Factors influencing Malaysian consumers' consumption of dairy products

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Contributed paper prepared for presentation at the 56th AARES annual conference, Fremantle, Western Australia, February7-10, 2012

Abstract:

Increasing demand for dairy products in Malaysia is driving government initiatives and structural change in the domestic dairy industry in order to increase competitiveness and self-sufficiency. This study endeavours to investigate the drivers of increasing dairy demand by examining the factors influencing Malaysian consumers' consumption and perceptions of various types of dairy products. A survey of 435 respondents was conducted and the data were analysed using logit models. The results indicate that demographic variables such as age and ethnicity as well as other attitudinal variables significantly influence consumers' increasing consumption of dairy products. Managerial recommendations for the domestic dairy industry are suggested and policy implications are discussed.

Keywords: Dairy products, consumers, milk consumption, Malaysia

1. Introduction

Similar to many Asian countries, significant transformation is occurring in Malaysia's food marketing system as a result of industrialization, economic growth, urbanization, globalization and trade liberalization (Arshad, Mohamed & Latiff, 2006). These changes have led to more affluent consumers who demand higher quality food products which are differentiated through branding, labelling information and a variety of quality attributes to meet consumers' increasingly diverse needs and preferences (Ishida, Law & Aita, 2003). Additionally, as consumers become more educated they tend to become more conscious about health and wellness issues related to food choices and diet (Quah & Tan, 2010). All of these factors are driving shifts in Asian diets away from starch-based staples (e.g. rice) and increasing demand for wheat-based, meat and dairy products as well as fruits and vegetables (Prescott, Young, O'Neill, Yau, & Stevens, 2002; Warr, Rodriguez & Penm, 2008).

Food consumption patterns in Malaysia appear to be evolving in a similar pattern to other emerging Asian economies, most notably Thailand, China and the Republic of Korea (Ishida et al., 2003; Warr et al., 2008). Per capita consumption of livestock products in Malaysia, including dairy, is substantially below Organisation for Economic Cooperation and Development (OECD) countries such as the United States, Australia and Japan. Yet, compared to Thailand, China and the Republic of Korea, per capita consumption of livestock products is relatively high. For example, in 2005 (the latest consumption data available), Malaysians consumed approximately 44 kilograms (kgs) of milk per person a year, compared to 25, 18 and 40 kgs in Thailand, China and the Republic of Korea, respectively (Warr et al., 2008). From 1990 to 2005, per capita consumption of fresh whole milk increased 33% from 32.9 kgs to 43.5 kgs. Dong (2006) and Beghin (2006) projected that dairy consumption in Malaysia will continue to increase substantially over the next ten years due to continued population and income growth.

Unlike, the domestic fruit, poultry, pig meat sectors, the Malaysian beef and dairy industries are relatively small. Various conditions, such as the hot and humid climate and limited land availability and a structure consisting of mostly smallholders with small herds have constrained domestic productivity, leading to cheaper imports and Malaysia's low level of self-sufficiency (approximately 5% in 2010) for beef and dairy (Warr et al., 2008). In 2005 imports of dairy products were valued at approximately USD $444 million and accounted for the second-

largest share of agricultural imports into Malaysia. In 2010, imports of dairy products by the government increased by 16% from 2005 (Department of Statistics, Malaysia, 2010).

A range of Malaysian government research and development programs and initiatives have been implemented over the years in an attempt to encourage growth of the domestic beef and dairy industries and increase productivity. Examples include the establishment of Milk Collection Centres (MCC), the introduction of more productive dairy breeds and the improvement of veterinary and extension services (Boniface, Gyau, Stringer & Umberger, 2010). Various scholars have studied the Malaysian dairy sector and have suggested methods to help increase the competitiveness and to grow the domestic dairy industry, including reducing production costs by increasing promoting integrated farming methods (Wan Hassan, Phipps & Owen, 1989), improving animal husbandry and management by using computerised record systems (Pharo et al., 1990) and improving the quality of domestic milk supplies (Chye, Abdullah & Ayob, 2004).

More recently, the focus of the Malaysian Government through the *Ninth Malaysia Plan, 2006-2010* is on increasing self-sufficiency by growing domestic dairy production through large-scale commercial farming and value-adding processes (Warr et al., 2008). For this initiative to be successful, the dairy industry must focus not only on increasing production capacity, but also on developing a consumer-focused value chain (Boniface et al., 2010). Currently, there are no known studies examining the factors influencing Malaysian consumers' demand for dairy products. Thus the primary aims of this paper are (1) to explore Malaysian consumers' purchasing patterns, perceptions of and preferences for various types of dairy products; (2) to determine the relative importance of various product attributes and information to Malaysian consumers when purchasing dairy products; and (3) to investigate factors influencing Malaysian consumers increasing demand for dairy products and fluid milk. The findings of this research can be used to improve the management of dairy supply chains, and to develop strategic plans and policies to aid in the development and expansion of the domestic Malaysian dairy industry.

