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The development of innovative functional food products is a major trend in today's food industry. The growth of this industry is driven by increased consumer awareness of their own health deficiencies, increased understanding of the possible health benefits of functional foods, development in formulation technologies, a positive regulatory environment and changing consumer demographics and lifestyles. While there has been a proliferation of omega-3 products such as milk, eggs, yogurt, and margarine in the Canadian food market, very little is known about consumers of omega-3 products.

In our study we use ACNielsen Homescan™ data combined with ACNielsen Panel Track™ survey data to develop profiles of omega-3 consumers in Canada. The focus of the study is on consumers of four products: omega-3 milk, omega-3 yogurt, omega-3 margarine and omega-3 eggs. We investigate whether there are significant differences between consumers and non-consumers of omega-3 products based on their age, income, education, and household composition. We also investigate whether a household's knowledge of the Canadian food guide, knowledge of nutrition labels, and consideration of health benefits influences the decision to purchase omega-3 products.

The results from the ordered probit model estimation show that an aging (baby boomer) population is the most frequent purchaser of omega-3 products, the presence of children in the home increases the purchasing frequency of omega-3 yogurt and omega-3 margarine, and reading the Nutrition Facts panel and health benefits are important factors that affect the purchase of omega-3 products.

Keywords: omega-3 fatty acids, nutritional labelling, health benefits, ordered probit model

JEL Classification: C81, D12, I19, Q19

Introduction

Public awareness of the link between diet and lifestyle related disease has increased over the last decade (Chandler 2006; Barkema 1994; Malla, Hobbs and Perger 2007). As public knowledge of the field has evolved, food manufacturers have responded to an increased demand for products that could be used to promote good health (Kinsey 1994). One of the results has been the development and marketing of a growing spectrum of products called functional foods. According to Health Canada (1998), a functional food is similar in appearance to, or may be, a conventional food, is consumed as part of a usual diet, and is demonstrated to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions. Examples of conventional functional foods include tomatoes with lycopene and wheat bran fiber, which are thought to help prevent the incidence of certain types of cancers (International Food Information Council 2006). Some functional foods can be fortified with nutrients such as calcium enriched orange juice to help prevent specific nutritional deficiencies. Other functional foods are fortified with nutrients that will reduce the risk of chronic disease like heart disease. Examples of this are products such as milk and yogurt that have been enhanced with omega-3 polyunsaturated fatty acids.

The health benefits of long-chain omega-3 polyunsaturated fatty acids have received a great deal of attention. Consuming omega-3 fatty acids can reduce high blood pressure, cholesterol and inflammation (Psota, Gebauer and Kris-Etherton 2006; Rose and Holub 2006; Bang and Dyerberg 1980; International Food Information Council 2005). From a nutritional point of view, the three most important omega-3 polyunsaturated fatty acids are docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA) and alpha-linolenic acid (ALA) (Jacobsen and Bruni Let 2006; Simopoulos 2006; Psota, Gebauer and Kris-Etherton 2006; Ruxton et al. 2004; Simopoulos 1999; Holman 1998). In 2004 the Food and Drug Administration (FDA) in the United States concluded that there was enough scientific evidence to allow companies to make qualified health claims about two specific omega-3 fatty acids, EPA and DHA. In the case of EPA and DHA, the FDA allows the use of the following language on packages, “supportive but not conclusive research shows that consumption of EPA and DHA omega-3 fatty acids may reduce the risk of coronary heart disease” (FDA 2004).

The major sources of ALA are plant materials such as flax seed, walnuts, canola and soybeans. EPA and DHA are naturally found in cold-water fish, algae and other marine sources. One of the major issues that we found from the literature on omega-3 fatty acids is that they are not equal (Jacobsen and Bruni Let 2006; Gerster 1998; Ruxton et al. 2004; Wright 2007; Heller 2006; Douaud 2006). EPA and DHA are superior to ALA, which has to be synthesized by the body and converted into DHA and EPA. This is a process that has been found to be inefficient as only a small potion of the ALA's get converted into EPA and DHA. For this reason ALA can only be identified as a good source of omega-3 fatty acids in health claims in the United States (Bonne 2004; FDA 2004).

Worldwide product launches of new foods and beverages containing omega-3 have more than doubled since 2002 (Seaton 2006). Omega-3 fatty acids can be found in a variety of product categories such as milk, yogurt, eggs, margarine, bread, pasta, pork and even chicken. Factors that have led to the expanded use and development of products containing omega-3 fatty acids include an increased understanding of the benefits of omega-3 fatty acids, growth in consumer awareness of their own health deficiencies, developments in formulation technologies and lastly, a positive regulatory environment (Seaton 2006). While there has been a proliferation of omega-3 enhanced products available in the market, research on the consumers of these products has been limited.

The purpose of this study is to provide insight into Canadian consumers' purchase motivators for omega-3 yogurt, omega-3 eggs, omega-3 milk and omega-3 margarine. Specifically, the objectives of this study are to: (1) investigate the market performance of select omega-3 products in the Canadian and Alberta food market, (2) provide insight into motivators of purchase behaviour and the implications for functional foods and specifically omega-3 products, and (3) assess the impact of consumer attitudes and socio-demographics (e.g., income, age, region) on omega-3 purchase behaviours.

It is expected that the findings of the study will contribute to a better understanding of Canadian consumers, particularly consumers of omega-3 products. Such information may be useful in policy development. This information can also help processing companies effectively target their customer base in developing new products, brands and marketing strategies. Information on Alberta and Canadian consumers are especially valuable to small to medium size

food processors or retailers whose marketing territory is local or domestic and who lack the resources or expertise to conduct their own consumer research.

Methods

This study involved analyzing three ACNielsen data sets: Market Track™, Homescan™ and Panel Track™. ACNielsen Market Track™ data consists of national retail sales scanner data. ACNielsen Market Track™ data is used to investigate the market performance of conventional and omega-3 yogurt, eggs, milk and margarine in the Canadian and Alberta food market for the three-year period from March 2003 to February 2006[1].

ACNielsen Homescan™ data captures all-outlet purchase information from 9,825 Canadian households. The data was collected for a period of 52 weeks ending March 18, 2006[2]. Each household is equipped with a hand held scanning device, which is used to scan the Universal Product Code (UPC) of their purchases. For every shopping occasion panellists scan all their UPC coded products. The panellist then transmits via telephone their purchase data on a weekly basis. A total of 3,290 households actually purchased any omega-3 product (milk, eggs, margarine, or yogurt). In addition to their expenditure on Omega-3 products, households provided information on the number of trips or occasions that a particular product was purchased, and their demographic information. The demographic information includes regional location, household income levels, the age and educational attainment of the head of household, and the presence of children in the household.

