Do Health Beliefs or Food Technology Neophobia Affect Canadian Consumer Interest in Purchasing Health Enhanced Dairy Products?

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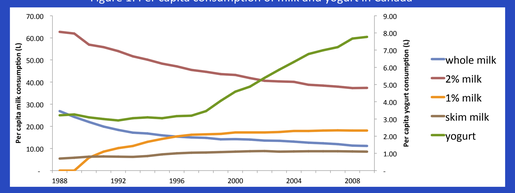
Background: In the past 20 years, the dairy market in North America has not experienced the kind of growth which has characterized most other sectors in the agri-food business. In Canada, the consumption of some products, such as cheese, has remained constant, while other products, such as butter and ice cream, have shown a decline in per capita consumption(1). Despite some increases in the consumption of skim and 1% milk, total milk consumption has declined. The only dairy product in Canada to have a striking increase in per capita consumption since 1996 is yogurt. This trend has also been noted in the US and some European countries(2). Given the decline in overall dairy consumption, it is not surprising that many Canadians do not consume adequate amounts of milk and alternatives in their diet, which are the main source of calcium and vitamins D, B_2, and B_{12} in the Canadian diet. These changes in consumption over time could be impacting the overall health of the Canadian population, and could be a result of many factors, including demographic characteristics, health beliefs, and attitudes towards food technologies.

Figure 1: Per capita consumption of milk and yogurt in Canada



Objectives:

1) To determine who consumes milk and yogurt; whether or not they are the same people, what their general demographic and health characteristics are, and their preferences for modifications to dairy products in the form of nutrient enhancement or nutritional accreditation.
2) To examine whether health beliefs or food technology neophobia are significant contributing factors to milk or yogurt intake.

Methods:

1) Analysis of self-reported intake of specialty milk and yogurt products to determine the role that demographic factors, health beliefs, and food technology attitudes play in product choice.
2) Stated preference experiments are used to evaluate whether new milk or yogurt products could change preferences for dairy products and how health beliefs and attitudes towards food technologies play a role in those preferences.

Health Belief Model(3) (HBM)

- Developed in 1966 by Irwin Rosenstock to understand why some individuals make use of health services while others do not.
- The construct is based on the following aspects of health: perceived susceptibility, perceived seriousness, perceived benefits, perceived barriers, and self-efficacy.
- Several studies (4,5,6,7) have used the HBM to predict eating behaviour since there is a direct link between diet and health outcomes.

Food Technology Neophobia Scale(8) (FTNS)

- The FTNS, which was loosely based on the Food Neophobia Scale(9), was developed in 2008 by Cox and Evans to evaluate consumers' fears of novel technologies used in food production.
- Because many functional foods retain their familiar appearance but are produced with novel technologies, the FTNS may be a good predictor of the acceptance of functional foods.

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Data:

- An original national Canadian dairy survey was administered in January 2011.
- The survey collected self-reported milk and yogurt intake along with demographic information, the Health Belief Model (HBM) questions and the Food Technology Neophobia Scale (FTNS).
- Of the 1705 respondents, 41 didn't eat dairy at all while 179 claimed to never drink milk and 250 claimed to never eat yogurt, 52 of which were the same people.

Analysis:

- Probit regressions explain whether or not respondents typically purchase specialty yogurt or milk products (eg: probiotic)
- Multinomial logit model is used to estimate willingness to pay (WTP) for specific milk and yogurt attributes (more nutritional information, Health Check™ logo, probiotic, etc). WTP measures are regressed on individual's health beliefs and FTNS values to identify any relationship.

Probit: $P\{y_i = 1|x_i\} = F(x_i, \beta)$
The probability that individual i consumes the product in question (eg: 1% milk) as a function of their characteristics and a set of parameters.

Multinomial Logit Model: Utility from the n^{th} individual facing a choice among j alternatives can be represented as: $U_{nj} = \beta'_n X_{nj} + \varepsilon_{nj}$
Where β_n is a vector of parameters and X_{nj} is a vector of explanatory variables.