1.1 Factors Influencing Malaysian Food Consumption

Although no studies have specifically addressed the objectives related to Malaysians' dairy consumption behaviour explored in this research, several studies have examined Malaysians' food consumption trends and factors influencing their demand for food products which may be

considered to be higher quality or perceived to be safer or healthier (e.g. organic, natural, MSG-free meat). Recent consumer research suggests that Malaysian food consumption is becoming increasingly diverse and consumers are growing more concerned about the quality, safety and nutritional content of their food (Ishida et al., 2003; Liana, Radam &Yacob, 2010 ; Prescott et al., 2002; Rezai, Mohamed, & Shamsudin, 2011).

A number of consumer characteristics such as socio-demographics (e.g. gender, age, income, education, presence of young children in the household, ethnicity), knowledge, attitudes and perceptions have been shown to influence Malaysian consumers' demand for quality-differentiated food products (Ong, Kitchen, & Jama, 2008; Prescott et al., 2002; Quah & Tan, 2010; Radam, Yacob, Siew Bee & Selamat, 2010; Rezai, Mohamed, Shamsudin & Chiew, 2010; Rezai, et al., 2011; Shaharudin, Pani, Mansor, Elias, & Sadek, 2010; Sheng, Shamsudin, Mohamed, Abdullah & Radam, 2008). Additionally, extrinsic product cues such as packaging, food labels, quality certifications, brands and promotional /marketing material can influence both consumers' perceptions and choices of food products (Liana et al., 2010; Ong et al., 2008; Prescott et al., 2002).

Several studies suggest that ethnicity has a significant impact on Malaysians' food consumption preferences and behaviour. Quah and Tan (2010), Sheng et al. (2008) and Warr et al. (2008) found Malaysians' food consumption patterns to be significantly different across three ethnic groups: Malay (approximately 50%), Chinese (25%) and Indian or other ethnic backgrounds (25%). Generally speaking, the Malays are predominantly Muslim and require food to be *Halal* certified. Chinese and Indian consumers tend to have more diverse diets, particularly with respect to consumption of proteins (Warr et al., 2008). The Malay segment is experiencing the largest growth both in terms of size and household income. Malays are demanding more functional fruit and vegetable food products rather than higher valued meat and fish products (Quah & Tan, 2010; Sheng et al., 2008). Quah and Tan (2010) found that Malay and Chinese consumers more likely to purchase organic food products than Indian or other ethnicities.

Several studies have found that gender and the presence of children in the household significantly influence food purchasing decisions. Malaysian men were found to spend significantly more than women on food and beverages away from home (Ong et al., 2008). Radam et al. (2010) found that females were generally more health-conscious than men and consumers in households with children less than 12 years of age were generally less concerned

about price and more interested in purchasing safe and wholesome food. Additionally, females were more likely to be willing to pay a premium for "MSG-free" meat, but consumers from households with four or more people, including children tended to be more price sensitive and less likely to pay a premium for "MSG-free" meat. Consistent with organic consumer studies in other countries, Quah and Tan (2010) found that women are significantly more likely than men to purchase and consumer organic food.

In addition to ethnicity, gender and household composition, other demographic variables such as income, education and age have been found to significantly influence Malaysian's food consumption. Higher income consumers were more likely to purchase organic food products (Quah & Tan, 2010; Rezai et al., 2011) and more likely to be willing to pay a premium for "MSG-free" meat (Radam et al., 2010). Rezai et al. (2011) found that respondents who had completed some level of tertiary education were more likely to buy organic vegetables, which were perceived by respondents to be 'healthier,' and Radam et al., 2010 found consumers with some University education were more likely to pay a premium for "MSG-free" meat.

Malaysian consumers between the age of 20 and 40 years old were found to purchase more organic and 'healthy' food while consumers aged 65 and over were found to spend relatively more on beverages and tobacco products (Ong et al., 2008; Rezai et al, 2011). When examining the relationship between age and organic food consumption, Quah and Tan (2010) found that for each 10-year increase in age, Chinese-Malaysian consumers are about 11% more likely to purchase organic food products. Interestingly, age was not a significant variable in the Malaysian consumer models examining Malay and Indian consumers' organic food purchases.