Lastly, a stated preference survey was administered through ACNielsen Panel Track™ in March 2006[3]. Hard copies of the survey were mailed to the households[4]. The households use their hand held scanning device to scan the barcode of the most appropriate answer. The responses are downloaded electronically to ACNielsen via the modem built into the hand-held

[1] ACNielsen MarketTrack™ data was collected over three 52 week periods between March 2003 and February 2006. For simplicity in reporting the data, the first 52 week period (data collected between March 2003 and Feb 2004) will be referred to as 2003, data collected during the second period (March 2004-Feb 2005) as 2004 and data collected during the last 52 week period (March 2005 – Feb 2006) as 2005.
[2] Note: With regards to the homescan data, the analyst knows only if the household bought an omega-3 but does not know how many conventional products or substitutes to the respective omega-3 the household bought. This limitation has implications on how the dependant variable was created when sub-dividing the number of trips into the 4 categories.
[3] The survey was designed by researchers at Alberta Agriculture and Food.
[4] The benefit of such a survey is that it is completely self-administered and the respondents have time to reflect on their answers.

device. Respondents were asked questions regarding their food purchasing habits and knowledge of the Nutrition Facts panel on package labels and Canada's Food Guide[5].

The ACNielsen Homescan™ and Panel Track™ data were used to develop the omega-3 consumer profile and to assess the impact of consumer attitudes and socio-demographics on purchase behaviors[6].

Data Summary

Market Performance of Select Omega-3 Products

Canadian Market Assessment

The ACNielsen Market Track™ data provides point-of-sale information that can be used to identify trends and assess market performance of food products. From the Market Track™ data it is apparent that national sales of conventional milk, eggs, yogurt and margarine dominate the sales of omega-3 milk, eggs, yogurt and margarine. In 2005, the national sales of conventional products mentioned above were $3,321.2 million while sales of the omega-3 products mentioned above were $96.7 million (Appendix A). Even though the sales volumes of conventional products are much higher, their growth rate is relatively flat compared to the exponential growth of omega-3 products between 2003 and 2005 (Appendix A and Appendix B). Nationally, omega-3 eggs continue to lead the category in sales, followed by omega-3 milk, omega-3 yogurt, and lastly, omega-3 margarine (Figure 1).

In terms of product availability, omega-3 yogurt and milk are examples of relatively new products available to consumers. Omega-3 eggs have been in the market since 1993 while omega-3 yogurt was launched in the Canadian market between December 2004 and February 2005. Omega-3 milk was first introduced to the Quebec market in the fall of 2003 and the rest of Canada during the summer of 2004.

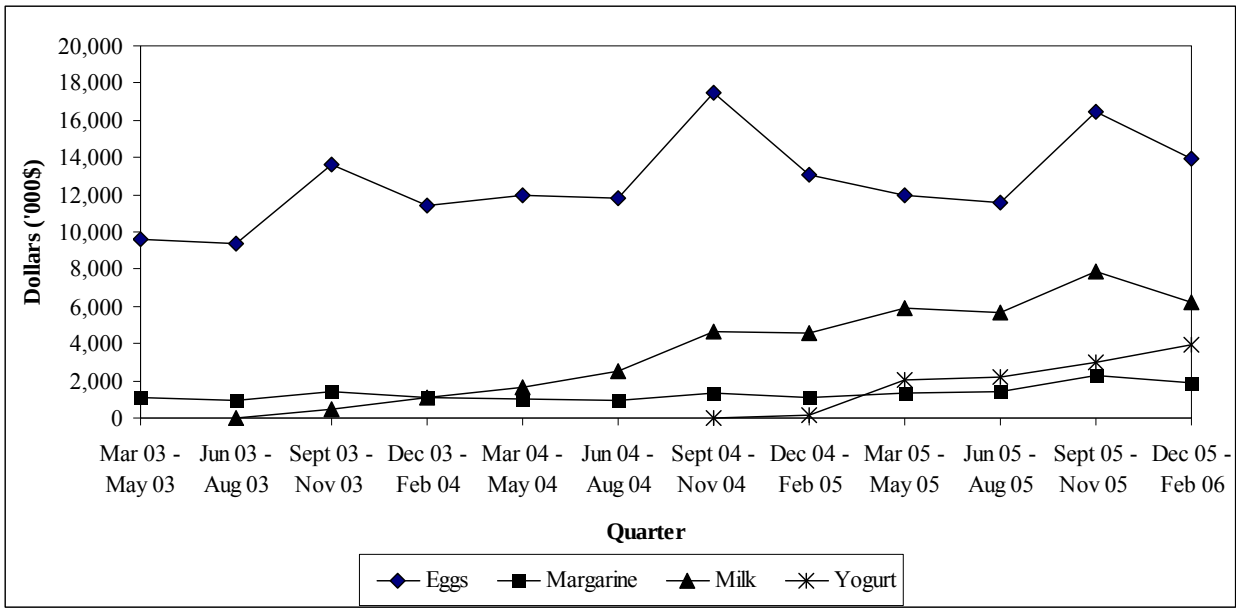
Alberta Market Assessment

Similar to the national data, it is apparent from the Alberta data that sales of conventional products dominate the sales of omega-3 products while the growth in sales of the omega-3

[5] Respondents are assumed to be the head of the household.
[6] One of the limitations to this study is that information on the prices and substitutes of the various omega-3 products was not collected. We know that price of a product and prices of the substitutes of that particular product do affect its demand. Thus, we are missing important information that could help us further understand the market of the various omega-3 products.

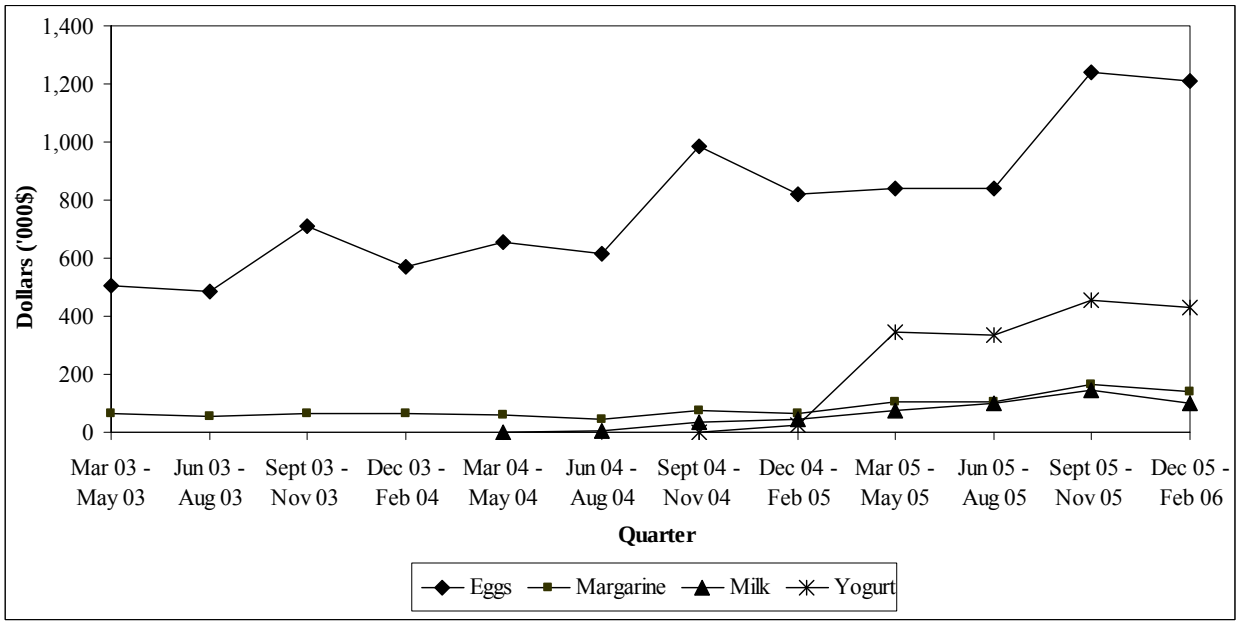
products surpass the conventional products growth. In 2005, the sales of conventional products were $349.3 million while sales of omega-3 products were $6.6 million (Appendix A). In Alberta, omega-3 eggs have the highest sales, followed by omega-3 yogurt, omega-3 margarine, and lastly, omega-3 milk (Figure 2).

