Consumer preferences for milk and yogurt attributes:
How health beliefs and attitudes affect choices.

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Abstract

Using data from a Canadian national survey assessing dairy product preferences in 2011, individual preferences for milk and yogurts with specific attributes are examined in this study. Statements developed based on the Health Belief Model, food attitudes, beliefs about the role that nutrition plays in health, nutrition knowledge, and an individual's propensity to make changes to improve their health are used to predict whether or not respondents consume milk/yogurt, the frequency with which they consume it, which type of product they typically consume, and how much they would be willing to pay for new milk or yogurt attributes. Results indicate that several aspects of the Health Belief Model as well as general nutrition knowledge can predict purchasing and consumption intentions for milk and yogurt products. All else being equal, the influences on an individual's willingness to pay for unique milk or yogurt characteristics in stated choices are different then the influences on their self-identified willingness to seek out milk or yogurt to increase calcium in their diet.

Introduction

Dietary patterns in North America are changing. There are many social, environmental, and individual factors that play a role in food and beverage intake. As the links between dietary practices and their positive and negative health implications have emerged, individual attitudes and beliefs towards health have become important factors in food purchasing and consumption decisions. Figure 1 shows many of the factors that affect individual food choices, while the bold items illustrate the factors being more closely considered in this study.

Insert Figure 1 here.

The consumption of dairy products is no exception to this trend of evolving eating patterns. Since 1990 in Canada, the per capita intake of some dairy products, such as cheese, has remained relatively constant, while other products high in fat, such as butter and ice cream, have shown a decline in per capita consumption (CDIC, 2011). Despite some increases in the consumption of skim and 1% milk, total fluid milk consumption has declined. The only dairy product in Canada to have a striking increase in per capita consumption since 1996 is yogurt.

There are several possible reasons for the increase in yogurt consumption, including the higher number of yogurt products available at the retail level, the greater advertising spending on yogurt, and functional claims such as probiotics for some yogurts. In addition to these extrinsic factors, it is important to consider the fact that yogurt may be perceived by consumers to be a healthy food (Hashim et al 2009), and intrinsic factors such as individual health attitudes and beliefs could play a role in different dairy product consumption patterns. If a person believes that their diet plays a

role in their overall health, they may be more likely to consider things like fat, fibre, or vitamin content before deciding what product to consume. People who are less concerned about their health or who don't believe that their diet affects their health may be more likely to choose products based on taste, convenience, or price.

Several studies have examined the relationship between health beliefs and dietary practices. Kwok et al (2009) found that fat, fruit, and vegetable intake differ between Chinese Canadians based on their health beliefs. Trondsen et al (2004) found that among Norweigan women, those who believed that food is important for health had higher fish consumption. Larson et al (2006) found that among American female adolescents, health attitudes were significantly and positively related to milk intake.

Objective

The objective of this paper is to determine if the influence of individual health attitudes and beliefs affect what milk and yogurt products people choose to consume, the frequency with which they consume them, their stated preferences for new attributes in dairy products (in the form of nutrient enhancement or nutritional accreditation), and whether these effects are consistent across milk and yogurt. The intent is to examine whether specific health attitudes and beliefs are influencing what individuals say they are currently consuming and would consume in an effort to improve health versus their actual choices in stated preference experiments.

There are a variety of questions and statements used in surveys to evaluate beliefs, knowledge, attitudes, and opinions about these issues. In order to address the objective, this study uses statements developed from the Health Belief Model (HBM), food attitude

statements used in a survey conducted by Agriculture and Agri-food Canada and analyzed in a study by Herath et al (2008), a general measure of nutrition knowledge, a statement pertaining to a belief that food plays a role in health, and stated changes made by the individual to improve health in the previous 12 months to explain and compare milk and yogurt choices among respondents.

Literature Review

The HBM is a construct which was developed by Rosenstock (1988) in an effort to understand why some individuals make use of health services while others do not. Rosenstock (1988) emphasized the fact that individual behaviour is a result of both emotional and cognitive elements. The construct is based on the following aspects of health: perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers. Perceived susceptibility is a measure of how likely an individual thinks that he or she is to contract a given disease. Many people think that despite the statistical probability that they are at risk, they don't truly believe that it will happen to them. The higher the perceived susceptibility, the more likely people are to take preventative action. Perceived seriousness refers to both the emotional reaction caused by thinking of the disease as well as the hardships a person believes a disease will impose on their life. Again, the higher the perceived seriousness, the more likely an individual is to take preventative actions. Perceived benefits are the reduction in one's mind to their susceptibility to a disease as a result of a given action or behaviour. Perceived barriers are negative aspects of actions (such as cost, time restrictions, and pain) which could reduce likelihood of a disease. A person is more likely to take action or implement a

behaviour the more the perceived benefits outweigh the perceived barriers. Rosenstock points out that in addition to the previous factors, a cue to action is also necessary for an individual to adopt a health improving behaviour. In 1988, Rosenstock et al suggested that a measure of self-efficacy (a person's belief that they are capable of taking action) be included in the construct to predict health behaviour. Many studies which use the HBM to explain behaviours also include a measure of health motivation (Vassallo et al 2009).

In addition to the many studies in health sciences that have used the HBM to predict health behaviours, several studies have used the HBM to predict eating behaviour, since there is a direct link between diet and health outcomes. Deshpande et al (2009) used the HBM to predict healthy eating behaviours among university students. They found that their data supported the use of the HBM in a nutritional setting, and that perceived susceptibility, seriousness, benefits, and self-efficacy were positively linked with healthy eating behaviours while perceived barriers were negatively linked. Li and Levy-Milne (2008) conducted interviews with high-school students from British Colombia based on the HBM to understand the determinants of fruit and vegetable intake among adolescents and how it might be increased. Sun et al (2006) used the HBM to predict the usage of a functional soy sauce among women in China. They found that the HBM could explain consumption intention of the functional soy sauce, and that by improving nutrition education people's understanding of the benefits of consuming the product would increase and therefore attitudes towards the product would improve. Swaim et al (2008) found that only the measure of self-efficacy, and none of the other HBM elements, explained post-menopausal women's actions to prevent osteoporosis. Vassallo et al (2009) evaluated consumer willingness to try functional breads in Europe

as a function of demographic variables and health attitudes and beliefs characterized by the Health Belief Model.

While the overall concept and four core health aspects (perceived benefits, barriers, susceptibility, and severity) are consistent across studies using the HBM, the exact statements, number of statements, and inclusion of additional health aspects such as health motivation or self-efficacy vary. Table 1 outlines four studies which used the HBM and shows some examples of statements they used. Please note that not all the statements are included in this table and that some studies use more than 30 items in total.

Insert Table 1 here.

There have also been studies examining consumer food choice based on individual health beliefs and attitudes besides those using the HBM. Schifferstein and Oude Ophuis (1998) used various health attitude measures to determine how these attitudes affect consumer likeliness to purchase organic foods. Herath et al (2008) used attitudinal and motivation constructs, which had been previously included in a national Agriculture and Agri-food Canada survey, to better understand the reasons consumers purchase functional foods. Fishbein and Ajzen (1975) also developed an approach to model behaviours based on attitudes which has been applied to food choices. Some additional studies, along with example statements from their questionnaires, are shown in Table 2.

Insert Table 2 here.

Methods

An online survey was developed by the authors and conducted by TNS Global across Canada in January 2011. The 1705 respondents were a representative sample of

Canadians excluding those under 19 years of age and those living in the territories. The survey included demographic characteristics, self-reported milk and yogurt consumption behaviours, and measures of health attitudes, knowledge, actions, and beliefs. Also included in the survey were two choice experiments involving milk and yogurt with various attributes (price, fat content, vitamin enhancement, probiotics, longer than mandatory nutrition facts panel, and a Health Check^{TM} symbol).

Choice experiments have been used for some time in the transportation, psychology, and marketing literature (Bastell and Louviere 1991; Louviere 1988a; Louviere 1988b; Hensher 1994) to elicit information about consumer preferences for goods or services which are bundles of various attributes. What sets choice experiments apart from other conjoint methods is that individuals are asked to choose between alternative bundles of attributes rather than rating or ranking them, making choice experiments consistent with random utility theory (Peters et al 1995). Because of the nature of choice experiments, they provide a thorough description of tradeoffs respondents are willing to make between various product attributes, thereby revealing whether or not individuals are sensitive to attribute levels or even to the attributes themselves. This is particularly useful for examining hypothetical products that may not exist in the marketplace, such as probiotic or vitamin-enhanced milk.