As well as the socio-demographic factors discussed above, extrinsic cues, particularly quality or production certifications authorized by government agencies or religious organizations (e.g. *Halal*), have been found to significantly influence Malaysians' food purchase decisions. For example, Rezai et al. (2011) and Liana et al. (2010) found that Malaysian consumers were more likely to purchase organically grown vegetables and meat products, respectively, certified by a government agency versus products not carrying the government certification. These studies shed light on the various factors which influence Malaysian consumers' preferences and purchases for food products. The following section summarizes key literature related to the increasing global consumption of dairy products.

1.2 Factors Influencing Consumption of Dairy Products

As discussed previously, global demand for dairy products is increasing dramatically as consumers in developing countries become more affluent (Ishida et al., 2003; Warr et al., 2008). Much of this demand growth is driven by growing evidence and awareness that dairy products can provide essential vitamins and nutrients as well as other health benefits (Heaney, 2000; McGill et al., 2008; Wang, Manson, Buring, Lee & Sesso, 2008). An example of this change can be seen in Malaysia, where traditionally, the morning meal (breakfast) consisted of rice or noodles, but has now significantly shifted to milk, bread and butter. Malaysians also now spend more on milk and dairy products than rice (Ishida et al., 2003).

Consumers' behaviour, preferences and attitudes towards consumption of dairy products differs substantially across countries (Bus & Worsley, 2003; Francesconi, Heerink & D'Haese, 2010; Grunert, TionBeck-Larsen & Bredahl, 2000; Hatirli, Ozkan, & Aktas, 2004; Hsu & Lin, 2006; Richardson-Harman, 2000; Robb & Abdel-Ghany, 2007; Yee & Chin, 2007). Grunert et al. (2000) discuss that consumers' perceptions of dairy product quality are complex and involve much more than sensory attributes. They contend that consumers consider four dimensions when forming perceptions about dairy product quality: (1) hedonic (e.g. sensory attributes such as taste or smell), (2) health-related, (3) convenience-related and (4) process-related (e.g. production processes such as organic, animal welfare or genetic modification). Thus, manufacturers/ processors and marketers must understand the role each of these dimensions plays in driving consumer demand for dairy products and realize consumers may be heterogeneous in their preferences or perceptions of what constitutes dairy product quality.

Richardson-Harman et al. (2000) were able to segment the New Zealand dairy market based on consumers' preferences for creaminess and liking of fluid dairy products, demographic characteristics and attitudinal variables. Bus and Worsley (2003) found Australian consumers perceived whole milk to be of lower quality than other types of milk. In particular, women and elderly consumers were more likely to consume reduced fat milk versus milk with higher fat content. A similar study of U.S. consumers found low fat milk consumption was positively related to age, education level and income (Robb & Abdel-Ghany, 2007). Taiwanese consumers who purchased relatively greater amounts of fluid milk had statistically higher levels of household incomes than consumers who purchased mostly yogurt drinks and flavoured milk (Hsu & Lin, 2006). In Turkey, households' choice of fluid milk sources was found to be

significantly influenced by the number of children living in the household and education levels of the respondent (Hatirli et al., 2004).

Only a few studies have examined Malaysian households' dairy consumption patterns (Babolian Hendijani & AbKarim, 2010; Norimah et al., 2008; Prescott et al., 2002). Malaysian consumers rated health as the most important factor when purchasing powdered milk and product familiarity as the least important (Prescott et al., 2002). The 2003 Malaysian Adults Nutrition Survey examined the food consumption patterns of 6,742 consumers aged 18 to 59 years. The study revealed that adults aged 50-59 were the most frequent consumers of full cream milk, and only 15% of consumers under age 20 consumed milk daily (Norimah et al., 2008). Women were more likely to consume full cream milk daily while men were more likely to prefer and consume less-healthy sweetened condensed milk daily. Norimah et al. (2008) suggest that this difference is likely due to women being more knowledgeable than men about potential health benefits of consuming milk.

To determine how milk intake could be increased among children, Babolian Hendijani and AbKarim (2010) studied the relationships between personal and environmental factors and beverage consumption preferences of primary school children in Malaysia. Consumption of milk relative to other beverages (e.g. mineral water, Milo, and fruit juice) among children was relatively low; and not surprisingly, children preferred flavoured milk to plain milk. Individual positive attitudes about the sensory aspects of milk, social acceptability (e.g. having family and friends who regularly consumed milk), availability of milk at home and packaging were more likely to positively influence milk consumption among children than exposure to advertising or awareness of the health benefits. Bobolian Hendijani and AbKarim (2010) suggest that the most efficient way to increase milk intake of children is to focus on increasing the social acceptability of milk through marketing campaigns to increase consumers' perceptions of the sensory aspects of milk.

