and Wujastyk (2009) also noted that uncontrolled phosphorus and potassium in CKD patients may cause metabolic disturbances. The researchers concluded that Blue Diamond's unsweetened almond milk is the most optimal choice for CKD patients who want to limit phosphorus, potassium intake (Tarantola & Wujasty, 2009). The current study investigates whether popularity, nutritional or price information will change people's perceptions and their choice of milk beverages. We want to use the data collected to help our client at the University of British Columbia (UBC) to effectively promote plant-based milk beverages within the university community. We investigated four different types of milk beverages including cow's, soy, almond and coconut milk. We hypothesized that people's perception on milk beverages will change after the popularity condition and that participants will choose to consider trying almond milk, since almond milk is currently most popular milk alternative on the American markets (Pierre, 2017). We also hypothesize that people's perception on milk beverages will change after providing them nutritional information on milk beverage products, and that they will consider trying almond milk since it contains less calories compared to the other milk beverages in our study. Lastly, for price condition, we hypothesize that people's perceptions on milk beverages will change and that they will choose cow's milk since it is the most affordable milk beverage out of the four milk beverages presented.

Methods

Participants

Participants were selected through convenience sampling. Each group member in our team personally reached out to friends who were undergraduate students at UBC. Additionally, the link to the survey was posted on the PSYC 321 course connect page to encourage fellow classmates to participate in the study. The survey questionnaires were conducted anonymously

and the confidentiality of participants was assured. The data was collected from a total of 91 undergraduate students at UBC (8 participants were omitted from an initial total of 99 respondents due to incomplete responses). 66% of the respondents were self-identified females (60), and 34% were self-identified males (31). The majority of the participants were aged within 21-23, some were aged within 18-20 and a few aged within 24+, which accumulated to a mean age of 21.49.

Conditions

Within our experiment, we had three different conditions which participants were randomly assigned to. The first condition was popularity with a total of 33 participants assigned to it. The second condition was the nutritional condition with a total of 28 participants. Lastly, the price condition with a total of 30 participants. All the milk beverages that were included in each condition (cow, soy, almond and coconut milk) are milk beverages we were investigating.

Popularity Condition. In the popularity condition, participants were provided with a detailed description which included statistics and charts based on US milk substitutes sales in 2015. The chart provides participants a visual representation of how many people prefer to purchase almond milk as a milk substitute. This data was retrieved from the Alberta Agricultural and Forestry (2016) website. In addition, keywords within the description were bolded to provide emphasis and draw participants' attention. Keywords that were bolded include: "almond milk", "boosting sales growth by 250%" and "total milk market shrunk". The bolded words suggest that almond milk is the most popular milk substitute. The aim of this condition is to see if participants will be influenced to try almond milk as a form of milk beverage due to its popularity as characterized by increased market sales. (See appendix A).

Nutritional Condition. In the nutritional condition, participants were provided with images of the milk beverages that we were investigating, along with detailed nutritional charts that were commonly seen on the side of the carton. As you can see in Appendix B, a red box was put around the "calories" row to draw participants' attention. To further emphasize and provide clarity to our participants, we listed the calories per serving for each milk beverage option below. We did this because, according to Soederberg and Cassady's (2015) paper on how nutritional knowledge will affect food label use, they stated that nutritional charts are often complex and hard to understand for the majority of the people. A factor on the nutritional chart which most people are most familiar with and exposed to is "calories". Hence, people tend to consider calories when determining if an item is nutritious or not. The aim of this condition is to investigate if participants will be influenced to try almond milk as it has the least calories compared to the other milk beverages presented. (See appendix B).

Price Condition. In Appendix C, you can see the information participants were provided with during the intervention. All prices were collected from www.walmart.ca. We stated the prices per 100mL for each milk beverage and the size of the carton the prices were based on. Participants were asked to consider the prices of each of the milk beverages listed. The most affordable milk beverage that was presented was cow's milk. The other three types of milk beverages (soy, almond and coconut milk) had the same price per 100mL. The aim of this condition is to study if participants will be influenced to try cow's milk due to the affordable price.