The milk and yogurt choice experiments were part of the survey that was conducted online throughout Canada, and each respondent was presented with 8 scenarios; 4 for milks and 4 for yogurts. The prices assigned to the products were for either a 2-litre carton of milk or an 8x100g package of yogurt, and price levels were based on average retail prices of $3.50 for a 2-litre carton of milk and $5.50 for an

8x100g package of yogurt. The choice sets included 2 product options and a third 'neither' option. Examples of the choice sets are shown in Figures 3 and 4. Experimental design was based on a fractional factorial design for the attributes and levels provided in Table 3 for each of milk and yogurt.

Insert Table 3 here.

Table 4 lists all of the questions from the survey used in this study, along with either their means and standard deviations or the percentage of respondents who fall into the category in question. Some of the responses are used individually while others are combined into factors. The variables used are: age (in years), gender, preferred language (English/French), presence of children in the home, education, income, region (urban/rural), health change dummy (has made changes in previous 12 months to improve health), belief that food and nutrition play a role in health, attitude towards foods in general, nutrition knowledge and the Health Belief Model variables of perceived benefits, barriers, susceptibility, severity, health motivation, and self-efficacy. Correlation between explanatory variables is shown in Table 5.

Insert Table 4 here.

Insert Table 5 here.

To address the stated objective, several stages of analysis are conducted. First, principal component analysis is used to condense multiple statements into single factors. Second, demographic and health belief/attitude factors involved in whether or not individuals self-report that they consume milk and/or yogurt are examined using probit analysis. Third, the non-consumers of milk and/or yogurt are removed from the sample and again using probit analysis, the type of products typically consumed (ie: 1% milk) are

modeled as a function of demographic and health belief/attitude characteristics. Fourth, an ordered probit regression is used to model frequency of milk/yogurt consumption as a function of demographic and health belief/attitude characteristics. Fifth, a multinomial logit model is used to analyze stated preference experiment data from which willingness to pay (WTP) for various product attributes will be calculated (for all respondents whether they currently eat milk or yogurt or not). Sixth, the individual WTP values are regressed on the health belief/attitude characteristics to examine whether some of the attitudes/beliefs may be driving the stated choices made by the individual respondents. As a comparison to Vassallo et al (2009), regressions are undertaken explaining the individual respondent's willingness to use either milk or yogurt with added calcium as a way of increasing the calcium content of their diet.

The data was analyzed using TSP version 5.0 statistical software. The first stage of analysis is to use principal component analysis to combine multiple statements into single factors for the variables composed of more than one item. Factor loadings demonstrate how well the factors represent the actual data, and are considered to be the optimal weights because they account for the variance in the observed variables (Hatcher 2003, pg.6). The first factor is computed as follows:

$$c_1 = b_{11}(x_1) + b_{12}(x_2) + \ldots b_{1p}(x_p) \qquad (1)$$

where

c_1 = the score on principal component 1
b_{1p} = the regression coefficient for observed variable p
x_p = the respondent‟s score on observed variable p

The individual statements from the survey and resulting factors are shown in Table 6.

In order to determine the factors involved in the decision of whether or not to consume milk or yogurt, probit regressions are run. The probit model is one of the

commonly used binary choice models and assumes a standard normal distribution. It is appropriate for modeling the factors involved in a consumer's choice of whether or not to participate in the consumption of a given product. It is important to note that it does not take into account the amount or frequency of consumption, only whether or not they consume it (Verbeek, 2008 pg.201):

$$\Pr(y_i = 1|x_i) = \phi\,(x_i\beta) \qquad (2)$$

where Pr denotes probability that individual *i* consumes the product in question and ϕ is the cumulative distribution function. β represents the parameters estimated by maximum likelihood and x_i represents individual *i*'s characteristics. In this study, Pr is the probability that individual *i* consumes a particular dairy product (milk/yogurt) which is a function of demographic and health attitude and belief variables.

Non-consumers of milk/yogurt are then removed from the sample and probit regressions are run with the dependent variable as the type of product typically purchased (ie: 1% milk) and the independent variables as the demographic characteristics and health attitudes and beliefs to see how they impact individual product choice.

Ordered probit regressions are then used to determine the factors affecting the frequency of total milk/yogurt consumption. An ordered probit is similar to the probit model but is used in situations where the dependent variable is ordinal rather than binary. (Verbeek, 2008 pg.213)

$$y_i^* = x'_i\beta + \varepsilon_i \qquad (3)$$

$$y_i = j \text{ if } \gamma_{j-1} < y_i^* \leq \gamma_j \qquad (4)$$

We observe individual *i*'s choice y_i if their actual y^*, which is a function of their characteristics and a set of parameters, falls within a designated range. This model

assumes a standard normal distribution. In this study, the frequency of milk or yogurt consumption could fall into one of six ranges which would give a y_i of 1 to 6. Therefore the frequency with which individual *i* consumes milk/yogurt is modeled as a function of demographic and health attitude and belief variables.

In order to explore how health attitudes and beliefs affect individual probability of choice of either milk or yogurt with new attributes, a multinomial logit regression is run including interactions between the attributes and demographic characteristics. In a multinomial logit the utility from the n^{th} individual facing a choice among *j* alternatives can be represented as (Verbeek, 2008 pg.221):

$$U_{nj} = \beta'_n V_{nj} + \varepsilon_{nj} \quad (5)$$

where β_n is a vector of parameters and V_{nj} is the systematic, observable portion of the individual's utility function. ε_{nj} is the error term.

The basic model can be written as:

$$V_{nj} = \beta_0(\mathrm{P_j}) + \beta_1(\text{fat content}_\mathrm{j}) + \beta_2(\text{nutrition label}_\mathrm{j}) +$$

$$\beta_3(\text{HealthCheck}^{\mathrm{TM}}{}_\mathrm{j}) + \beta_4(\text{probiotic}_\mathrm{j}) + \beta_5(\text{vitamin-enhanced}_\mathrm{j}) \quad (6)$$

where V_{nj} is the probability that individual *n* will choose alternative *j*, $\mathrm{P_j}$ is the price of alternative *j* and fat content is the % of milk fat in alternative *j*. Nutrition label is a dummy variable equal to one if alternative *j* has the voluntary nutrition label and zero if it has the mandatory nutrition label. Health Check$^{\mathrm{TM}}$ is a dummy variable equal to one if alternative *j* has the Health Check$^{\mathrm{TM}}$ symbol, zero if not. Probiotic and vitamin-enhanced are also dummy variables equal to one if alternative *j* contains probiotics or additional vitamins and zero otherwise.

Using the coefficients from the multinomial logit estimation, WTP for the various attributes can be calculated. According to Alpizar et al (2001), assuming a linear utility function, the marginal rate of substitution between two different attributes is the ratio of the coefficients of the two attributes, so marginal WTP is calculated as follows:

$$MWTP_x = -\beta_x / \beta_p \quad (7)$$

where β_x is the estimated coefficient for attribute *x* and β_p is the estimated price coefficient.

When estimating a regression with interacted variables, the interaction coefficients must also be included in WTP calculations. To incorporate the interacted variables in calculating mean WTPs, the coefficients for all the interactions are first multiplied by the sample means of the characteristic in question to generate a value *v* (ie: *v*(probiotic/age) = β(probiotic/age) x mean age). Next, all of the coefficient times mean values for attribute *x* are summed along with the coefficient for attribute *x* (ie: βprobiotic + *v*(probiotic/age) + *v*(probiotic/gender) + …) to generate an overall coefficient for that attribute (as is done to calculate Hanemann's (1989) grand constant). The negative of the overall attribute coefficient is then divided by the price coefficient to get the mean WTP.

$$\text{Mean } WTP_x = -[\beta_x + \sum_{i=d}^{n} \beta_{xi}(i)] / [\beta_p] \quad (8)$$

where β_{xi} is the estimated coefficient for the interaction between attribute *x* and characteristic *i*, β_x is the estimated coefficient for attribute *x*, β_p is the estimated price coefficient, *x* is the attribute, and *i* is the sample mean of the characteristic. To calculate the individual level WTP, *i* becomes each individual's value for characteristic *i* instead of the sample mean.