The above literature summarizes the key factors shown to affect consumption behaviour of food products, particularly products such as dairy which are often associated with nutritional and health benefits. This research endeavours to add to this literature by increasing of Malaysians' dairy product consumption behaviour, attitudes and perceptions regarding various types of fresh and processed dairy products. The remaining sections summarize the research methods, results and conclusions.

2. Materials and Methods

2.1 Survey instrument and design

In order to understand Malaysian consumer's preferences and consumption patterns, a questionnaire /survey instrument was designed to ascertain information on (a) consumers' purchasing frequency and consumption patterns of several fresh and processed dairy products, (b) the relative importance of factors which may influence purchases and purchase location of dairy products, (c) perceived benefits gained from consuming dairy products (d) perceptions of fluid milk compared to powdered milk products and (e) socio-demographic information. This consumption behaviour and attitudinal questions were developed based on the literature discussed previously and additional related consumer studies including Jensen, Kesaven and Johnson (1992) and Hsu and Lin (2006).

The purchasing frequency and consumption patterns section asked consumers to indicate how frequently (5 = daily and 0 = never) they purchased fluid milk, milk powder, cheese, yogurt, butter and ice cream. Respondents were asked if they had increased their consumption of dairy products in the last three years, and if so, which products were applicable. A seven-point scale was used by respondents to determine the perceived influence (7 = strongly influential and 1 = not at all influential) of 16 factors to respondents when purchasing (1) dairy products in general and (2) fluid milk. These factors were related to health /nutrition, convenience, quality, affordability, packaging and marketing aspects of dairy products. Respondents were then asked to state the most preferred retail format for purchasing dairy products, and to indicate, using a seven-point scale, the influence of 10 different retail format characteristics (e.g. availability of products, play in determining where dairy products were purchased.

To determine respondents' attitudes towards dairy products (in general) respondents indicated how strongly they agreed or disagreed (1 = strongly disagree and 7 = strongly agree) with 16 statements regarding the quality and acceptability of dairy products. Both positive and negative statements were included in this section to avoid biasing answers. These statements related to health aspects (e.g. good source of protein, good source of vitamins, good source of calcium, dairy is fattening), sensory and social acceptability aspects. Consumers' perceptions of the quality of fresh (fluid) milk relative to powdered milk were then assessed by asking respondents to indicate how strongly they agreed (1 = strongly disagree and 7 = strongly agree)

with 20 statements similar regarding product quality and acceptability. All four quality dimensions discussed by Grunert et al. (2000) were included in these attitudinal questions.

Respondents then indicated their awareness and opinion of the Government's school milk program. The final section assessed socio-demographics of respondents (e.g. age, level of education, income, and household makeup). The questionnaire was pre-tested with 30 consumers. Respondents involved in the pre-test were asked to provide feedback on the length, content, format, comprehensibility and accuracy of the survey instrument. After each stage of pre-testing, the questionnaire was modified; incorporating the feedback and revising the survey instrument accordingly.

2.2 Data collection

The survey was administered and data was collected in 2010 at various locations in Kota Kinabalu, the capital city of the Sabah state of Malaysia. This city is one of the fastest emerging consumer markets in Malaysia with increasing numbers of modern food retailers, including supermarkets and hypermarkets such as Giant, Parkson, Ngiu Kee, and Survey supermarkets. The population of Kota Kinabalu is very culturally diverse and is comprised of consumers with all of various ethnic and religious backgrounds existing in the Malaysian population. A convenience sample of 435 consumers was obtained using mall intercept recruitment methods and face-to-face interviews. Each respondent was randomly approached by a trained enumerator placed in front of one of 12 shopping centres located in Kota Kinabalu. Respondents who were 18 years and older were asked to fill in the questionnaire by completing an interview with the enumerator. A token of appreciation /gift was provided to each respondent upon completion of the survey. Table 1 provides a summary of the socio-demographic profile of the respondents.

Table 1:

Summary statistics for demographic variables

Variable	Description (coding)	%	Mean	Std. Dev.	N
Level of education	0 = Primary school	6.9	1.43	0.85	435
	1 = Secondary school	58.6			
	2 = Technical institutions, Polytechnic	20.7			
	3 = University degree	12.4			
	4 = Graduate degree, Master, PhD	1.4			
Education	0= if having primary and secondary schools	86	0.14	0.35	435
	1= if having tertiary education	14			
Age	0 = 18-24 years	43.7	0.99	1.15	435
	1 = 25-34 years	31.3			
	2 = 35-44 years	12.4			
	3 = 45-54 years	8.7			
	4 = 55-64 years	3.0			
	5 = 65 years and above	0.9			
Income	Monthly household income in Malaysian Ringgits		1.50	0.99	435
	0 = < MYR 2,079	64.4			
	1 = MYR 2,080-MYR 4,159	26.0			
	2 = MYR 4,160-MYR 6,239	4.8			
	3 = MYR 6,240-MYR 8,319	1.8			
	4 = MYR 8,320-MYR 10,399	2.1			
	5 = MYR 10,400-MYR 15,599	0.9			
Household size	Numbers of family members including children and elderly (over 60 years old)		4.31	2.79	435
Children	Number of dependent children aged between 0-14 years old*		0.88	1.36	435
Wchild	1= if Yes, children aged 0-14 live in the household; 0 = if No		0.38	0.49	435
Elderly	Numbers of individuals living in household that over 60 years of age and above		0.25	0.82	435
Single	0= if married, divorced/ widowed	46	0.54	0.50	435
	1= if single and not married	54			

Table 1:

Summary statistics for demographic variables

Variable	Description (coding)	%	Mean	Std. Dev.	N
Gender	0 = if male	65	0.35	0.48	435
	1 = if female	34			
Employment	0 = if unemployed, stay at home parent, retired and disabled.	17	0.83	0.38	435
	1= if working part time and full time,	83			
Ethnicity	1 = Malay	27.1	NA	2.12	435
	2 = Chinese	12.6			
	3 = India	9.0			
	4 = Kadazandusun	28			
	5 = Bajau	23.4			
	6 = Murut	1.4			
	7 = Iban	2.0			
	8 = Bidayuh	7.0			
	9 = Others	5.5			
Fluid Milk Expense	Fresh milk is cheaper and less expensive		3.78	1.66	435

* Note: Malaysian government promotes School Milk Program (provides free fluid milk to school) which include children under 14 years old.

2.2 Data analysis and model development

Several steps were involved in data analysis and development of empirical models to determine factors influencing dairy consumption behaviour. The Data Analysis and Statistical Software (STATA) package (version 10) was used for all statistical analysis. The first step involved basic statistical analysis and evaluation of consumers' responses to the survey question. The initial analysis revealed that consumers' responses to several of the attitudinal statements were highly correlated. Therefore, principal component analysis was used to create various attitudinal variables to be used in models to help explain consumers' dairy consumption behaviour.

2.2.1 Principal Component Analysis

The results of the Principal Component Analysis (PCA) are shown in Table 2. Varimax rotation was used to determine the dimensionality of the variables considered. Factors with Eigen Values of above 1.00 were extracted and factors loading above 0.5 were retained. Five factors: *Nutrition, External, Dairy Negative, Milk Negative, Dairy Packaging* had loadings within the acceptable range of higher than 0.50 (0.680-0.867) and were retained. The variables were named based on the statements/items that were used to form the variable. For instance, *Nutrition* factor is based on consumers' indicated level of agreement with statements that dairy products are 'a good source of calcium' and 'a good source of protein'. The *External* factor consists of consumers' responses related to the influence of social status, family or friends, embedded with *Halal* logo.*Milk Negative* is composed of respondents' agreement with three statements related to negative perceptions of fluid milk: hard to digest, watery and genetically modified. *Dairy Packaging* is a factor representing the relative importance that consumers placed on the type of packaging used for dairy products, the brand of milk and availability of product information on the label or package.

The Kaiser-Meyer-Olkin Measure of sampling adequacy (KMO-MSA) was used to test the appropriateness of the factor analysis scale. As shown in Table 2, all of the KMO values are between 0.500 to 0.920, which is within the accepted region (KMO greater than or equal to 0.50). A reliability test using the Cronbach Alpha was conducted to purify the measurement scale for each of the constructs used in the study. The alpha coefficients for most of the components were above the conventional cut off point of 0.60 (Boniface et al., 2010).

Table 2:

Principal Component Analysis Results

Factors and Related Statements from Survey	Factor Loadings
Nutrition Factor:	
KMO.920, Cronbach's alpha = .917	
Dairy products are a healthy choice for me and my family	0.867
Dairy products are a good source of vitamins	0.861
Dairy products are a good source of protein	0.856

Dairy products are a good source of calcium	0.843
Dairy products provide many good nutrients	0.834
Dairy products are low in cholesterol	0.801
Dairy products are a good source of vitamin D	0.716
Dairy products are necessary in my diet	0.680
External Influencing Factor	
KMO .663, Cronbach's alpha = .704	
Family or friends influence my purchases of dairy products	0.820
Consumption of dairy impacts my social status	0.819
Product is embedded with*Halal* logo	0.745
Dairy Negative Factor	
KMO .500, Cronbach's alpha = .650	
Not all dairy products are good for my health	0.861
Dairy products too fattening	0.861
Milk Negative Factor	
KMO = .677, Cronbach's alpha = .0.729	
Hard to digest	0.836
Watery	0.798
Genetically modified	0.786
Dairy Packaging	
KMO = .680, Cronbach's alpha = .740	
Type of Packaging (e.g. in bottle/ boxes)	0.838
Milk brand (e.g. Nestle, Dutch Lady)	0.813
Complete label information (e.g. Expiration date, nutrition information)	0.783