Table 1: Descriptive statistics expressed as either a percentage or a mean (standard deviation)

Demographics		**Typically purchases product in question**	
French is preferred language	21%	Fortified yogurt	24%
Female	50%	Organic yogurt	10%
Children under 18 in the home	26%	Probiotic yogurt	33%
Urban	85%	Fortified milk	10%
Age - years	50 (14.28)	Organic milk	6%
Education - years	14 (2.37)		
Household income - in thousands	63 (37.54)	Never drinks milk	10%
Has made changes to improve health in previous 12 months	61%	Never eats yogurt	15%
FTNS (13 = min, 65 = max)			
Aggregate score	42.4 (6.21)		
HBM			
Perceived pleasantness of milk (1-6)	3.9 (1.44)	Self-efficacy (1-5)	3.7 (0.96)
Perceived pleasantness of yogurt (1-6)	3.3 (1.30)	Perceived Barrier (1-5)	2.7 (1.14)
		Individual Statements (1-5)	
Health motivation (1-5) (mean of responses to 4 statements)	3.6 (0.67)	Do you agree or disagree with the following statements?	
		The vitamin B_2 content is appropriate for my health.	3.5 (0.75)
		The vitamin B_{12} content is appropriate for my health.	3.6 (0.77)
		The vitamin D content is appropriate for my health.	3.7 (0.82)
		The calcium content is appropriate for my health.	3.8 (0.79)
Factors			
Perceived benefits		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.	3.9 (0.77)
		Higher likelihood of consuming an adequate amount of B vitamins.	3.6 (0.78)
		Higher likelihood of consuming an adequate amount of D vitamins.	3.8 (0.80)
		I will have improved bone health and be less likely to get osteoporosis.	3.9 (0.82)
		My body will burn more fat.	3.2 (0.89)
		My digestive system will contain more 'good bacteria'.	3.6 (0.80)
		My diet will contain more 'good fats'.	3.5 (0.83)
Perceived susceptibility		Do you agree or disagree with the following statements?	
		I would be more likely to get osteoporosis if I did not eat enough dairy products.	3.5 (0.95)
		I believe that I am at risk to develop osteoporosis.	2.8 (1.13)
		Not consuming enough dairy products may be harmful to my health.	3.6 (0.93)
		I believe that I am at risk to develop a vitamin deficiency.	2.6 (1.06)
Perceived severity		Do you agree or disagree with the following statements?	
		I would be worried if I developed osteoporosis.	4.0 (0.88)
		I would be concerned if I had a B-vitamin deficiency.	3.7 (0.89)
		I would be worried if I had a D-vitamin deficiency.	3.8 (0.88)
		Osteoporosis is a health concern for Canadians.	3.8 (0.81)

Table 2: Experimental design and attribute levels for stated preference experiments. Prices are for a 2L carton of milk (average retail price: $3.50) or an 8 x 100g package of yogurt (average retail price: $5.50). Note: In Canada, nutrition facts panels are required to list the amount of the following micronutrients: calcium, iron, vitamin A , and vitamin C. In this experiment, the mandatory nutrition label listed only the required micronutrients while the voluntary nutrition label listed the amounts of other micronutrients in addition to the required ones.

Price (milk)	Price (yogurt)	Fat Content	Nutrition Panel	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)				

Figure 2: Distribution of FTNS scores
(Higher score indicates more concern with novel food technologies.)

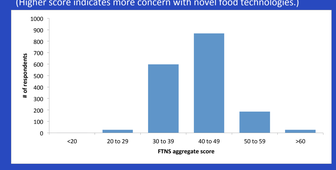

Figure 3: Example of milk and yogurt choice sets from stated preference experiments.

Results: The marginal effects from the specialty dairy product probit regression are shown in Table 3. The WTP measures from the choice experiment are shown in Table 4. The distributions of WTP are shown in Figures 4 and 5. The regression coefficients of WTP on FTNS and HBM variables are shown in Tables 5 and 6.