Once individual measures of WTP have been calculated, the calculated WTP can be regressed on the health belief and attitude variables using the ordinary least squares (OLS) method to examine how they predict WTP for the various attributes in both milk and yogurt. OLS estimates the constant values of β which result in the best approximation of y given the sample values of x in the linear expression:

$$y = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k \quad (9)$$

where the difference between the actual y and observed y_i is expressed as

$$y_i - (\beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k). \quad (10)$$

OLS achieves the best possible estimations by choosing values for β that minimize this difference. In other words, β is determined to minimize the following objective function:

$$S(\beta) = \sum_{i=1}^{N} (y_i - x_i \beta)^2 \quad (11)$$

In this study, y_i is the individual willingness to pay for the attribute in question, x is the health attitude/belief variable, and β is the estimated coefficient.

In addition, the individual respondent's willingness to use the milk and yogurt with additional calcium as a way of increasing calcium in the diet is also regressed on the same variables based on similar work by Vassallo et al (2009), who used HBM based statements to assess willingness to use functional breads. This analysis uses an ordered probit equation in which willingness to use milk/yogurt (on a scale from 1-5) is regressed on the HBM variables, health changes, food attitudes, and belief that food plays a role in overall health.

Results

Milk and yogurt consumption

In the probit regressions used to model whether or not respondents consume milk and/or yogurt, the estimated coefficients suggest more similarities than differences. The only difference is that men are more likely to consume milk while women are more likely to consume yogurt. Younger individuals, those who have higher belief that they are capable of consuming the recommended amount of dairy products, and those who perceive the benefits of consuming dairy products as higher are more likely to consume both milk and yogurt.

Insert Table 7 here.

Probit regressions are then used to model which milk and yogurt types respondents claim to typically purchase (for those who actually self-report consuming the products). Younger people, individuals whose preferred language is English, people without children in the home, and those with higher education and income are more likely to purchase skim milk. In addition, people with higher perceived pleasantness of milk, those who have more belief in their ability to consume the daily recommended amount of dairy products, and those who perceive the barriers to dairy consumption as lower are more likely to purchase skim milk. People whose preferred language is English, those with lower belief in their ability to consume the daily recommended amount of dairy products, and those who perceive the benefits of dairy consumption as higher are more likely to purchase 1% milk. Older individuals, those with children in the home, people whose preferred language is French and individuals with less education are more likely to purchase 2% milk. In addition, people who perceive the barriers to dairy consumption as higher and the benefits of dairy consumption as lower are more likely to

purchase 2% milk. Individuals with lower income and whose preferred language is French, as well as those with higher nutrition knowledge scores and lower attitude scores are more likely to purchase whole milk. Women, people with higher perceived pleasantness of dairy products, and people with lower nutrition knowledge scores are more likely to purchase low or non-fat yogurt. People whose preferred language is English, who perceive the barriers to dairy consumption as lower, who perceive the benefits to dairy consumption as lower, and those with higher nutrition knowledge scores are more likely to purchase whole-fat yogurt.

Insert Table 8 here.

Insert Table 9 here.

Men, people with children in the home, those with lower incomes, and those not living in urban areas drink milk more frequently. In addition, people with higher belief in their ability to consume the daily recommended amount of dairy products, people with higher perceived benefits and susceptibility, and people who believe they consume an adequate amount of micronutrients drink milk more frequently. Women, people whose preferred language is French, people with children in the home, and people with higher education and incomes eat yogurt more frequently. In addition, people with higher belief in their ability to consume the daily recommended amount of dairy products, people with higher perceived benefits and barriers, and people who believe that their micronutrient intake is adequate consume yogurt more frequently.

Insert Table 10 here.

Demographic and attribute interactions

For complete numerical results from the multinomial regression, please see Table 11. In this section, only coefficients statistically significant at a level of 10% or better are discussed. The estimated price coefficients for both milk and yogurt are negative and significant, indicating that consumers prefer cheaper milk and yogurt. The coefficients for both nutrition information and vitamin enhancement are positive and significant for both milk and yogurt, indicating that these attributes appeal to consumers. The coefficients for the other attributes are not consistently significant for both milk and yogurt.

Younger people are more interested in more comprehensive nutrition facts panels and probiotics in both their milk and yogurt. Younger people also prefer milk with higher fat content. People whose preferred language is French are less interested in vitamin-enhanced milk or yogurt and more interested in milk with a higher fat content. Women are more interested in yogurt with a Health Check^{TM} symbol and less interested in yogurt with a longer nutrition facts panel and have a strong preference for lower fat milk products. People with children in the home prefer yogurt with a higher fat content. People with less education are more interested in longer nutrition facts panels on both milk and yogurt as well as in probiotic yogurt. Individuals with higher incomes are more interested in having a Health Check^{TM} symbol and less interested in a longer nutrition facts panel on both their milk and yogurt. Higher income individuals are also more interested in probiotic milk. People who never purchase milk/yogurt are less interested in all attributes in milk/yogurt.

Mean WTP for attributes in milk and yogurt

After estimating the multinomial logit model, mean values for WTP for the various attributes in milk and yogurt are calculated and shown in Table 12.

Insert Table 12 here.

Based on the mean sample values for WTP, people are WTP approximately $0.22 to avoid fat in milk and $0.58 to avoid fat in yogurt. The WTP value for probiotic milk is negative but not significant, while the WTP for probiotic yogurt is -$0.16, indicating that on average, people want to avoid probiotic yogurt. People are WTP $0.15 for vitamin-enhanced milk and $0.62 for vitamin-enhanced yogurt. People are WTP $0.31 to have milk with a Health Check™ symbol on it and $0.18 for yogurt with a Health Check™ symbol on it. People are willing to pay $0.25 to have a more comprehensive nutrition facts panel on both milk and yogurt.

Effects of health beliefs on WTP for attributes in milk and yogurt

Given the demographic interactions included in the multinomial logit model estimated to explain the probability of choice of milk/yogurt products with different attributes, it is possible to calculate each individual's willingness to pay for the specific milk or yogurt. These series can also be regressed on the various health beliefs and attitudes. People who have higher perceived pleasantness of milk are WTP more for all attributes (vitamin enhancement, probiotic, Health Check™ symbol, additional nutrition information, and higher fat content) associated with milk. People with higher belief in their ability to consume the daily recommended amount of dairy products are WTP less for vitamin enhanced milk and milk with a longer nutrition facts panel. Individuals who perceive the barriers to dairy consumption as higher are WTP less for probiotic milk and

milk with a Health Check™ symbol. People with higher perceived susceptibility are WTP more for vitamin enhanced milk, probiotic milk, milk with additional nutrition information, and milk with lower fat content. Individuals with higher perceived severity are WTP more for vitamin-enhanced milk and milk with lower fat content and less for probiotic milk. People who have higher belief that their micronutrient intake is adequate are WTP less for vitamin enhanced milk, milk with a Health Check™ symbol, and milk with additional nutrition information and are WTP more for milk with higher fat content. People with higher nutrition knowledge scores are WTP more for vitamin-enhanced milk and milk with a lower fat content. People who believe that food plays a role in health are WTP less for probiotic milk and more to have milk with a lower fat content.

Insert Table 13 here.

People who have higher perceived pleasantness of yogurt are WTP more for all attributes (vitamin enhancement, probiotic, Health Check™ symbol, additional nutrition information, and higher fat content). People with higher belief in their ability to consume the daily recommended amount of dairy products are WTP less for vitamin enhanced yogurt and yogurt with additional nutrition information and more for yogurt with a higher fat content. People who perceive the barriers to dairy consumption as higher are WTP less for probiotic yogurt and yogurt with a Health Check™ symbol and more for yogurt with a lower fat content. Individuals with higher perceived susceptibility are WTP more for vitamin-enhanced yogurt, probiotic yogurt, yogurt with a Health Check™ symbol, and yogurt with additional nutrition information. People with higher perceived severity are WTP more for vitamin enhanced yogurt and yogurt with a lower fat content and less for probiotic yogurt and yogurt with additional nutrition information. Individuals who

have more belief that they are consuming and adequate amount of micronutrients are WTP less for vitamin-enhanced yogurt, probiotic yogurt, and yogurt with additional nutrition information. People who perceive the benefits of dairy consumption as higher are WTP more for yogurt with additional nutrition information. Individuals with higher nutrition knowledge scores are WTP more for vitamin-enhanced yogurt and yogurt with a lower fat content. People who believe that food plays a role in health are WTP more for yogurt with lower fat content. Individuals who have higher attitude scores are WTP less for yogurt with a Health Check^{TM} symbol.