Measures

The dependent variable of our study was the participants' perception on the different milk beverages, in particular, the change in perception of participants following the 3 different conditions, which was our Independent Variables. To measure the change in people's perception on milk beverages, we asked follow-up questions after their exposure to either the Popularity, Nutritional, or Price interventions. Regardless of which condition participants were assigned to, they received the same follow-up questions which were, "After reading the information that was provided to you previously, would you consider trying other milk beverages?" (Yes/No) and "Did your milk preference change compared to your initial answer provided at the beginning of the survey?" (Yes/No). A *Yes* response to either of these questions were regarded as a participant's change in perception on milk beverages. Amongst those who answered *Yes* for the first question, participants were asked another follow-up question, which was a nominal likert-type scale requiring them to specify which milk beverage they would consider trying (Cow, Soy, Almond, Coconut milk or Other). Prior to assigning participants to the different conditions, we also gathered baseline data on participants' preferred milk beverage prior to their exposure to one of our interventions.

Procedure

Our survey was created on an online platform called Qualtrics and the duration of the entire survey is between 3-6 minutes. The surveys were distributed through private conversations on social media platforms and by posting the survey link on the PSYC 321 course page. Each member of the team was to send the survey to 25 of their friends or acquaintances who is an undergraduate student at UBC. During the survey, participants were first asked to read and agree to a consent form. Then participants were asked some basic background questions such as their gender and age. Before participants were presented with the interventions, they were asked their current milk beverage preference and the reasons behind that choice. Next, participants were introduced to one of the three conditions through random assignment by Qualtrics. After the intervention, participants were then asked which milk beverage within the intervention they would consider trying and if their milk preference has changed compared to their initial preference before the intervention. These questions were to examine participant's change in perception and preference after the interventions.

Results

From our preliminary findings, the popularity intervention seemed to have a notable effect on participant's perceptions as observed through their willingness to try another milk beverage (see Appendix D). Additionally, from our preliminary observations, participants were likely to consider trying almond milk compared to other milk beverages presented (see Appendix E). No significant effect of the other two condition (nutrition and price) were observed in influencing participant's individual perception of each milk beverage (see Appendix F and Appendix H). However, in our preliminary findings, we did observe that after the nutritional intervention, for the people who were willing to try another milk beverage, almond milk was a popular choice among participants (see Appendix G). On the other hand, from our preliminary findings, we found that coconut milk and almond milk were almost equally as popular as secondary milk beverage choices (see Appendix I).

The statistical findings indicate that the conditions (popularity, nutrition and price) had no significant effect (p value= .595) on participant's perception of milk beverage. There are also

no significant gender or age differences. Additionally, there was no significant difference on the preference of milk beverage participants would be willing to consider trying (p value=.279). Furthermore, the chi square test data analysis did not indicate any significant effect of any of the conditions with participant's willingness to change their initial milk beverage preference (p value=.803).

Therefore, our collected data did not unexpectedly support any of our hypotheses. Popularity, nutritional value and price interventions all had no sizeable impact on perception of milk beverages as there was no significant difference in participant's willingness to consider trying other milk beverages.

Discussion

From the results stated above, through the use of the chi square statistical analysis, there was no significant difference found in participants' perception from the results after participants were exposed to either one of the conditions. Our results suggest that there is no statistical correlation between popularity, nutritional and price on participants' perception on a specific milk beverage. Hence, our results from all three conditions do not support the three hypothesis we presented. Moreover, we identified several limitations within our study. Our results showed that there was no significant effect found and this might have been due to inadequate strength and the effectiveness of the information provided within the three conditions that was presented (popularity, nutritional and price) such as graphs or charts presented may be difficult for participants to read or comprehend. Moreover, participants may not have paid enough attention to the interventions as much as we have liked them to since we did not control the pace that participants take to complete the survey. Another major limitation of our study is sample size we had. We collected data from total of 99 participants, but only analyzed data from 91 participants as 8 participant's data were excluded due to incomplete responses. Our number of pariticipants is a very limited sample compared to a total of 52,386 undergraduates within UBC (Redish & Mathieson, 2017, p.7).