Table 3: Marginal effects and standard errors from probit regressions of purchase of specialty milk and yogurt products on demographic, FTNS, and HBM variables

	probiotic yogurt	fortified yogurt	organic yogurt	fortified milk	organic milk
Constant	-1.067***	-1.188***	-3.865***	-3.162***	-4.313***
Female	0.204***	0.079	-0.091	0.070	-0.036
French	-0.133	-0.152*	0.049	0.199**	-0.061
Age	-0.004	0.002	-0.004	-0.001	-0.011***
Children in the home	-0.065	-0.035	0.126	-0.108	0.248**
Education	0.007	0.003	0.051***	0.039**	0.061***
Household income	0.004***	0.000	0.000	-0.001	-0.001
Urban	-0.092	-0.003	-0.045	0.050	0.335*
Health Changes	0.242***	0.367***	0.265***	0.189**	0.282**
FTNS	-0.008	-0.022***	0.024***	-0.002	0.022***
Perceived pleasantness	0.004	0.079***	-0.040	0.006	-0.087**
Health motivation	0.111**	0.170***	0.134*	0.251***	0.286***
Perceived benefits	0.052	0.054	0.025	-0.007	-0.102*
Perceived barriers	0.067**	0.097***	0.134***	0.136***	0.084*
Perceived susceptibility	-0.017	0.034	-0.161***	0.081	-0.052
Perceived severity	0.092**	0.110**	0.137**	-0.019	-0.031
Self-efficacy	0.029	-0.058	0.039	-0.012	0.002
R-squared	0.055	0.069	0.050	0.033	0.063

Table 4: Mean WTP (in $CAD) for attributes in a 2L carton of milk or an 8 x 100g package of 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

Figure 4: Distribution of WTP for attributes in milk

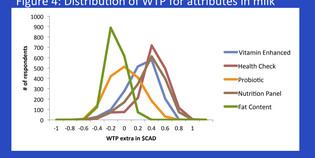

Figure 5: Distribution of WTP for attributes in yogurt

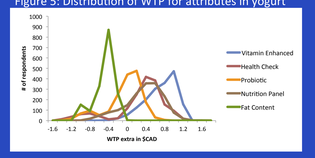

Table 5: Regression of WTP's for attributes in milk on HBM and FTNS variables

	Vitamin Enhanced		Health Check™		Nutrition Information		Probiotic	
Variable	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)
Constant	0.154***	(0.050)	0.216***	(0.047)	0.125**	(0.053)	-0.094*	(0.055)
FTNS	0.001	(0.001)	-0.002***	(0.001)	0.001	(0.001)	0.000	(0.001)
Health changes	0.021*	(0.011)	0.001	(0.010)	0.015	(0.011)	0.041***	(0.012)
Perceived pleasantness	0.044**	(0.004)	0.076***	(0.004)	0.071***	(0.004)	0.008**	(0.004)
Perceived barriers	-0.003	(0.005)	-0.014***	(0.004)	0.001	(0.005)	-0.018***	(0.005)
Health motivation	-0.029***	(0.009)	-0.014*	(0.008)	-0.025***	(0.009)	0.006	(0.009)
Perceived benefits	0.008	(0.006)	0.001	(0.006)	0.010	(0.007)	-0.009	(0.007)
Perceived susceptibility	0.025***	(0.007)	0.009	(0.006)	0.041***	(0.007)	0.038***	(0.007)
Perceived severity	0.024***	(0.007)	0.002	(0.006)	-0.006	(0.007)	-0.018**	(0.007)
Self-efficacy	-0.030***	(0.006)	-0.005	(0.006)	-0.035***	(0.006)	-0.007	(0.007)
R-squared	0.125		0.251		0.204		0.029	