Figure 1. National Quarterly Sales of Omega-3 Products



Source: Authors' computation of ACNielsen Market Track™ data.

Figure 2. Alberta Quarterly Sales of Omega-3 Products



Source: Authors' computation of ACNielsen Market Track™ data

Consumer Attitudes When Purchasing Food

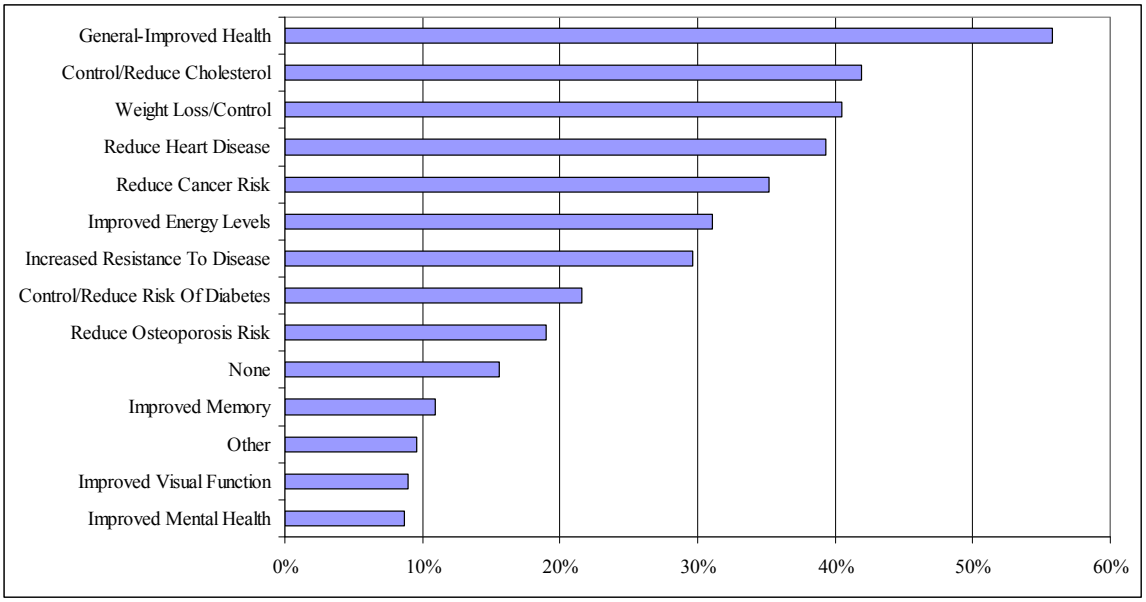
A stated preference survey was administered through ACNielsen Panel Track™ in March 2006. The sample size is 7,947 respondents. The sample includes purchasers and non-purchasers of omega-3 products. The results of the survey provide some insight into the health benefits considered when purchasing food, and whether consumers are knowledgeable of the Nutrition Facts panel on package labels and Canada's Food Guide and how these factors influence purchase decisions. In addition to these questions, socio-demographic information was also collected from each respondent. The responses to five specific questions relating to the potential purchase motivators of omega-3 products are summarized below.

Health Benefits Considered when Purchasing Food

Because foods provide health benefits, households were queried about which health benefits they consider when purchasing food. Respondents were asked to select as many benefits as they saw fit, out of 14 possible choices[7]. From Figure 3 it can be concluded that people generally consider a number of health benefits when purchasing a food product. The most frequently stated health benefits that are considered when purchasing a food item are general improved health, control/reduce cholesterol, weight loss/control, reduce heart disease and reduce cancer risk. This bodes well for developers and marketers of omega-3 products given that the health benefits of consuming omega-3 fatty acids such as control/reduce cholesterol and reduce heart disease are consistent with some of the most common health benefits consumers consider when purchasing a food item.

[7] This is the reason why the percentages in Figure 3 do not add up to 100.

Figure 3. Health Benefits Considered When Purchasing Food

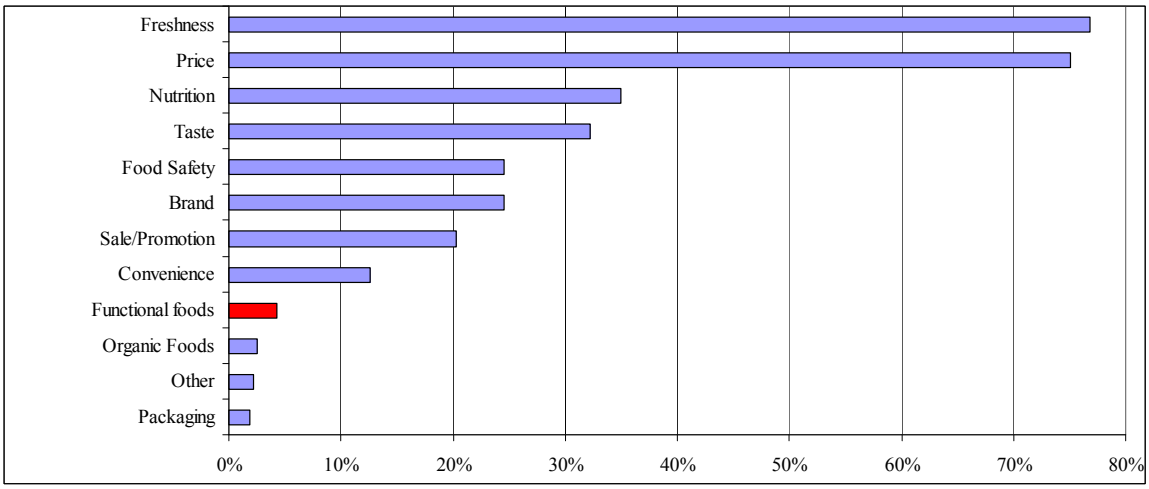


Source: Authors' computation from ACNielsen Panel Track™ data

Factors Considered When Purchasing Food in a Grocery Store

Respondents were queried about the three most important factors they consider when buying a food product in a grocery store. As can be seen from Figure 4, the functionality of foods is not a top of mind driver when purchasing foods from a grocery store. Freshness and price remain the most important factors.