2.2.2 Empirical models

Two logit models were used to 1) determine the factors that help explain consumers who are more likely to have increased their consumption of dairy products over the past three years and 2) to understand the factors influencing the probability a consumer increased their consumption of dairy products over the past three years. The traditional logit model as described by Greene (2003) is

$$(1)\ \Pr ob(Y=1 \mid X_i) = \frac{e^{x'\beta}}{1+e^{x'\beta}}.$$

The first model explores the factors which help explain the probability an individual increased their consumption of dairy products over the past three years:

$$(2) CONSUP_i = \beta_o + \beta_1 Education + \beta_2 Age + \beta_3 Wchild + \beta_4 Gender + \beta_5 Chinese + \beta_6 Malay + \beta_7 Income + \beta_8 Elderly + \beta_9 Nutrition + \beta_{10} External + \beta_{11} DairyNegative + \beta_{12} Packaging$$

Where the dependent variable *CONSUP* is used to represent consumers who indicated that "yes" they had increased their consumption of dairy products in the last three years. Thus *CONSUP* is equal to 1 if a consumer increased their dairy consumption in the last three years and is equal to 0 otherwise. The subscript *i* is used to represent each individual consumer (*i*=1…435). *Education* is a dummy variable equal to 1 if the respondent acquired higher levels of education (a university degree or at least some postgraduate studies) and equal to 0 if the respondent acquired lower levels of education (e.g. primary, secondary and polytechnic levels of education). *Age* is a categorical variable representing the age level of the respondent. *Wchild* is a dummy variable indicating the presence of children in the household. *Gender* is a dummy variable indicating the respondent was a female. *Chinese* and *Malay* are ethnicity dummy variables equal to 1 if the respondent was Chinese and Malay, respectively, and equal to 0 if the respondent was another ethnicity such as Kadazandusun, Bajau or Indian. *Elderly* is the number of elderly (age above 60 years old) people living in the household. *Nutrition*, *External*, *Dairy Negative*, and *Packaging* are the factors created using Principal Component Analysis (see Table 2).

The second model explores the factors which may explain the probability an individual consumer increased their consumption of milk in the last three years:

$$(3) CONSUMILK_i = \beta_o + \beta_1 Education + \beta_2 Age + \beta_3 Wchild + \beta_4 Gender + \beta_5 Chinese + \beta_6 Malay + \beta_7 Income + \beta_8 Elderly + \beta_9 Nutrition + \beta_{10} External + \beta_{11} DairyNegative + \beta_{12} MilkNegative + \beta_{13} FluidMilkExpense$$

The dependent variable *CONSUMILK* is equal to 1 if a consumer indicated they increased their consumption of fresh milk in the last three years and is equal to 0 otherwise. The demographic variables *Education, Age, Wchild, Gender, Chinese, Malay, Income, Elderly* are as defined in equation 2. *Nutrition, External, Dairy Negative* and *Milk Negative* are also as explained in the Principal Component Analysis section. We created composite measures by combining two or more related statements (O'Toole & Donaldson, 2000). For instance, one variable such as *Dairy Negative Factor* derived from two related statements namely "Not all dairy products are good for my health" and "Dairy products too fattening." Another variable (*FluidMilkExpense*) was developed from a single statement (Fresh milk is cheaper and less expensive). A single statement can be used as composite measure if the statement is composite in nature and represent the intended variable (Gyau & Spiller, 2007). Summary statistics and further explanations of each of the variables are provided in Tables 1 and 2.

3.0 Results and discussion

3.1 Characteristics of survey respondents

In total, 435 respondents fully completed the questionnaire. The socio-demographic profiles of the respondents are summarized in Table 1. Approximately 65% of the sample was female, the average age was between 24-34 years old and average income was around MYR 2,080 to MYR 4,159 monthly. Only 14% of respondents indicated they had completed a University degree or higher level of education. The average household size was 4.31 family members and 38% of the respondents had children aged 14 or younger living at home.