Insert Table 14 here.

Compared to the study by Vassallo et al (2009), which examined consumer willingness to try functional bread products, this study found similar results with one notable difference. Both studies found that people with higher perceived pleasantness of the product in question were either WTP more for attributes in it or were more willing to try the product. While the health motivation coefficient is negative in this study and positive in Vassallo et al's (2009) study, the wording of the statements is such that the findings are consistent. This study found that people who don't believe that their micronutrient intake is adequate are WTP more for several attributes in both milk and yogurt while Vassallo et al (2009) found that individuals who feel they need to pay more attention to various health issues were more willing to try functional bread products. The notable difference between the two studies is the effect of self-efficacy on interest in functional food products. This study found that people who have less confidence in their ability to consume the daily recommended amount of dairy products are WTP more for additional nutrition information and vitamin enhancement in both milk and yogurt.

Conversely, Vassallo et al (2009) found that individuals who thought it was easier to purchase functional bread products were more willing to try them.

Willingness to try

Willingness to try milk or yogurt with additional calcium as a way of increasing the calcium content of the diet is regressed on the HBM, attitude, health change, and food's role in health variables in an ordered probit model to compare to Vassallo et al's (2009) study on consumer willingness to try functional breads. Similarly to Vassallo et al (2009), the results from this study suggest that individuals with higher perceived pleasantness of the functional product are more willing to try it. Both studies also found that self-efficacy positively predicts willingness to try. Also similar is that perceived benefits, susceptibility, and severity all positively predicted willingness to try. In addition to the HBM variables, this study found that people who have made changes to improve their health are more willing to try milk with extra calcium while people who believe that food plays a role in health are more willing to try yogurt with extra calcium. Insert Table 15 here.

Discussion

In summary, this study has examined a number of self-reported behaviours and stated preferences for milk and yogurt focusing on whether food attitudes and health beliefs affect these behaviours/preferences. The results describing the impact of the various health attitudes and beliefs on current self-reported consumption and on preferences for attributes in new milks/yogurts are expressed in Tables 15 and 16.

Insert Table 15 here.

Insert Table 16 here.

The results suggest that some elements of the HBM have significant explanatory power for both self-reported behavior and for stated preferences for milks/yogurts with new attributes. Perceived barriers and benefits appear to be more important in explaining self-reported milk and yogurt consumption while perceived susceptibility and severity appear to be more important in explaining stated preferences for new milks/yogurts. Perceived pleasantness is very important in explaining some aspects of self reported milk consumption and all preferences for 'new' milk and yogurt attributes. Health motivation, which is higher if the respondent believes that their micronutrient intake is adequate, has a positive effect on the self-reported frequency of milk and yogurt consumption. Those, however, with a high health motivation score, are WTP less for most of the 'new' attributes in milk and yogurt. Self-efficacy (a person's belief that they can consume the daily recommended amount of dairy products) has positive explanatory power for milk and yogurt consumption but has a negative relationship with WTP for vitamin enhancement and additional nutrition for milk and yogurt. Nutrition knowledge is important in explaining preferences for vitamin enhanced milk and yogurt and stated preferences for lower fat milk and yogurt but positive in explaining self-reported whole fat milk and yogurt self-reported consumption. The more individuals believe that food plays a role in overall health does not significantly predict stated consumption behaviours, but those who do believe that food plays a role in health are WTP to have less fat in their milk and yogurt.

The study began with the observation that milk and yogurt were exhibiting very different trends in the aggregate per capita disappearance figures for Canada. From the results of this study there are significant differences in the levels and types of consumption of milk and yogurt (what percentage don't consume milk or yogurt – what percentage frequently consume milk or yogurt – top category) but not as many differences in the stated preferences individuals have for 'new' milks and yogurt with different attributes. In terms of Health Belief model variables – perceived benefits and self-efficacy have significant explanatory power in consumption of milk and yogurt and in frequency of milk and yogurt consumption. However perceived pleasantness of milk (yogurt) explains WTP for all new attributes of milk and yogurt and willingness to use milk (yogurt) to increase calcium in the diet. Perceived susceptibility (osteoporosis and vitamin deficiency) explains WTP for almost all new attributes of milk and yogurt. Thinking that your micronutrient intake is okay implies a lower WTP for the attributes of vitamin enhancement, a Health Check™ symbol and additional nutrition information on milk and for vitamin enhanced or probiotic yogurt. The differences in the explanatory variables for actual self-reported behavior and for stated choices of new dairy products suggests the need for further study of dairy product consumption, particularly as overall consumption declines and the inadequate intake of certain nutrients associated with dairy products becomes a public health concern.

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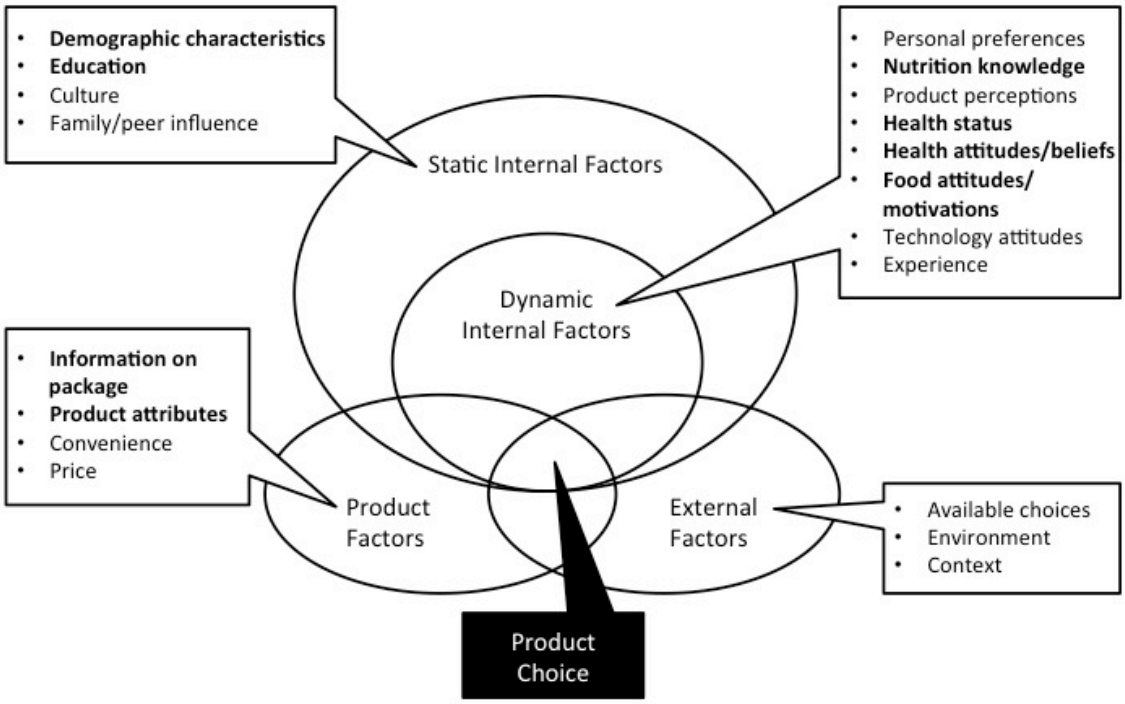
Appendix

Figure 1: Conceptual framework for factors affecting individual choice of food products



Source: Adapted from (1) U.S. Department of Agriculture Dietary Guidelines for Americans 2010, page 56. Accessed May 18, 2012. http://www.cnpp.usda.gov/DGAs2010-PolicyDocument.htm. (2) Sims, L. The Politics of Fat: Food and Nutrition Policy in America, pages 9 & 63. 1998 M.E. Sharpe, Inc. Armonk, New York.