Figure 4. Factors Considered When Purchasing Food

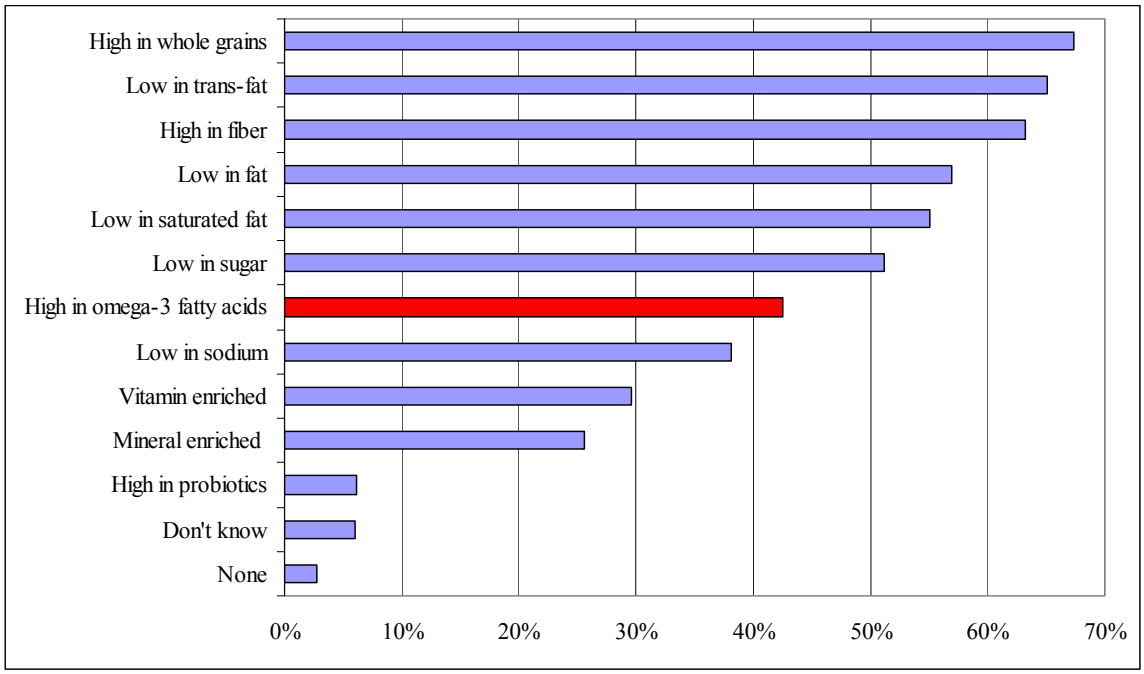


Source: Authors' computation from ACNielsen Panel Track™ data

Foods Purchased in a Grocery Store in the Past 12 Months

When asked to identify which foods, out of 12 possible choices, they had purchased in a grocery store in the past 12 months, respondents indicated they had purchased at least some type of healthy food (Figure 5). Most of the respondents indicated they had purchased a food that was high in whole grains, low in trans fat or high in fiber. It is interesting to note that almost 43% of the respondents indicated they had purchased a food that was high in omega-3 fatty acids in the past 12 months.

Figure 5. Foods Purchased in the Past 12 Months



Source: Authors' computation from ACNielsen Panel Track™ data

Awareness of Nutrition Facts Panel

Households were queried about their awareness of the Nutrition Facts panel label on packaged food products and the information they look for on the panel when buying a product for the first time.

Table 1. Awareness of the Nutrition Facts Panel

	Percentage of Respondents
Aware of Nutrition Facts panel and read	63
Aware of Nutrition Facts panel but do not read it	26
Not aware of Nutrition Facts panel	11

Source: Authors' computation from ACNielsen Panel Track™ data

It can be seen from Table 1 that 89 % of the households stated that they were aware of the Nutrition Facts panel while 63 % of them actually read the Nutrition Facts panel. Only 11 % of the households were not aware of the Nutrition Facts panel.

Knowledge of Canada's Food Guide

Another question queried households on whether they have heard of Canada's Food Guide. Based on Table 2, the vast majority of households have at least seen or heard of Canada's Food Guide. However, just over half of the respondents that have seen or heard of the Guide actually used the information.

Table 2. Knowledge of Canada's Food Guide

	Percentage of Respondents
Not seen or heard of Canada's Food Guide	9
Have seen or heard of the Guide but do not use the information	40
Have seen or heard of the Guide and use the information	51

Source: Authors' computation from ACNielsen Panel Track™ data

Combining the Survey and Purchase Data

To evaluate how households' demographics and attitudes affect consumption of omega-3 products, the Panel Track™ and Homescan™ data were merged. After merging the two data sets, we found that 2,684 households completed the Panel Track™ survey and also purchased an omega-3 product[8]. We also noted that 5,263 households completed the survey but did not purchase an omega-3 product. Thus, the final data set was made up of 7,947 households.

The sample data seems to be fairly representative of the Canadian population with a few noted exceptions (Appendix C). For instance, households in the Maritimes, households with an older head of the household, and households with no children under the age of 18 years present in the home are over represented in the data.

Methodology and Results

Theoretical and Empirical Models

The model used in this study follows the random utility maximization (RUM) framework rooted in the economic theory of consumer choice (McFadden 1974). Models of trip chaining constructed with RUM theory generate "optimal" tours as results of individuals' internal utility

[8] Of the 3290 households that purchased an omega-3 product, 606 households did not complete the survey.

maximization. In these models it is often assumed that a household is capable of making "rational" decisions that optimize their internal utility, represented by a function of expenditure for activity participation and travel. Examples of studies that have used this approach include Adler and Ben-Akiva (1979) and Kitamura (1984).

For each omega-3 product, we assume that a household faces a choice between Never purchasing (Nv), purchasing once (On), purchasing occasionally (Oc) and purchasing frequently (Fr). Utilities derived from the purchasing decision are given by U_{nv}, U_{On}, U_{Oc} and U_{Fr} , respectively, and these utilities are not observable. The observable variables are the purchase decisions p (p= Nv, On, Oc, Fr) and a vector of consumer characteristics (X). The utility of a household i is postulated as follows:

$$U_{pi} = V_{pi} + \varepsilon_{pi} = \beta x + \varepsilon, \quad \varepsilon \sim N(0,1) \tag{1}$$

where U_{pi} is the latent, unobserved utility for choice alternative "p", V_{pi} is the explainable part of the latent utility that depends on the purchasing decision with attributes p and a set of socioeconomic characteristics and attitudes, and ε_{pi} is the random component of the latent utility associated with the choice "p" and household "i".