Furthermore, to resolve our limitations and to run a better study in the future, some improvements include: having a pilot test for our conditions to gather feedback on the effectiveness of the information before putting it in our experiment. In addition, in our popularity intervention, we can perhaps use statistics on milk substitutes that is specifically based on the Vancouver population as it might be easier for participants to relate to and be compelled to conform to the majority. Also instead of using personal connections as a main channel to distribute the surveys as it only reaches a limited sample within a population, the surveys can be distributed through various Facebook groups vastly used by the UBC undergraduate population. To further increase the sample size, an incentive could be added. Lastly, we were able to identify a confounding variable. Participants were able to go over the intervention at their own speed, hence the time which participants were exposed to the intervention is unknown. We are unable to ensure that participants read through the information within the intervention clearly and understood all part. Because this will strongly influence their change in perception and preference.

We believe that our research project can benefit the environmental sustainability in the long run due to the carbon footprint the meat and dairy industry leaves. Franklin (2017) quotes Alpro a soy product produced, who claims that "soy uses four times less water than milk, two times less land and produces two and a half times less CO2 emission". By conducting experiments on methods to help promote plant based diets, we believe that eating sustainably will help the environment.

Recommendation for our UBC client

The behavioral interventions that we used (popularity, nutritional, or price) were analyzed via chi square analysis to not infer a significant difference in people's perceptions of milk beverages. Since that is the case, we could not recommend actions that builds up from the three interventions we used, since we could not guarantee their effectiveness. Hence, we would like to provide insight for our clients based on our preliminary findings.

From our baseline data, our study gathered information on the current most preferred milk beverage amongst undergraduate students at UBC, which was cow's milk. Following cow's milk, our preliminary findings detected that the second most preferred milk beverage was almond milk, followed by soy milk in third position (see Appendix J). Based on these data, we would like to suggest our client to focus on supplying and increasing accessibility to almond or soy milk because our preliminary findings suggest that those two milk beverages are the most popular demanded plant-based milk alternatives.

Based on our preliminary findings, we detected an openness to change amongst our participants, in that some students would consider trying different plant-based milk alternatives even amongst those who initially chose cow's milk as their initial preferred milk beverage. Hence, we would like to recommend our client to keep supplying plant-based milk alternatives in current markets and stores around UBC and continue promotional strategies for them.

Another baseline data that we gathered amongst our participants were the factors that influence participants' milk beverage preferences. Participants were asked to rate eight possible factors from most influential to least influential (nutritional value, taste, popularity, price/affordability, accessibility, environmental/ethical reasons, health reasons, or others), to which the determinant of "taste" seemed to be highly ranked. The next most contributive factor seemed to be "nutritional value", followed by "health reasons" (see Appendix K). Deducing from these preliminary findings, we would like to recommend our client to apply promotional strategies for plant-based milk alternatives that mainly emphasize on taste.

Lastly, pertaining to our price condition, we initially hypothesized that participants would choose cow's milk as it is the most affordable out of all milk beverages presented, but instead participants chose almond and coconut milk. We speculate that this is because the price jump from cow's milk to coconut and almond milk is not significant enough that it would trigger participants to choose the most affordable option. We believe that this data will be useful towards our client when pricing milk beverages within the UBC markets and stores.

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Appendix A

Survey Questions from the Popularity Condition

According to Neilson (2016) study, "almond milk is now America's favorite milk substitute, boasting sales growth of 250% over the past five years. During that same period, however, the total milk market shrunk by more than \$1 billion."...and the following statistic regarding how popular each milk substitute is as defined with U.S. market sales in 2015.

U.S. MIL	K SUBSTITUTE SALES IN 2015
Almond Milk	\$894,650,036
Soy Milk	\$297,698,048
Coconut Milk	\$61,265,393
-	
)

Source: http://www.nielsen.com/us/en/insights/news/2016/americans-are-nuts-for-almond-milk.html

After reading the information that was provided to you previously, would you **consider trying** other milk beverages?