3.2 Preferences of the dairy consumers

In this study we examined consumers' purchasing behaviour of six types of dairy products: fresh milk (fluid milk including pasteurised and UHT milk), powdered milk, butter, cheese (any type), yogurt and ice-cream. Table 3 shows respondents' purchasing frequency for each dairy product. Fluid milk and ice cream are consumed most frequently, with nearly 41% and 34%, respectively, purchasing these products at least weekly. Powdered milk is also purchased regularly (considering the mean consumption frequency), however, the largest share of respondents (22%) purchase powdered milk on a monthly basis. Interestingly, cheese is the least frequently purchased dairy product, with 61% indicating they never purchased cheese.

Table 3:

Consumers' purchasing frequency of various dairy products

Dairy Product	5 = Daily	4 = Weekly	3 = Fort-nightly	2 = Monthly	1 = < once/ month	0 = Never	Mean	Std. Dev.	N
Milk	12.4%	28.5%	16.6%	23.7%	6.0%	12.9%	1.94	1.46	435
Powdered Milk	3.9%	9.9%	12.4%	22.3%	9.7%	41.8%	1.21	1.31	435
Cheese	1.1%	6.7%	6.0%	11.7%	14.0%	60.5%	0.68	1.02	435
Butter	1.4%	6.9%	7.1%	18.2%	17.2%	49.2%	0.89	1.08	435
Ice Cream	8.7%	25.1%	14.9%	12.4%	10.6%	28.3%	1.49	1.47	435
Yogurt	2.5%	11.7%	10.6%	9.4%	12.9%	52.9%	0.89	1.20	435

Table 4 shows the various store characteristics that influence consumers' decision on where to purchase dairy products. Based on the mean values, cleanliness of the store, convenient location and the availability of higher quality dairy products appear to be the three most important characteristics influencing where consumers purchase their dairy products. The opportunity to socialize was least influential.

Table 4:

Factors influencing retail outlet where dairy products are purchased

Factor	0 = Strongly not influential	1= Not influential	2= Somewhat not influential	3= Neither	4= Somewhat influential	5= Influential	6= Strongly influential	Mean	Std. Dev.	N
Cleanliness of store	3.9%	3.9%	3.0%	3.0%	13.6%	27.1%	45.5%	4.82	1.60	435
Convenient location	3.9%	5.5%	2.3%	3.2%	14.7%	32.6%	37.7%	4.68	1.62	435
Availability of higher quality products	5.5%	4.1%	3.0%	3.9%	13.6%	33.1%	36.8%	4.62	1.68	435
Product variety& availability	5.3%	6.9%	4.6%	5.3%	18.4%	35.2%	24.4%	4.28	1.72	435
Knowledgeable staff	7.1%	6.4%	5.1%	8.5%	19.3%	25.5%	28%	4.15	1.84	435
Good reputation	6.4%	9.9%	5.5%	6.4%	20.4%	27.4%	23.9%	4.02	1.86	435
Speed, efficient shopping experience	7.8%	9.2%	4.6%	5.1%	20.7%	31.3%	21.4%	4.01	1.87	435
Social opportunities	10.1%	13.3%	7.6%	14.3%	20.2%	20.7%	13.8%	3.38	1.91	435

Consumers were also asked to rate the importance (influence) of 16 different factors when purchasing dairy products. Considering the mean values displayed in Table 5, information displayed on the label, perceived health benefits gained and *Halal*-certified are the most influential factors. Quality certifications by an international agency and brand are also considered to be "somewhat influential" to respondents when purchasing dairy products.

Table 5:

Factors influencing consumers' dairy product purchasing behaviour

Variables	0 = Strongly not influential	1 = Not influential	2 = Somewhat not influential	3= Neither	4 = Somewhat influential	5= Influential	6 = Strongly influential	Mean	Std. Dev.	N
Household necessity	13.8%	11.3%	6.2%	5.7%	14.3%	23.7%	25.1%	3.67	2.16	435
Product price	6.4%	13.3%	10.8%	6.2%	21.1%	24.1%	17.9%	3.66	1.89	435
Milk brand	6.9%	9.0%	4.8%	5.3%	14.9%	37.0%	22.1%	4.12	1.84	435
Packaging	5.3%	11.7%	7.4%	8.5%	21.4%	29.0%	16.8%	3.83	1.79	435
Health benefits	5.7%	5.3%	4.4%	4.4%	16.1%	29.2%	34.9%	4.47	1.76	435
Locally produced	7.8%	9.4%	7.1%	7.4%	21.4%	26.4%	20.5%	3.86	1.88	435
Imported	9.2%	15.2%	8.7%	10.6%	20.5%	24.8%	11.0%	3.37	1.90	435
Complete label information	4.8%	6.0%	4.4%	4.4%	8.7%	26.4%	45.3%	4.67	1.78	435
Milk location	6.4%	12.0%	5.5%	8.7%	17.2%	24.8%	25.3%	3.94	1.92	435
Affordable	6.2%	8.5%	8.3%	6.9%	24.6%	24.4%	21.1%	3.93	1.80	435
Frequently advertised	8.0%	13.1%	6.4%	10.8%	21.6%	21.1%	18.9%	3.64	1.92	435
Company marketing package	9.0%	12.0%	4.8%	10.8%	22.8%	26.9%	13.1%	3.58	1.88	435
Quality verified by international agency	5.8%	7.1%	6.5%	6.9%	20.0%	23.7%	30.0%	4.19	1.82	435
Family or friends influence	7.1%	12.9%	7.1%	11.7%	23.0%	23.9%	14.3%	3.59	1.83	435
Social status	10.3%	16.6%	8.3%	12.4%	22.5%	19.5%	10.3%	3.20	1.89	435
Embedded with Halal logo	9.9%	6.9%	3.2%	5.5%	8.0%	16.6%	49.9%	4.44	2.09	435