Household i's choice ordering between Never purchasing (Nv), purchasing once (On), purchasing occasionally (Oc) and purchasing frequently (Fr) the respective omega-3 products is modeled in the following way. Household i ranks the decision to purchase a respective omega-3 product in one of the four categories. For example, Z_i can be interpreted as additional utility derived by household i choosing to purchase an omega-3 product once (On) over never purchasing (Nv), so that

$$Z_i = (V_{Oni} + \varepsilon_{Oni}) - (V_{Nvi} + \varepsilon_{Nvi}) = (\varepsilon_{Oni} - \varepsilon_{Nvi}) - (V_{Oni} - V_{Nvi}) \tag{2}$$

A household expresses strong disapproval for a specific purchase occasion if Z_i is below some threshold value (e.g., μ_1), shows moderate disapproval if Z_i is above μ_1 but below another threshold value μ_2 , and shows approval of a purchase decision if Z_i is above μ_2 . Formally, household i's choice ordering is denoted by U_i where U=0 implies never purchasing, U=1 implies purchasing once, U=2 implies purchasing occasionally, and U=3 implies purchasing frequently and can be expressed as follows:

$U = 0$ (Never) if $u_i^* \leq \mu_1$

$U = 1$ (Once) if $\mu_1 < u_i^* \leq \mu_2$

$U = 2$ (Occasionally) if $\mu_2 < u_i^* \leq \mu_3$

$U = 3$ (Frequently) if $\mu_3 > u_i^*$ (3)

where the unknown μ_i's are estimated along with the β's . Assuming that the ε_i's are normally distributed, the ordered probit maximum likelihood estimator results and the probabilities are:

$$\begin{aligned}
&\Pr ob(U = 0 \mid x) = F(-x'\beta) \\
&\Pr ob(U = 1 \mid x) = F(\mu_1 - x'\beta) \\
&\Pr ob(U = 2 \mid x) = F(\mu_2 - x'\beta) - F(\mu_1 - x'\beta) \\
&\Pr ob(U = 3 \mid x) = 1 - F(\mu_2 - x'\beta)
\end{aligned} \tag{4}$$

where F is the cumulative function of a standard normal distribution. In the above model the $\mu's$ are unknown parameters that separate the adjacent categories. The estimated β coefficients of equation (1) do not directly represent the marginal effects of the independent variables on the probabilities of choice. The marginal effects of changes in the explanatory variables are calculated as follows:

$$\begin{aligned}
&\partial \Pr ob(U = 0 \mid x) / \partial x = F(-x'\beta)\beta \\
&\partial \Pr ob(U = 1 \mid x) / \partial x = [F(-x'\beta) - F(\mu_1 - x'\beta)]\beta \\
&\partial \Pr ob(U = 2 \mid x) / \partial x = [F(\mu_1 - x'\beta) - F(\mu_2 - x'\beta]\beta \\
&\partial \Pr ob(U = 3 \mid x) / \partial x = F(\mu_2 - x'\beta)\beta
\end{aligned} \tag{5}$$

where F is the probability density function of the standard normal variable. For continuous independent variables, marginal effects are calculated at the sample means; and for binary or dummy variables, they are calculated as the difference between the probabilities at the two end points, $\Pr ob(y \mid x = 1) - \Pr ob(y \mid x = 0)$. The marginal effects for a given variable sum to zero across the different response categories.

Empirical Application

In our study, for each omega-3 product (eggs, milk, yogurt and milk) it is assumed that the decision to purchase a respective product depends on how often a household went to the grocery store or retail store and purchased the respective product (number of trips). The more trips a household makes to the grocery store to purchase an omega-3 product the higher the expenditure on a respective omega-3 product and consequently, the higher the preference or utility for that respective omega-3 product. For each of the products the number of trips were divided into; 0=Never (Nv), 1=Once (On), 2=Occasionally (Oc) and lastly, 3= Frequently (Fr).

Determining the "Never" and " Once" categories was straight forward as "never" represented those households that never took a trip to the grocery store and "once" represented those households that took a single trip to the grocery store. The "Occasionally" and "Frequently" categories were developed based on the frequencies of the number of trips to the grocery store to ensure that each category had sufficient data to carry out the analysis (Table 3).

It should be noted that these frequencies pertain to omega-3 products only since we do not know how many trips the household took to purchase the conventional products or substitute products. Consequently, we label a household that buys omega-3 eggs five or more times a year a "frequent" purchaser of omega-3 eggs, and not a frequent purchaser of eggs in general. The same explanation can be applied to the other omega-3 categories.

Table 3. Deriving the Dependent Variable for each Respective Product using Number of Trips

	Omega-3 products			
	Eggs	Milk	Yogurt	Margarine
Category	*Trips*	*Trips*	*Trips*	*Trips*
Never (Nv)	0	0	0	0
Once (On)	1	1	1	1
Occasionally (Oc)	2 - 4	2 - 12	2 - 3	2 - 3
Frequently (Frq)	5 plus	13 plus	4 plus	4 plus

Source. Authors' computation from ACNielsen Homescan™ data

From Table 4 it can be seen that the number of households that actually purchased omega-3 products ranged from approximately 5% for omega-3 milk to 20 % for omega-3 eggs.

Table 4. Distribution of the Households across the Different Options by Product Type

Omega-3 products				
	Eggs	Milk	Yogurt	Margarine
Category	*% of households*	*% of households*	*% of households*	% of households
Never (Nv)	80.6	95.3	89.5	91.9
Once (On)	6.4	1.9	6.2	3.8
Occasionally (Oc)	5.4	1.9	3	2.1
Frequently (Frq)	7.6	0.9	1.2	2.2
Mean	0.4	0.08	0.15	0.16
Standard Deviation	0.9	0.41	0.55	0.52
TOTAL	100	100	100	100

Source. Authors' computation from ACNielsen Homescan™ data

The following empirical model is used to estimate the relationship between the probability that a household will purchase an omega-3 product based on number of trips and their personal characteristics and attitudes:

$$U_i = \beta_0 + \sum_{n=1}^{5} \beta_n location_i + \beta_6 Inc_i + \sum_{n=7}^{10} \beta_n Age_i + \beta_{11} Poc_i + \beta_{12} Educ + \beta_{13} Label + \beta_{14} Nutritionawareness + \beta_{15} HB + \varepsilon_i \quad (6)$$

where U_i is the purchase of omega-3 products based on the number of trips and is ranked between 0 and 3.

Table 5 provides a summary of the variables used in the estimating the model. Location is a dummy variable equal to one if the purchase of the omega-3 product was in a particular region and zero otherwise. A dummy variable is created for each region with the exception of Alberta which is the base case. Income (inc) is a continuous variable representing the total household income before taxes. Age is a dummy variable reflecting the age of the head of the household. A dummy variable is created for each age group with the exception of over 65 years of age which is the base case. Presence of children (poc) is a dummy variable indicating the presence of children in the household. Education level (educ) is a continuous variable representing the education level of the respondent. The variables NFPANEL and FGUIDE are dummy variables that indicate whether consumers are aware of and/or read the Nutrition Facts panel label and Canada's Food Guide, respectively. Health benefit (HB) is a continuous variable that refers to the heath benefits that households consider important when they decide which foods to buy.