Figure 2: Canadian per capita Consumption of Dairy Products (CDIC 2011)

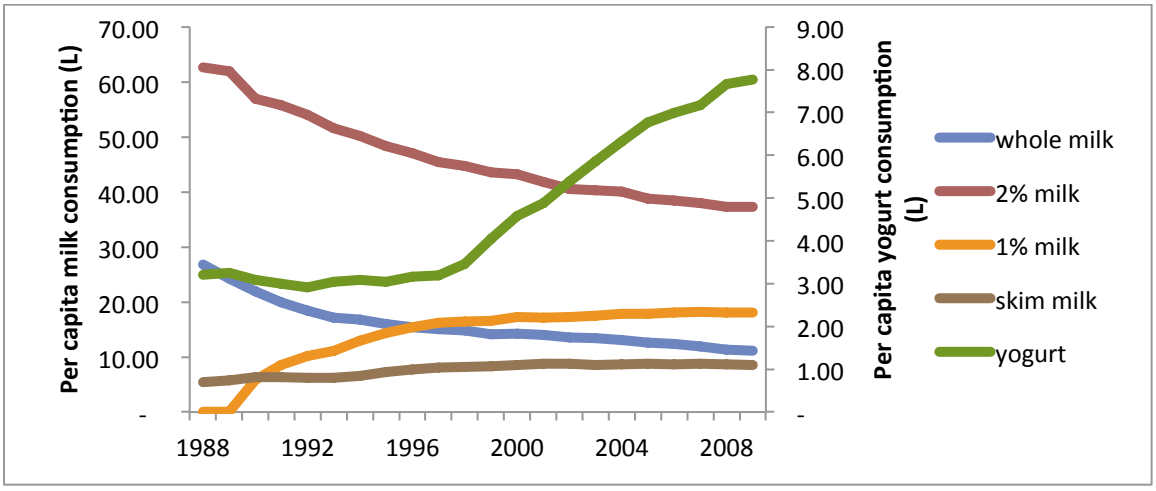
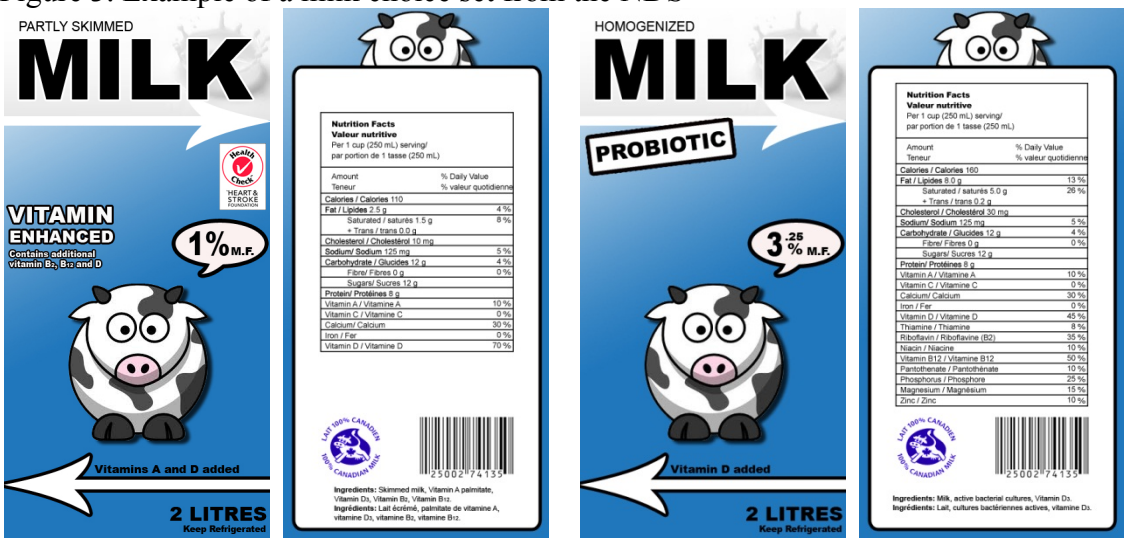


Figure 3. Example of a milk choice set from the NDS



Price: $3.50

A) I would choose this option. ☐

Price: $5.00

B) I would choose this option ☐

C) I would choose neither option. ☐

Figure 4. Example of a yogurt choice set from the NDS

Price: $7.50

A) I would choose this option. ☐

Price: $6.50

B) I would choose this option ☐

C) I would choose neither option. ☐

Table 1: Examples of statements from studies using the HBM to model health behaviours including reliability score (Cronbach's alpha).

Author(s)	Champion 1984	Li and Levy-Milne 2008	Deshpande et al 2009	Kim et al 1991
Topic of study	Breast self-exam behaviours.	Fruit and vegetable consumption.	Healthy eating behaviours.	Calcium intake and osteoporosis risk.
Susceptibility	(Ca=0.78)	(Ca=0.16)		(Ca=0.8)
	My chances of getting breast cancer are great.	I would be more likely to get heart disease if I did not eat fruits and vegetables.	Do you think some day you will get seriousy ill if you do not make good food choices?	You feel your chances of getting osteoporosis in the future are good.
	I feel that my chances of getting breast cancer in the future are good.			There is a good possibility that you will get osteoporosis.
	There is a good possibility that I will get breast cancer.			Your chances of getting osteoporosis are great.
	I worry a lot about getting breast cancer.			
Severity	(Ca=0.78)	(Ca=0.55)	(Ca=0.86)	(Ca=0.65)
	The thought of breast cnacer scares me.	I would be worried if I developed heart disease.	I will have long lasting effects.	The thought of osteoporosis scares you.
	Problems I would experience from breast cancer would last a long time.		I will have medical expenses.	Having osteoporosis would make daily activities more difficult.
			My social relationships will suffer.	Osteoporosis would endanger your marriage (or a significant relationship)
Benefits	(Ca=0.61)	(Ca=0.51)	(Ca=0.84)	(Ca=0.68)
	Doing self breast exams prevents future problems for me.	Fruits and vegetables are good sources of fibre.	For me to eat a nutritious diet most of the time in the next two week period would be harmful/beneficial; unpleasant/pleasant; bad/good; worthless/valuable; unenjoyable/enjoyable.	You would not be so anxious about osteoporosis if you ate calcium rich foods.
	I have a lot to gain by doing self breast exams.			Eating calcium rich foods reduces risks of broken bones
	Self breast exams can help me find lumps in my breast.			Eating calcium rich foods prevents future problems from osteoporosis.

Barriers	(Ca=0.76)	(Ca=0.72)	(Ca=0.79)	(Ca=0.73)
	In order to do monthly breast exams I have to give up quite a bit.	It is expensive to eat fruits and vegetables.	I don't like the taste of most foods that are high in nutrition.	Eating calcium rich foods requires changing your dieatry habits which is difficult.
	Self breast exams can be painful.		I think it would take too much time to change my diet to include more foods high in nutrition.	Calcium rich foods do not agree with you.
	Self breast exams are time consuming.		I think it would be too hard to change my diet to include more foods high in nutrition.	Calcium rich foods are too expensive.
	The practice of self breast exams interferes with my activities.			You dislike calcium rich foods.
Self-efficacy			(Ca=0.88)	
		I am confident that I could eat the recommened five servings of fruits and vegetables each day.	If I tried, I am confident that I could maintain a diet high in nutrition most of the time.	
			If I wanted to, I feel that I would be able to follow a diet high in nutrition most of the time.	

Table 2: Examples of statements and subscales used in studies to assess respondent attitudes towards food or eating.

Author(s)	Hawks et al (2012)	Rozin et al (1999)	Fotopoulos et al (2009)	Roininen et al (2001)
Topic of study	Motivation for eating scale.	Perceptions and attitudes about food and diet.	Food choice questionnaire.	Health and taste attitude scales.
Subscales (Cronbach's alpha)	emotional eating (0.95)	low cholesterol (0.82)	health (0.77)	general health interest (0.87)
	environmental eating (0.80)	low salt (0.80)	mood (0.74)	light product interest (0.78)
	physical eating (0.86)	low fat (0.59)	convenience (0.74)	natural product interest (0.76)
	social eating (0.75)		sensory appeal (0.67)	craving for sweet foods (0.84)
			natural content (0.78)	using food as a reward (0.74)
			price (0.77)	pleasure (0.63)
			weight control (0.82)	
			familiarity (0.61)	
			ethical concern (0.30)	
Number of	43	25	36	38

items				
Example statements	The situations or conditions that most often exist when I choose to eat are when I:	How often do you:	It is important to me that the food I eat on a typical day:	
	Have tempting food in front of me.	Eat low-cholesterol foods.	Contains a lot of vitamins and minerals.	In my opinion it is strange that some people have cravings for chocolate.
	Need physical energy.	Eat reduced salt products.	Keeps me healthy.	I indulge myself by buying something really delicious.
	See advertisements for food.	Eat low fat foods.	Keeps me awake/alert	The appearance of food makes no difference to me.
	Want to sit back and enjoy some food.	On a scale of 1-4, how much of an effect do you believe diet has on the following? (heart disease, obesity, good health, cancer)	Is easily available in shops and supermarkets.	I do not care about additives in my daily diet.
			Tastes good.	
			Contains no artificial ingredients.	