Yes

No

Appendix B

Survey Questions from the Nutritional Condition

Consider the nutritional charts for each of the different types of milk beverage below:

Dairyland Dairyland	Silk	Silk Almondmilk	Silk comut
2% Cows Milk Source: www.dairyland.ca	Silk Soy Milk (Original) Source: www.silk.com	Silk Almond Milk (Original) Source: www.silk.com	Silk Coconut Milk (Origin Source: www.silk.com
Nutrition Facts	Nutrition Facts Serving Size 1 Cup (240mL) Servines Per Container 8	Nutrition Facts Serving Size 1 Cup (240mL) Servings Per Container About 8	Serving Size 1 Cup (240mL) Servings Per Container 8
Nutrition Facts Serving Size 1 Cup (240mL)	Nutrition Facts Serving Size 1 Cup (240mil) Servings Per Container 8	Nutrition Facts Serving Size 1 Cup (240ml.) Servings Per Container About 8	Serving Size 1 Cup (240mL) Servings Per Container 8
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Nutrition Facts Serving Size 1 Cup (240mL) Amount per Serving Calories 130 Fat Cal 45	Nutrition Facts Serving Size 1 Cup (240mL) Servings Per Container 8 Amount Per Serving Calories 110 Calories from Fat 40	Nutrition Facts Serving Size 1 Cup (240mL) Servings Per Container About 8 Amount Per Serving Calories 60 Calories from Fat 25 S Colley Value	Serving Size 1 Cup (240mL) Servings Per Container 8 Amount Per Serving Calories 80 Calories from Fat 5
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Nutrition Facts Serving Size 1 Cup (240mL) Amount per Berving Calories 130 Fat Cal 45 *Chains Fat 30 Fat Cal 45 Total Fat 50 8% Saturated Fat 30 15% Trans Fat 00 7% Sodium 120mg 5% Potasium 360mg 10% Total Carbohydrate 12g 4% Dietary Fiber 00 0% Sugars 110 9% Protein 8g 16% Vitamin C 0% 0% Vitamin A 10% Vitamin C 0%	Rutrition Facts Serving Size 1 Cup (240mL) Servings Per Container 8 Amount Per Serving Calories 110 Calories from Fat 40 % Daily Values* % Daily Values* Total Fat 4.5g 7% Saturated Fat 0.5g 7% Saturated Fat 1g Cholessterol 0rg 0% Sodiam 95mg 4% Potassium 3800mg 11% Total Carbohydrate 9g Sugara 6g Protein 8g 16% Vitamin A 10%	Rutrition Facts Servings Per Container About 3 Amount Per Serving Calories 60 Calories from Fat 25 Total Fat 2.5g 3% Saturated Fat 0g 0% Trans Fat 0g 0% Polyanshurated Fat 0.5g 0% Cholesterol 0mg 0% Sodium 150mg 7% Polyanshurated Fat 1.5g Cholesterol 0mg Cholesterol 0mg 0% Sodium 150mg 7% Potasslum 35mg 1% Dietary Fiber <1g	Serving Size 1 Cup (240mL) Servings Per Container 8 Amount Per Serving Calories 80 Calories from Fat 5 % Dally Value Total Fat 5g 8 Saturated Fat 4.5g 23 Trans Fat 0g Cholesterol Omg 0 Sodium 35mg 22 Potassium 40mg 11 Total Carbotydrate 7g 2 Dietary Fiber 0g 0 Sugars 7g Protein 0g Vitamin A 10% • Vitamin C 0%

 2% Cows Milk:
 130 calories per 240mL

 Silk Soy Milk:
 110 calories per 240mL

 Silk Almond Milk:
 60 calories per 240mL

 Silk Coconut Milk:
 80 calories per 240mL

After reading the information that was provided to you previously, would you **consider trying** other milk beverages?

Yes

No

Appendix C

Survey Questions from the Price Condition

Consider prices for each of the different types of milk beverage below:







(Based on 2L carton)



Silk Soy Milk (Original) \$0.20 per 100mL

(Based on 1.89L carton)

Silk Almond Milk (Original) \$0.20 per 100mL

(Based on 1.89L carton)

Prices reflected in Canadian Currency. Source: Walmart.ca



Silk Coconut Milk (Original) \$0.20 per 100mL

(Based on 1.89L carton)

2% Cows Milk: \$0.17 per 100mL Silk Soy Milk: \$0.20 per 100mL Silk Almond Milk: \$0.20 per 100mL Silk Coconut Milk: \$0.20 per 100mL

After reading the information that was provided to you previously, would you **consider trying** other milk beverages? (Select 1 only)

Yes

No

Appendix D

Preliminary analysis: percentage of participants that were willing to consider trying a different

type of milk beverage in the popularity condition.