Table 5. Summary of Variables

Definitions of variables and summary statistics

	Abbreviation	Mean	Standard Deviation
Location			
1=Maritimes, 0 otherwise	MART	0.12	0.33
1=Quebec, 0 otherwise	QUE	0.26	0.44
1=Ontario, 0 otherwise	ONT	0.31	0.46
1=Manitoba/Saskatchewan, 0 otherwise	MANSAS	0.11	0.31
1=Alberta, 0 otherwise*	ALB	0.10	0.30
1=British Columbia, 0 otherwise	BC	0.10	0.30
Income	**INC**	4.062	1.761
1= Under $20,000, 2=$20000-$29999, 3=$30000-$39999, 4=$40000-$49999, 5=$50000-$69999, 6=$70000 or more			
Age			
1= Under 35, 0 otherwise	AGE1	0.06	0.24
1=35-44, 0 otherwise	AGE2	0.21	0.40
1=45-54, 0 otherwise	AGE3	0.25	0.43
1=55-64, 0 otherwise	AGE4	0.23	0.42
1=65 and over, 0 otherwise*	AGE5	0.26	0.44
Presence of children in a Household	**POC1**	0.23	0.42
1= if children under 18 are present in a household, 0 Otherwise			
Education Level	**EDUC**	3.622	1.734
1=Not completed High School, 2=Completed High School, 3=Some Technical or College, 4=Completed Technical or College, 5=Some University, 6=Completed University			
Label (Nutrition Facts Panel)	**NFPANEL**	0.63	0.48
1= household is aware of the Nutrition Facts panel and has read it when buying a product for the first time 0 otherwise (i.e. household is not aware of the Nutrition Facts panel, household is aware of the Nutrition Facts panel but do not read it when buying a product for the first time).			
Nutritional awareness (Canada's Food Guide)	**FGUIDE**	0.514	0.50
1= household has seen or heard of Canada's Food Guide, and has used the information 0 Otherwise (i.e. household has not seen or heard of Canada's Food Guide, household has seen or heard of Canada's Food Guide but do not use the information)			
Health Benefits	**HB**	3.52	2.88
Range from 0 to 13 with 0 being no health benefit and 13 being all the health benefits listed below. General-improved health, improve memory, improve mental health, improve visual function, increase resistance to disease, improve energy levels, reduce heart disease, reduce cancer risk, reduce osteoporosis risk, control/reduce risk of diabetes, control/reduce cholesterol, weight loss/control, other			

Model Estimation and Empirical Results

Four ordered probit models for the different omega-3 products (eggs, milk, yogurt and margarine) were estimated to explain the household's preferences for omega-3 products. The estimated models coefficients with associated t-ratios, threshold parameters for the index functions μ_1 and μ_2 are reported in Appendix D. The marginal effects of the explanatory variables along with their t-ratios are reported in Appendix E to Appendix H. Also reported in these tables are the estimated values of unrestricted model and restricted model log likelihood functions, Chi-square statistics of model significance, McFadden's r-squared and model prediction success rates.

The estimated coefficients and standard errors reveal which factors influence households' purchase intentions for omega-3 eggs, milk, margarine and yogurt. However, the coefficients from the ordered probit model are difficult to interpret; therefore, caution must be used when making inferences (Greene 2003). The marginal effects and predicted probabilities provide better insights into how the explanatory variables affect household's decisions to purchase omega-3 products. The marginal effects represent changes in the dependent variable for a one percent change in the independent variable (explanatory variable) in question holding all other independent variables constant at their sample means.

The following discussion is based on the summary of marginal effects presented in Table 6. Our interpretation here is limited to the households that never purchased an omega-3 product and those respondents that frequently took trips to the grocery stores to purchase the omega-3 products[9]. In the table, a statistically significant positive marginal effect is represented by "+" and a statistically significant negative marginal effect is represented by "-". If the marginal effect is not statistically significant, the box is left blank.

For example, in the "never" purchased omega-3 eggs category, a unit change in the explanatory variable, age2 (35-44 years) and age3 (45-54 years) will cause an increase in the probability of the head of the household never purchasing omega-3 eggs. Also, there is not a statistically significant difference between the omega-3 egg purchases of households with head of household under 35 years and households with head of the household aged 65 years and over. Thus, households with a head of the family aged 35-44 years or 45-54 years are more likely to

[9] Information on the once and occasionally options are also shown in Appendix D-G.

have never purchased omega-3 eggs or households with a head of the family aged 65 years and over are more likely to have purchased omega-3 eggs.

A unit change in the regressor, Nutrition Facts Panel (NFPanel), from those households who read the nutrition label to households who do not read the nutrition label causes an increase in the probability for the "frequently" category. Thus, households who read the Nutrition Facts panel label are more likely to purchase omega-3 eggs. This results also holds for all the other omega-3 products.

Similarly a unit increase in the regressor, health benefits (HB), causes an increase in the probability for the "frequently" category. Thus, households who purchase food at the grocery to attain health benefits are more likely to purchase omega-3 eggs. This result also holds for all other omega-3 products with the exception of omega-3 milk.

Table 6. Summary of Households that Never and Frequently Purchased Omega-3 Products

	Eggs		Margarine		Milk		Yogurt	
	Never	Frequent	Never	Frequent	Never	Frequent	Never	Frequent
Region								
Maritimes	-	+	-	+	+		-	
MB/SK	+		+		+		+	
QC	-	+	-	+	-	+	+	-
ON	-	+	-	+	+			
BC	-	+					+	
Income	-	+					-	+
Age								
<35			+		+		-	
35-44	+		+		+			
45-54	+		+		+		+	
55-64								
Children	+		-		+		-	+
Education	-	+					-	+
Nutrition Facts Panel	-	+	-	+	-	+	-	+
Food Guide							-	+
Health Benefits	-	+	-	+	-		-	+

Conclusions

The increased awareness of the link between diet and lifestyle related diseases have resulted in consumers seeking more from their food choices. Governments are recognizing the interconnectedness of food and health policy. Studies have also shown that industry will address specific health concerns through product development and marketing (Cash, Goddard and Lerohl 2006). The case of omega-3 enriched foods is viewed as an attempt to address these consumer concerns.

Over the study period from 2003 to 2005 the percentage growth in omega-3 product sales (eggs, milk, yogurt and margarine) exceeded the percentage growth in conventional food product sales. This growth in the omega-3 food category presents opportunities for Alberta firms looking to expand their market presence. Thus, there is a need to better understand what is influencing consumer's decisions to purchase or not purchase omega-3 products. Knowledge of how these choices vary by household is relevant to policy development and product marketing.

The results from the ordered probit model show that an aging baby boomer population is the most frequent purchaser of omega-3 products. We also found that the presence of children in the home increases the purchasing frequency of omega-3 yogurt and omega-3 margarine. Knowledge and utilization of the Nutrition Facts panel is an important purchase motivator for omega-3 products.

Based on the results obtained from the analysis, most households consider some form of health benefit a food will provide before they purchase the food. This bodes well for marketers of omega-3 products since some of the most frequently stated health benefits consumers consider are consistent with the same health benefits provided by consuming an omega-3 fatty acid. Targeting educational efforts to enhance knowledge about these health properties seems warranted. For instance, making parents and caregivers aware of the benefits that omega-3 can have on children (such as brain development) could encourage growth in the demand for omega-3 yogurt.