Table 3: Experimental Design for Choice Experiment

Price (milk)	Price (yogurt)	Fat content	Nutrition label	Health Check™	Probiotic	Vitamin enhanced
$3.50	$4.50	0% (skim)	Mandatory	No	No	No
$4.00	$5.50	1%	Voluntary	Yes	Yes	Yes
$4.50	$6.50	2%				
$5.00	$7.50	3.25% (whole)				

Table 4: Descriptive statistics of data used in this study.

Variable	Mean	(St Dev)
Demographic characteristics:		
age (years)	50.19	(14.28)
gender (dummy)	50%	
language (dummy)	21%	
education (years)	14.28	(2.37)
income (in thousands)	63.49	(37.54)
children (dummy)	26%	
urban (dummy)	85%	
Dairy consumption:		
never drink milk	10%	
never eat yogurt	15%	
total milk (1-6)	3.87	(1.44)
total yogurt (1-6)	3.31	(1.30)
% who typically purchase:		
skim milk	16%	
1% milk	29%	
2% milk	45%	
whole milk	8%	
low/non-fat yogurt	71%	
full-fat yogurt	10%	
Health attitudes and beliefs (1-5):		
I have made changes in the past 12 months to improve my health. (dummy)	61%	
Nutrition knowledge score (out of 40)	30.20	(4.23)
To what extent do you think food and nutrition play a role in health?	3.82	(0.51)
I am confident that I could eat the recommended amount of dairy products every day.	3.70	(0.96)
Would you agree or disagree that the following are benefits from consuming dairy products?		
Higher likelihood of consuming an adequate amount of minerals, including calcium.	3.89	(0.77)
Higher likelihood of consuming an adequate amount of B vitamins.	3.61	(0.78)
Higher likelihood of consuming an adequate amount of D vitamins.	3.79	(0.80)
I will have improved bone health and be less likely to get osteoporosis.	3.94	(0.82)
My body will burn more fat.	3.15	(0.89)
My digestive system will contain more ‘good bacteria’.	3.64	(0.80)
My diet will contain more ‘good fats’.	3.53	(0.83)
Would you agree or disagree that the following are barriers to consuming dairy products?		
Availability.	2.72	(1.14)
Do you agree or disagree with the following statements?		
I believe that I am at risk to develop osteoporosis.	2.82	(1.13)
I believe that I am at risk to develop a vitamin deficiency.	2.63	(1.06)
I would be worried if I developed osteoporosis.	3.96	(0.88)
I would be concerned if I had a B-vitamin deficiency.	3.73	(0.89)
I would be worried if I had a D-vitamin deficiency.	3.76	(0.88)
Some foods contain active components that reduce risk of diseases and improve long term health.	3.81	(0.73)
Some foods contain active components that help with current health.	3.89	(0.71)
How likely would you be to try the following products?		
Milk with extra calcium.	3.67	(1.15)
Yogurt or cheese with extra calcium.	3.70	(1.13)

Table 5: Correlation between explanatory variables (**significant**).

	TYOG	SE	BAR	SUS	SEV	HM	BEN	NK	FRIH	ATT	TMILK
TYOG	1										
SE	**0.21**	1									
BAR	0.01	-0.03	1								
SUS	0.02	**-0.08**	**0.04**	1							
SEV	-0.02	**-0.1**	0	**0.4**	1						
HM	**0.18**	**0.29**	0.03	**0.08**	0	1					
BEN	-0.01	**-0.08**	0	**0.3**	**0.33**	**0.07**	1				
NK	**0.13**	**0.22**	**-0.15**	**0.06**	-0.03	**0.34**	-0.03	1			
FRIH	**0.1**	**0.12**	**-0.11**	**-0.05**	**-0.2**	**0.1**	**-0.19**	**0.32**	1		
ATT	-0.01	**-0.06**	0	**0.22**	**0.41**	-0.03	**0.39**	-0.02	**-0.23**	1	
TMILK	**0.16**	**0.3**	0	**-0.12**	**-0.05**	**0.12**	**-0.07**	**0.04**	0.01	**-0.02**	1

Table 6: Factor names, their reliability scores, their comprising statements, and the factor loadings of each statement.

Variable	Statement	Factor Loading			Cronbach's alpha
Benefits	Would you agree or disagree that the following are benefits from consuming dairy products?				0.89
	Higher likelihood of consuming an adequate amount of minerals, including calcium.	0.82	0.34	0.12	
	Higher likelihood of consuming an adequate amount of B vitamins.	0.81	0.04	-0.43	
	Higher likelihood of consuming an adequate amount of D vitamins.	0.82	0.25	-0.28	
	I will have improved bone health and be less likely to get osteoporosis.	0.80	0.37	0.21	
	My body will burn more fat.	0.64	-0.65	-0.14	
	My digestive system will contain more 'good bacteria'.	0.8	-0.17	0.30	
	My diet will contain more 'good fats'.	0.76	-0.34	0.20	
Susceptibility	Do you agree or disagree with the following statements?				0.69
	I would be more likely to get osteoporosis if I did not eat enough dairy products.	0.78		0.43	
	I believe that I am at risk to develop osteoporosis.	0.72		-0.50	
	Not consuming enough dairy products may be harmful to my health.	0.71		0.56	
	I believe that I am at risk to develop a vitamin deficiency.	0.68		-0.55	
Severity	Do you agree or disagree with the following statements?				0.85
	I would be worried if I developed osteoporosis.	0.82		0.13	
	I would be concerned if I had a B-vitamin deficiency.	0.86		-0.31	
	I would be worried if I had a D-vitamin deficiency.	0.86		-0.32	
	Osteoporosis is a health concern for Canadians.	0.78		0.56	
Attitude	Do you agree or disagree with the following statements?				0.45
	Some foods contain active components that reduce risk of diseases and improve long term health.	0.87	0.21	0.17	
	Some foods contain active components that help with current health, such as improving digestion.	0.87	0.20	0.18	
	Foods cannot be used to reduce the use of medications or other medical treatments.	-0.25	0.45	0.79	
	Foods enriched with active components that reduce risk of diseases and improve long term health are just as effective as pills and supplements containing the same compound.	0.51	0.37	-0.41	
	It is not important to eat foods that are fortified or enriched with added vitamins or minerals.	-0.31	0.77	-0.15	
	It is not important to take vitamin and/or nutritional supplements daily.	-0.26	0.77	-0.20	

Table 7: Probit regression estimations for whether or not respondents consume milk or yogurt.

	milk		yog	
Parameter	Coef.	(SE)	Coef.	(SE)
Constant	1.814***	(0.604)	-0.917	(0.559)
Female	-0.166*	(0.094)	0.407***	(0.087)
French	0.058	(0.111)	0.147	(0.101)
Age	-0.010***	(0.003)	-0.010***	(0.003)
Children in the home	0.095	(0.115)	0.003	(0.103)
Education	-0.009	(0.019)	0.071***	(0.019)
Income	0.000	(0.001)	0.001	(0.001)
Urban	0.029	(0.118)	0.106	(0.107)
Self-efficacy	0.179***	(0.047)	0.187***	(0.045)
Perceived barrier	-0.098**	(0.040)	-0.022	(0.038)
Perceived susceptibility	0.184***	(0.054)	-0.069	(0.053)
Perceived severity	-0.042	(0.057)	0.045	(0.055)
Health motivation	0.044	(0.072)	0.056	(0.067)
Perceived benefits	0.150***	(0.051)	0.132***	(0.048)
Nutrition Knowledge	-0.014	(0.013)	0.001	(0.013)
Food's role in health	0.016	(0.069)	0.077	(0.059)
Attitude	-0.053	(0.054)	0.006	(0.052)
N	1705		1705	
Scaled R squared	0.051		0.072	
Fraction of correct predictions	0.899		0.854	

Table 8: Probit regression estimates for milk type typically purchased.