Preliminary Analysis: percentage of participant's choice of milk beverage that they would

consider trying after the popularity condition.



Appendix F

Preliminary analysis: percentage of participants that were willing to consider trying a different

type of milk beverage in the nutritional condition.





Preliminary Analysis: percentage of participant's choice of milk beverage that they would



consider trying after the nutritional condition.

Appendix H

Preliminary analysis: percentage of participants that were willing to consider trying a different



type of milk beverage in the price condition.



Preliminary Analysis: percentage of participant's choice of milk beverage that they would

consider trying after the price condition.



Appendix J

Relationship Between (Popularity, Nutrition, Price) Interventions and Participants' Consider

Trying Responses

Condition * Q9: Consider Trying Crosstabulation

Count

		Q9: Consid		
		Yes	No	Total
Condition	Popularity Condition	20	10	30
	Nutrition Condition	16	12	28
	Price Condition	18	15	33
Total		54	37	91

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.038 ^a	2	.595
Likelihood Ratio	1.050	2	.592
Linear-by-Linear Association	.931	1	.335
N of Valid Cases	91		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.38.

Appendix K

Relationship Between (Popularity, Nutrition, Price) Interventions and Participants' Consider Beverage

Responses

Condition * Q10: Consider Beverage Crosstabulation

Count

		C	210: Consid	er Beverage			
		Cow	Soy	Almond	Coconut	Other	Total
Condition	Popularity Condition	1	4	13	2	0	20
	Nutrition Condition	0	4	10	2	0	16
	Price Condition	1	3	6	7	1	18
Total		2	11	29	11	1	54

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.810 ^a	8	.279
Likelihood Ratio	10.423	8	.237
Linear-by-Linear Association	2.588	1	.108
N of Valid Cases	54		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .30.

Appendix L

Relationship Between (Popularity, Nutrition, Price) Interventions and Participants' Milk

Beverage Preference Change Responses

Condition * Q11: Milk preference change Crosstabulation

Count

		Q11: Milk pref	Q11: Milk preference change								
		Yes	No	Total							
Condition	Popularity Condition	7	23	30							
	Nutrition Condition	6	18	24							
	Price Condition	6	27	33							
Total		19	68	87							

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.438 ^a	2	.803
Likelihood Ratio	.445	2	.801
Linear-by-Linear Association	.252	1	.616
N of Valid Cases	87		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.24.

Appendix M

Participants' Initial Milk Beverage Preferences

#	Field	Choic Coun	e t
1	Cows milk	44.58%	37
3	Almond milk	22.89%	19
2	Soy milk	21.69%	18
4	Coconut milk	8.43%	7
5	Others - please specify	2.41%	2

Appendix N

#	Field	1		2		3		4		5		6		7		8	
2	Taste	39.76%	33	27.71%	23	20.48%	17	8.43%	7	3.61%	3	0.00%	0	0.00%	0	0.00%	0
1	Nutritional value	25.30%	21	24.10%	20	20.48%	17	1 0.8 4%	9	10.84%	9	7.23%	6	1.20%	1	0.00%	0
7	Health reasons	14.46%	12	18.07%	15	9.64%	8	12.05%	10	12.05%	10	16.87%	14	16.87%	14	0.00%	0
4	Price/affordability	7.23%	6	9.64%	8	10.84%	9	16.87%	14	25.30%	21	16.87%	14	12.05%	10	1.20%	1
6	Environmental/ethical reasons	6.02%	5	2.41%	2	4.82%	4	9.64%	8	10.84%	9	26.51%	22	36.14%	30	3.61%	3
8	Others - please specify	3.61%	3	0.00%	0	0.00%	0	0.00%	0	0.00%	0	1.20%	1	2.41%	2	92.77%	77
5	Accessibility	2.41%	2	15.66%	13	19.28%	16	24.10%	20	20.48%	17	10.84%	9	7.23%	6	0.00%	0
3	Popularity	1.20%	1	2.41%	2	14.46%	12	18.07%	15	16.87%	14	20.48%	17	24.10%	20	2.41%	2
						5	Showir	ng Rows: 1	l - 8 Of	8							

Ranking of Factors Influencing Participants' Milk Beverage Preferences