Health Canada requires disclosure of the nutritional contents for most prepackaged food products on a standardized label. How consumers interpret and utilize the information contained on the Nutrition Facts panel is important to policy makers. Our study found that households with a head of the household that reads the Nutrition Facts panel frequently purchased omega-3

products. This supports the notion that people who are concerned about their health tend to read food product labels.

Not all omega-3 fatty acids are created equal. Our review indicated that EPA and DHA were found to be more effective than ALA. It may not be enough to just stress the benefits of omega-3 products in general. Product differentiation may be required to identify which particular omega-3 is included in a product. It is also acknowledged that people may be confused about the further differentiation, thus educating consumers about the different omega-3's and their benefits is required.

Government agencies need to keep pace with the research, technology and development of the various functional foods including omega-3 fatty acids. Certainly, the approved health claim for two specific omega-3 fatty acids, EPA and DHA, by the FDA in the United States is a step in the right direction. Such a claim has not yet been approved in Canada. This impasse needs to be addressed for the continued growth of the omega-3 product category. Opportunities to position Canadian agriculture as a solution provider to society's needs for healthy lifestyle choices have been identified in new Agricultural Policy Framework (Agriculture and Agri-Food Canada 2007).

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Appendix A. Annual Sales of Conventional and Omega-3 Products

Conventional Products										
	National ($)					Alberta ($)				
Year	Eggs	Margarine	Milk	Yogurt	Total	Eggs	Margarine	Milk	Yogurt	Total
2003	436,322,020	276,698,116	1,773,277,592	660,224,038	3,146,521,766	47,241,893	33,979,479	185,540,209	61,537,730	328,299,311
2004	441,459,147	277,349,633	1,766,842,243	744,385,646	3,230,036,669	48,384,129	33,547,126	177,847,336	70,875,219	330,653,810
2005	438,600,463	272,840,900	1,820,872,233	788,904,109	3,321,217,705	48,442,429	33,973,109	186,759,459	80,172,887	349,347,884

Omega-3 Products										
	National ($)					Alberta ($)				
Year	Eggs	Margarine	Milk	Yogurt	Total	Eggs	Margarine	Milk	Yogurt	Total
2003	44,017,758	4,607,624	1,584,336		50,209,718	2,267,215	250,735			2,517,950
2004	54,291,549	4,375,138	13,320,310	152,356	72,139,353	3,074,140	241,623	84,844	25,427	3,426,034
2005	53,918,244	6,909,414	25,611,125	11,226,636	97,665,419	4,126,598	517,297	418,317	1,563,864	6,626,076

Source: Authors' computation from ACNielsen Market Track™ data

Appendix B. Annual Sales Growth of Conventional and Omega-3 Products

Conventional Products

Year	National (%)	Alberta (%)
2003-04	2.7	0.7
2004-05	2.8	5.7

Omega-3 Products

Year	National (%)	Alberta (%)
2003-04	43.7	36.1
2004-05	35.4	93.4

Source: Authors' computation from ACNielsen Market Track™ data

Appendix C. Comparing Sample Data with 2001 Census Profile of Canada

	Panel Track™ Data (7947 households)	2001 Census Profile Canada
Region		
	%	**%**
Maritimes	12.2	5.9
Quebec	25.5	24.2
Ontario	30.7	39.0
Manitoba/Saskatchewan	11.0	8.0
Alberta	10.3	9.9
BC	10.3	13.0
HOUSEHOLD SIZE		
Single Member	26.6	25.7
Two Members	41.3	32.6
Three Members	12.6	16.3
Four Members	12.9	22.3 (4-5 persons)
Five or More Members	6.6	3.1 (6 or more persons)
HOUSEHOLD INCOME		
Under $20,000	11.3	19.0
$20000-$29999	13.3	11.9
$30000-$39999	13.8	11.5
$40000-$49999	11.7	10.6
$50000-$69999	19.3	17.5
$70000+	30.6	29.5
AGE[10]		
Under 35	6.0	22.6
35-44	20.6	17.0
45-54	24.8	14.8
55-64	22.9	9.5
65 and over	25.7	13.0
CHILDREN		
Children under 18	23.1	48.0
No children under 18	76.9	52.0
LANGUAGE		
Non-French	76.3	75.9
French	23.7	24.1
EDUCATION		
Not completed High School	14.7	25.9
Completed High School	17.4	11.9
Some Technical or College	13.4	8.4
Completed Technical or College	22.2	26.0
Some University	9.8	11.2
Completed University	22.4	18.6

Source. Authors' computation from Homescan™ data, Statistics Canada (2003): Geographic Classification 01000000

[10] For the census data, the age group under 18 was not considered when computing the under 35-age group. That is why this category might not add to 100.

Appendix D. Regression Results for the Ordered Probit Estimation

	Omega-3 Eggs	Omega-3 Margarine	Omega-3 Milk	Omega-3 Yogurt
	Coef's	Coef's	Coef's	Coef's
Constant	-1.807*	-1.908*	-2.108*	-1.779*
MART	0.181*	0.513*	-0.577*	0.051
MANSAS	-0.165*	-0.187**	-0.189	-0.117
QUE	0.500*	0.380*	0.736*	-0.539*
ONT	0.423*	0.204*	-0.222*	0.018
BC	0.211*	-0.118	-0.058	-0.072
INC	0.075*	0.016	0.024	0.051*
AGE1	-0.047	-0.214*	-0.103	0.032
AGE2	-0.139*	-0.183*	-0.237*	-0.024
AGE3	-0.167*	-0.114**	-0.078	-0.071
AGE4	-0.049	-0.027	-0.046	-0.024
POC	-0.116*	0.101**	-0.110	0.122*
EDUC	0.034*	-0.001	0.003	0.035*
NFPANEL	0.300*	0.210*	0.175*	0.108*
FGUIDE	-0.007	0.060	0.003	0.154*
HB	0.032*	0.031*	0.031*	0.032*
LL-Function				
Restricted	-5596.3	-2927.4	-1891.3	-3426.5
Unrestricted	-5391.3	-2836.4	-1704.5	-3289.2
Threshold parameters for index				
μ_1	0.278*	0.331*	0.265*	0.491*
μ_2	0.599*	0.635*	0.790*	1.039*

*Denotes significance at the 5% level; ** denotes significance at the 10% level

Appendix E. Results for the Ordered Probit Model (Omega-3 Eggs)