	Skim		1.00%		2.00%		whole	
Parameter	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)
Constant	-1.886***	(0.605)	-0.216	(0.518)	0.253	(0.487)	-1.895***	(0.703)
Female	0.085	(0.087)	-0.031	(0.076)	0.050	(0.072)	-0.181*	(0.107)
French	-0.611***	(0.118)	-0.327***	(0.090)	0.434***	(0.082)	0.264**	(0.111)
Age	-0.005*	(0.003)	0.000	(0.003)	0.005*	(0.003)	-0.001	(0.004)
Children in the home	-0.381***	(0.102)	-0.017	(0.085)	0.172**	(0.082)	0.193	(0.120)
Education	0.042**	(0.018)	0.013	(0.015)	-0.031**	(0.015)	-0.001	(0.022)
Income	0.002*	(0.001)	0.001	(0.001)	-0.001	(0.001)	-0.003**	(0.001)
Urban	0.049	(0.113)	0.095	(0.100)	-0.029	(0.093)	-0.191	(0.130)
Perceived pleasantness	0.111***	(0.039)	-0.015	(0.033)	-0.055*	(0.031)	0.016	(0.046)
Self-efficacy	0.139***	(0.051)	-0.085**	(0.042)	0.012	(0.041)	-0.069	(0.057)
Perceived barrier	-0.104***	(0.037)	-0.028	(0.032)	0.105***	(0.031)	-0.045	(0.045)
Perceived susceptibility	-0.041	(0.055)	0.059	(0.047)	-0.033	(0.044)	-0.010	(0.065)
Perceived severity	0.057	(0.059)	-0.031	(0.050)	0.024	(0.048)	-0.056	(0.067)
Health motivation	-0.047	(0.068)	-0.085	(0.058)	0.057	(0.056)	0.077	(0.083)
Perceived benefits	0.024	(0.057)	0.099**	(0.049)	-0.089**	(0.045)	0.032	(0.063)
Nutrition Knowledge	-0.015	(0.012)	0.001	(0.011)	-0.006	(0.010)	0.029*	(0.015)
Food's role in health	0.116	(0.083)	0.028	(0.062)	-0.089	(0.058)	0.009	(0.081)
Attitude	-0.055	(0.053)	0.009	(0.047)	0.069	(0.044)	-0.128**	(0.062)
N	1526		1526		1526		1526	
Scaled R squared	0.063		0.023		0.048		0.021	
Fraction of correct predictions	0.830		0.711		0.601		0.921	

Table 9: Probit regression estimates for yogurt type typically purchased.

	Non/low-fat		whole fat	
Parameter	Coef.	(SE)	Coef.	(SE)
Constant	-0.319	(0.539)	-1.800***	(0.634)
Female	0.140*	(0.079)	-0.029	(0.101)
French	0.006	(0.089)	-0.372***	(0.130)
Age	0.001	(0.003)	-0.006	(0.004)
Children in the home	-0.118	(0.090)	0.073	(0.109)
Education	-0.025	(0.016)	-0.004	(0.020)
Income	0.002	(0.001)	0.001	(0.001)
Urban	0.084	(0.104)	0.013	(0.128)
Perceived pleasantness	0.106***	(0.039)	-0.051	(0.049)
Self-efficacy	0.007	(0.043)	0.051	(0.053)
Perceived barrier	0.027	(0.033)	-0.095**	(0.041)
Perceived susceptibility	-0.034	(0.047)	-0.027	(0.058)
Perceived severity	0.039	(0.051)	-0.002	(0.061)
Health motivation	0.022	(0.061)	0.009	(0.076)
Perceived benefits	0.045	(0.048)	-0.114*	(0.058)
Nutrition Knowledge	-0.039***	(0.011)	0.042***	(0.013)
Food's role in health	0.098	(0.069)	-0.050	(0.082)
Attitude	0.072	(0.047)	-0.010	(0.058)
N	1455		1455	
Scaled R squared	0.025		0.031	
Fraction of correct predictions	0.726		0.891	

Table 10: Ordered probit regression estimates for frequency of milk and yogurt consumption.

	milk		yogurt	
Parameter	Coef.	(SE)	Coef.	(SE)
Constant	0.326	(0.398)	-1.012**	(0.413)
Female	-0.197***	(0.060)	0.176***	(0.062)
French	0.055	(0.068)	0.177**	(0.070)
Age	-0.003	(0.002)	0.004	(0.002)
Children in the home	0.170**	(0.068)	0.116*	(0.070)
Education	0.015	(0.012)	0.026**	(0.013)
Income	-0.002**	(0.001)	0.002**	(0.001)
Urban	-0.170**	(0.078)	-0.026	(0.081)
Self-efficacy	0.306***	(0.033)	0.103***	(0.033)
Perceived barrier	-0.014	(0.026)	0.047*	(0.026)
Perceived susceptibility	0.081**	(0.037)	-0.011	(0.037)
Perceived severity	-0.065	(0.040)	-0.020	(0.039)
Health motivation	0.095**	(0.047)	0.184***	(0.047)
Perceived benefits	0.169***	(0.037)	0.083**	(0.038)
Nutrition Knowledge	-0.002	(0.008)	0.004	(0.008)
Food's role in health	-0.042	(0.048)	0.014	(0.052)
Attitude	-0.060	(0.037)	0.006	(0.037)
MU4	0.550***	(0.037)	0.760***	(0.038)
MU5	1.489***	(0.049)	2.096***	(0.053)
MU6	2.762***	(0.063)	3.333***	(0.091)
N	1526		1455	
Scaled R squared	0.129		0.067	

Table 11: Parameter estimations from multinomial logit regressions.

Parameter	Coefficient	(SE)	Coefficient	(SE)
Price	-0.769***	(0.031)	-0.492***	(0.018)
Neither	-3.764***	(0.138)	-3.325***	(0.118)
Fat content	-2.295	(13.279)	-25.713*	(13.625)
Vitamin enhanced	0.782**	(0.337)	0.689**	(0.347)
Health CheckTM	0.389	(0.334)	-0.011	(0.355)
Nutrition info	1.240***	(0.270)	1.420***	(0.284)
Probiotic	0.264	(0.336)	0.730**	(0.347)
Age*viten	-0.001	(0.003)	-0.001	(0.003)
Age*HC	-0.001	(0.003)	-0.002	(0.003)
Age*ninfo	-0.005**	(0.002)	-0.006**	(0.002)
Age*probio	-0.009***	(0.003)	-0.006*	(0.003)
Age*fatcon	-0.320***	(0.111)	-0.112	(0.113)
French*viten	-0.241***	(0.088)	-0.221**	(0.090)
French*HC	-0.123	(0.087)	0.146	(0.092)
French*ninfo	-0.108	(0.070)	0.022	(0.074)
French*probio	-0.108	(0.087)	-0.054	(0.090)
French*fatcon	12.701***	(3.477)	4.964	(3.590)
Female*viten	0.099	(0.076)	0.081	(0.078)
Female*HC	0.054	(0.075)	0.168**	(0.080)
Female*ninfo	0.043	(0.061)	-0.108*	(0.064)
Female*probio	0.099	(0.075)	0.010	(0.078)
Female*fatcon	-13.344***	(3.029)	-3.297	(3.117)
Kids*viten	-0.087	(0.089)	-0.039	(0.091)
Kids*HC	-0.021	(0.088)	-0.049	(0.093)
Kids*ninfo	-0.030	(0.071)	-0.034	(0.074)
Kids*probio	0.077	(0.088)	0.009	(0.090)
Kids*fatcon	2.084	(3.559)	8.458**	(3.611)
Education*viten	-0.031	(0.021)	-0.014	(0.021)
Education*HC	-0.020	(0.021)	-0.001	(0.022)
Education*ninfo	-0.042***	(0.017)	-0.052***	(0.017)
Education*probio	0.002	(0.021)	-0.038*	(0.021)
Education*fatcon	0.600	(0.819)	0.293	(0.837)
Urban*viten	-0.036	(0.077)	0.010	(0.078)
Urban*HC	0.041	(0.075)	0.035	(0.080)
Urban*ninfo	-0.080	(0.061)	-0.040	(0.064)
Urban*probio	-0.110	(0.076)	-0.010	(0.078)
Urban*fatcon	-2.427	(3.056)	-1.331	(3.115)
Income*viten	-0.002	(0.001)	0.000	(0.000)
Income*HC	0.003***	(0.001)	0.000***	(0.000)

Income*ninfo	-0.002**	(0.001)	-0.000*	(0.000)
Income*probio	0.002*	(0.001)	0.000	(0.000)
Income*fatcon	-0.025	(0.044)	0.000	(0.000)
Never*viten	-0.282**	(0.119)	-0.304***	(0.113)
Never*HC	-0.425***	(0.117)	-0.615***	(0.117)
Never*ninfo	-0.375***	(0.100)	-0.422***	(0.099)
Never*probio	-0.092	(0.116)	-0.432***	(0.113)
Never*fatcon	-5.034	(4.668)	-23.186***	(4.461)

Table 12: Mean WTP and standard error values for attributes in milk and yogurt.