Table 6: Regression of WTP's for attributes in yogurt on HBM and FTNS variables

	Vitamin Enhanced		Health Check™		Nutrition Information		Probiotic	
Variable	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)
Constant	0.387***	(0.067)	-0.700***	(0.098)	-0.209**	(0.086)	-0.621***	(0.074)
FTNS	0.002**	(0.001)	0.003	(0.002)	0.003**	(0.001)	0.002	(0.001)
Health changes	0.037**	(0.015)	-0.018	(0.021)	-0.002	(0.019)	0.015	(0.016)
Perceived pleasantness	0.114***	(0.006)	0.278***	(0.008)	0.152***	(0.007)	0.174***	(0.006)
Perceived barriers	-0.009	(0.006)	-0.029***	(0.009)	0.011	(0.008)	-0.014**	(0.007)
Health motivation	-0.038***	(0.011)	-0.013	(0.017)	-0.040***	(0.015)	-0.031**	(0.013)
Perceived benefits	0.004	(0.008)	0.001	(0.012)	0.023**	(0.011)	0.009	(0.009)
Perceived susceptibility	0.024***	(0.009)	0.035***	(0.013)	0.036***	(0.011)	0.039***	(0.010)
Perceived severity	0.041***	(0.009)	-0.008	(0.013)	-0.049***	(0.011)	-0.030***	(0.010)
Self-efficacy	-0.027***	(0.008)	-0.002	(0.012)	-0.018*	(0.010)	-0.008	(0.009)
R-squared	0.244		0.431		0.232		0.34	

Summary:

- Women and people with higher household incomes are more likely to purchase probiotic yogurt, younger people are more likely to purchase organic milk, and individuals with more education are more likely to purchase organic yogurt, fortified milk, and organic milk.
- People whose preferred language is English are more likely to purchase fortified yogurt and those whose preferred language is French are more likely to purchase fortified milk.
- Individuals who have made changes to improve their health in the past 12 months are more likely to purchase all specialty dairy products.
- People who are more concerned about food technologies are more likely to purchase organic milk and yogurt and less likely to purchase fortified yogurt.
- Individuals who have higher health motivation scores (feel that their micronutrient intake is adequate) or who perceive availability as a barrier to dairy consumption as higher are more likely to purchase specialty dairy products.
- Individuals who perceive severity of osteoporosis as higher are more likely to purchase all specialty yogurt products.

Conclusions:

- Adding a Health Check™ logo or a more comprehensive nutrition panel to milk and yogurt packages could increase sales. There are some consumer segments who would pay extra to have vitamin enhanced or probiotic milk or yogurt.
- Individuals who have made health changes in the past year are WTP more for vitamin enhanced milk and yogurt as well as for probiotic milk.
- People who are more concerned about food technologies are WTP less for a Health Check™ symbol on their milk and more for vitamin enhanced yogurt.
- People who have higher perceived pleasantness of dairy products are WTP more for all attributes in both milk and yogurt. Vassallo et al(7) found that people who had higher perceived pleasantness of bread were more willing to try functional bread products.
- Individuals who don't see availability as a barrier to dairy consumption are WTP more for probiotics and a Health Check™ symbol on both milk and yogurt.
- Individuals who don't believe their micronutrient intake is adequate are WTP more for vitamin enhanced milk and yogurt, additional nutrition information on their milk and yogurt, a Health Check™ symbol on their milk, and probiotic yogurt. Vassallo et al(7) found that individuals who felt they needed to pay more attention to various health issues were more willing to try functional bread products.
- People who have higher perceived susceptibility are WTP more for all attributes in both milk and yogurt with the exception of a Health Check™ symbol on their milk while those with higher perceived severity are WTP more for vitamin enhanced milk and yogurt but are WTP less for probiotic milk and yogurt and additional nutrition information on yogurt.
- 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(7) found that individuals who thought it was easier to purchase functional bread products were more willing to try them.
- While peoples' attitudes towards novel food technologies do appear to play a role in determining their propensity to purchase and consume functional dairy products, they do not appear to have as big an effect as do their health beliefs.

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