	Estimated marginal effects and standard errors							
	Never		Once		Occasionally		Frequently	
Variable	M.E	S.E.	M.E	S.E.	M.E	S.E.	M.E	S.E.
Constant	0	0	0	0	0	0	0	0
Mart	-0.051*	0.0036	0.012*	0.0018	0.013	0.0111	0.026*	0.0061
ManSas	0.041*	0.0052	-0.011*	0.0005	-0.011*	0.0009	-0.019	0.0120
Que	-0.146*	0.0020	0.033*	0.0031	0.036**	0.0215	0.077*	0.0020
Ont	-0.119*	0.0023	0.028*	0.0028	0.03	0.0186	0.061*	0.0017
BC	-0.060*	0.0035	0.014*	0.0020	0.015	0.0122	0.030*	0.0056
Inc	-0.020*	0.0027	0.005*	0.0007	0.005*	0.0010	0.010*	0.0029
Age1	0.012	0.0046	-0.003	0.0009	-0.003	0.0040	-0.006	0.0101
Age2	0.035*	0.0051	-0.009*	0.0006	-0.009*	0.0015	-0.017	0.0118
Age3	0.042*	0.0053	-0.011*	0.0005	-0.011*	0.0008	-0.02	0.0124
Age4	0.013	0.0047	-0.003	0.0009	-0.003	0.0040	-0.006	0.0102
Poc	0.030*	0.0050	-0.008*	0.0007	-0.008*	0.0021	-0.014	0.0114
Educ	-0.009*	0.0026	0.002*	0.0007	0.002*	0.0007	0.004*	0.0018
NFPanel	-0.076*	0.0025	0.020*	0.0022	0.02	0.0135	0.036*	0.0026
FGuide	0.002	0.0045	-0.0004	0.0011	-0.001	0.0052	-0.001	0.0095
HB	-0.008*	0.0015	0.002*	0.0004	0.002*	0.0005	0.004*	0.0013

*Denotes significance at the 5% level; ** denotes significance at the 10% level

Appendix F. Results for the Ordered Probit Model (Omega-3 Margarine)

	Estimated marginal effects and standard errors							
	Never		Once		Occasionally		Frequently	
Variable	M.E	S.E.	M.E	S.E.	M.E	S.E.	M.E	S.E.
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mart	-0.094*	0.000	0.035*	0.003	0.024	0.017	0.035*	0.003
ManSas	0.023*	0.004	-0.010*	0.001	-0.006*	0.001	-0.007	0.006
Que	-0.061*	0.001	0.024*	0.002	0.016	0.012	0.021*	0.001
Ont	-0.030*	0.002	0.012*	0.002	0.008	0.007	0.010*	0.002
BC	0.015	0.004	-0.007	0.001	-0.004	0.002	-0.005	0.005
Inc	-0.002	0.002	0.001	0.001	0.001	0.000	0.001	0.001
Age1	0.026*	0.004	-0.011*	0.001	-0.007*	0.000	-0.008	0.006
Age2	0.024*	0.004	-0.010*	0.001	-0.006*	0.001	-0.007	0.006
Age3	0.015*	0.004	-0.006*	0.001	-0.004*	0.002	-0.005	0.006
Age4	0.004	0.003	-0.002	0.001	-0.001	0.003	-0.001	0.005
Poc	-0.015*	0.002	0.006*	0.002	0.004	0.006	0.005	0.003
Educ	0.0002	0.002	-0.0001	0.001	0.000	0.000	0.000	0.001
NFPanel	-0.028*	0.002	0.012*	0.002	0.007	0.007	0.009*	0.001
FGuide	-0.008	0.003	0.003	0.001	0.002	0.005	0.003	0.003
HB	-0.004*	0.001	0.002*	0.000	0.001*	0.000	0.001**	0.001

*Denotes significance at the 5% level; ** denotes significance at the 10% level

Appendix G. Results for the Ordered Probit Model (Omega-3 Milk)

Estimated marginal effects and standard errors								
	Never		Once		Occasionally		Frequently	
Variable	M.E	S.E.	M.E	S.E.	M.E	S.E.	M.E	S.E.
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mart	0.028*	0.004	-0.012*	0.0001	-0.011*	0.001	-0.004	0.003
ManSas	0.012*	0.003	-0.005*	0.0004	-0.005**	0.003	-0.002	0.002
Que	-0.074*	0.002	0.027*	0.003	0.031*	0.011	0.015*	0.004
Ont	0.014*	0.003	-0.006*	0.000	-0.006*	0.003	-0.002	0.002
BC	0.004	0.002	-0.002*	0.001	-0.002	0.003	-0.001	0.002
Inc	-0.002	0.001	0.001	0.000	0.001	0.001	0.000	0.000
Age1	0.007*	0.003	-0.003*	0.001	-0.003	0.003	-0.001	0.002
Age2	0.015*	0.003	-0.006*	0.000	-0.006*	0.002	-0.002	0.002
Age3	0.005*	0.003	-0.002*	0.001	-0.002	0.003	-0.001	0.002
Age4	0.003	0.002	-0.001	0.001	-0.001	0.003	-0.001	0.002
Poc	0.007*	0.003	-0.003*	0.001	-0.003	0.003	-0.001	0.002
Educ	-0.0002	0.001	0.0001	0.000	0.00008	0.000	0.00003	0.000
NFPanel	-0.012*	0.001	0.005*	0.001	0.005	0.004	0.002*	0.000
FGuide	-0.0002	0.002	0.0001	0.001	0.0001	0.004	0.0000	0.001
HB	-0.002*	0.001	0.001*	0.000	0.001*	0.000	0.000	0.000

*Denotes significance at the 5% level; ** denotes significance at the 10% level

Appendix H. Results for the Ordered Probit Model (Omega-3 Yogurt)

Estimated marginal effects and standard errors								
	Never		Once		Occasionally		Frequently	
Variable	M.E	S.E.	M.E	S.E.	M.E	S.E.	M.E	S.E.
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mart	-0.009*	0.003	0.005*	0.002	0.003	0.005	0.001	0.002
ManSas	0.018*	0.004	-0.010*	0.002	-0.006	0.004	-0.003	0.003
Que	0.075*	0.006	-0.042*	0.001	-0.023*	0.001	-0.010*	0.005
Ont	-0.003	0.003	0.002	0.002	0.001	0.005	0.000	0.002
BC	0.011*	0.004	-0.006*	0.002	-0.004	0.004	-0.002	0.002
Inc	-0.008*	0.002	0.005*	0.001	0.003*	0.001	0.001**	0.001
Age1	-0.005**	0.003	0.003	0.002	0.002	0.005	0.001	0.002
Age2	0.004	0.004	-0.002	0.002	-0.001	0.004	-0.001	0.002
Age3	0.012*	0.004	-0.006*	0.002	-0.004	0.004	-0.002	0.002
Age4	0.004	0.004	-0.002	0.002	-0.001	0.004	-0.001	0.002
Poc	-0.021*	0.003	0.011*	0.002	0.007	0.006	0.003*	0.001
Educ	-0.006*	0.002	0.003*	0.001	0.002*	0.001	0.001**	0.001
NFPanel	-0.018*	0.003	0.010*	0.002	0.006	0.005	0.003*	0.001
FGuide	-0.025*	0.002	0.014*	0.002	0.008	0.006	0.004*	0.001
HB	-0.005*	0.001	0.003*	0.001	0.002*	0.000	0.001**	0.000

*Denotes significance at the 5% level; ** denotes significance at the 10% level