Attribute	Milk - WTP (in $CAD)	Milk - SE	Yogurt - WTP (in $CAD)	Yogurt - SE
Fat content	-0.22**	0.024	-0.58***	0.040
Probiotic	-0.08	0.064	-0.16**	0.079
Vitamin Enhanced	0.15***	0.051	0.62***	0.081
Health Check™	0.31***	0.052	0.18**	0.085
Nutrition Panel	0.25***	0.039	0.25***	0.065

Table 13: OLS estimations for effects of health attitudes/beliefs on WTP for attributes in milk.

	Vitamin enhanced	Health Check™	Nutrition info	Probiotic	Fat content
Constant	0.002	0.095	0.122*	0.015	-0.148***
	(0.065)	(0.060)	(0.068)	(0.071)	(0.035)
Perceived Pleasantness	0.047***	0.079***	0.073***	0.010**	0.020***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)
Self-efficacy	-0.031***	-0.005	-0.036***	-0.009	0.005
	(0.006)	(0.006)	(0.006)	(0.007)	(0.003)
Perceived barrier	0.002	-0.013***	0.002	-0.018***	0.002
	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)
Perceived susceptibility	0.027***	0.009	0.040***	0.035***	-0.007**
	(0.007)	(0.006)	(0.007)	(0.007)	(0.004)
Perceived severity	0.015**	-0.002	-0.005	-0.015**	-0.022***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.004)
Health Motivation	-0.034***	-0.018**	-0.025***	0.006	0.010**
	(0.009)	(0.008)	(0.009)	(0.010)	(0.005)
Perceived benefits	0.001	-0.001	0.009	-0.006	0.003
	(0.007)	(0.006)	(0.007)	(0.007)	(0.004)
Nutrition knowledge	0.005***	0.000	0.002	0.000	-0.005***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Food's role in health	0.011	0.004	-0.001	-0.022**	-0.017***
	(0.009)	(0.008)	(0.009)	(0.010)	(0.005)
Attitude	0.003	0.006	-0.005	0.008	0.002
	(0.007)	(0.006)	(0.007)	(0.007)	(0.004)
R-squared	0.135	0.254	0.211	0.027	0.150

Table 14: OLS estimations for effects of health attitudes/beliefs on WTP for attributes in yogurt.

	Vitamin enhanced	Health Check™	Nutrition info	Probiotic	Fat content
Constant	0.270***	-0.656***	0.069	-0.477***	-0.797***
	(0.086)	(0.124)	(0.110)	(0.094)	(0.046)
Perceived Pleasantness	0.117***	0.280***	0.154***	0.178***	0.101***
	(0.005)	(0.008)	(0.007)	(0.006)	(0.003)
Self-efficacy	-0.029***	-0.001	-0.019*	-0.009	0.007*
	(0.008)	(0.012)	(0.010)	(0.009)	(0.004)
Perceived barrier	-0.003	-0.033***	0.006	-0.016**	-0.007**
	(0.006)	(0.009)	(0.008)	(0.007)	(0.003)
Perceived susceptibility	0.026***	0.035***	0.032***	0.037***	0.005
	(0.009)	(0.013)	(0.011)	(0.010)	(0.005)
Perceived severity	0.029***	0.001	-0.036***	-0.023**	-0.011**
	(0.010)	(0.014)	(0.012)	(0.010)	(0.005)
Health Motivation	-0.044***	-0.005	-0.030**	-0.027**	0.004
	(0.012)	(0.017)	(0.015)	(0.013)	(0.006)
Perceived benefits	-0.006	0.005	0.030***	0.013	0.002
	(0.009)	(0.013)	(0.011)	(0.010)	(0.005)
Nutrition knowledge	0.007***	-0.002	-0.004	-0.002	-0.003***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.001)
Food's role in health	0.011	0.019	-0.013	-0.010	-0.012*
	(0.012)	(0.017)	(0.015)	(0.013)	(0.006)
Attitude	0.008	-0.027**	-0.010	-0.002	-0.003
	(0.009)	(0.013)	(0.011)	(0.010)	(0.005)
R-squared	0.254	0.447	0.237	0.354	0.427

Table 15: Ordered probit regression estimates for willingness to try milk/yogurt with extra calcium as a way of increasing the calcium content of their diet

	milk		yogurt	
Parameter	Coefficient	(SE)	Coefficient	(SE)
Constant	0.754***	(0.268)	0.451*	(0.264)
Health Change	0.093*	(0.055)	0.047	(0.055)
Perceived pleasantness	0.195***	(0.020)	0.249***	(0.022)
Self-efficacy	0.075**	(0.032)	0.050	(0.031)
Perceived barrier	-0.031	(0.025)	-0.070***	(0.025)
Health motivation	-0.016	(0.045)	-0.003	(0.045)
Perceived benefits	0.326***	(0.034)	0.289***	(0.034)
Perceived susceptibility	0.140***	(0.035)	0.159***	(0.034)
Perceived severity	0.212***	(0.035)	0.180***	(0.035)
Attitude	0.041	(0.026)	0.013	(0.026)
Food's role in health	-0.007	(0.044)	0.107**	(0.044)
MU3	0.354***	(0.035)	0.323***	(0.034)
MU4	1.214***	(0.050)	1.149***	(0.050)
MU5	2.546***	(0.061)	2.539***	(0.061)
N	1705		1705	
Scaled R squared	0.306		0.299	

Table 16: Effects of health attitude and belief variables on self-reported milk and yogurt consumption.

Variable	Consume Milk	Consume Yogurt	Skim Milk	1% milk	2% milk	Whole milk	Low Fat yogurt	Whole fat yogurt	Frequency Milk	Frequency Yogurt
Nutrition Knowledge						+ve	-ve	+ve		
Health Status										
Health Belief Model										
Perceived pleasantness			+ve		-ve		+ve			
Perceived susceptibility	+ve								+ve	
Perceived Seriousness										
Perceived benefits	+ve	+ve		+ve	-ve			-ve	+ve	+ve
Perceived barriers	-ve		-ve		+ve			-ve		+ve
Self Efficacy	+ve	+ve	+ve	-ve					+ve	+ve
Health motivation									+ve	+ve
Attitude						-ve				
Food's role in health										

Table 17: Effects of health attitude and belief variables on WTP for attributes in milk and yogurt.

Variable	Wtp Vit. enhan. Milk	Wtp Health Check™ milk	Wtp N.info milk	Wtp Prob. milk	WTP Fat in milk	Wtp Vit. enhan. yogurt	Wtp Health Check™ yogurt	Wtp N. info yogurt	Wtp Prob. yogurt	Wtp Fat In yogurt
Nutrition Knowledge	+ve				-ve	+ve				-ve
Health Status										
Health Belief Model										
Perceived pleasantness	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
Perceived susceptibility	+ve		+ve	+ve	-ve	+ve	+ve	+ve	+ve	
Perceived Severity	+ve			-ve	-ve	+ve		-ve	-ve	-ve
Perceived benefits								+ve		
Perceived barriers		-ve		-ve			-ve		-ve	-ve
Self Efficacy	-ve		-ve			-ve		-ve		+ve
Health motivation	-ve	-ve	-ve		+ve	-ve		-ve	-ve	
Attitude							-ve			
Food's role in health				-ve	-ve					-ve