Respondents also indicated how strongly they agreed or disagreed with several statements revealing their perceptions of fluid milk. Considering the mean level of agreement for each statement (Table 6), it appears that consumers generally agreed that fluid milk is easy to purchase, durable, a good source of protein, calcium and vitamins and healthy.

Table 6:

Consumers' perceptions of fluid milk

Fresh milk is…	0 = Strongly disagree	1= Disagree	2= Somewhat disagree	3= Neither	4= Somewhat agree	5 = Agree	6= Strongly agree	Mean	Std. Dev.	N
More environmentally friendly	3.0%	10.3%	4.8%	13.8%	21.8%	32.9%	13.3%	3.93	1.61	435
Necessary in my diet	2.1%	10.1%	5.7%	14.0%	23.7%	33.3%	11.0%	3.91	1.54	435

Table 6 (continue):

Consumers' perceptions of fluid milk

Fresh milk is…	0 = Strongly disagree	1= Disagree	2= Somewhat disagree	3= Neither	4= Somewhat agree	5 = Agree	6= Strongly agree	Mean	Std. Dev.	N
Cheaper, less expensive	4.4%	9.4%	8.7%	12.9%	21.8%	31.0%	11.7%	3.78	1.66	435
Feels good in the mouth	4.1%	13.6%	9.9%	16.1%	19.1%	27.6%	9.7%	3.54	1.7	435
A good source of vitamins	2.1%	4.1%	4.1%	9.7%	16.1%	43.2%	20.7%	4.46	1.42	435
Hard to digest	8.3%	15.9%	7.8%	18.4%	18.2%	23.0%	8.5%	3.25	1.8	435
Convenient to drink	1.8%	7.4%	4.4%	8.7%	14.3%	45.3%	18.2%	4.35	1.51	435
Genetically modified	3.0%	7.8%	5.3%	15.6%	20.2%	37.5%	10.6%	3.97	1.53	435
Easily purchased from the shop	2.1%	2.5%	3.7%	4.8%	10.8%	51.2%	24.9%	4.73	1.32	435
Watery	10.3%	23.4%	6.9%	14.9%	19.1%	19.1%	6.2%	2.91	1.86	435
Low in cholesterol	3.2%	6.9%	4.8%	14.0%	19.3%	38.2%	13.6%	4.08	1.55	435
Higher quality	3.9%	7.4%	6.7%	12.0%	24.1%	32.0%	14.0%	3.97	1.6	435
Fresher	3.9%	12.2%	7.1%	14.9%	16.6%	33.8%	11.5%	3.75	1.7	435
Tastes better	3.2%	10.3%	6.4%	13.6%	19.5%	34.5%	12.4%	3.89	1.63	435
Healthy for me and my family	2.1%	2.3%	6.4%	12.6%	22.3%	37.2%	17.0%	4.31	1.37	435
Packaged better	1.4%	5.3%	5.3%	12.2%	18.6%	41.4%	15.9%	4.53	1.25	435
Creamy	1.4%	5.3%	5.3%	12.2%	18.6%	41.4%	15.9%	4.29	1.41	435
A good source of calcium	1.1%	2.1%	3.7%	7.4%	13.6%	50.6%	21.4%	4.68	1.22	435
Durable and long-lasting	1.8%	2.5%	3.4%	7.1%	11.7%	44.4%	29.0%	4.73	1.34	435
A good source of protein	1.8%	1.8%	3.7%	6.2%	13.6%	49.2%	23.7%	4.7	1.27	435

To understand how consumption of dairy products is changing in Malaysia, consumers were asked if they had increased their consumption of dairy products in the past three years. If consumers indicated they had increased their consumption then they were asked to indicate which products they were consuming more of over time. Interestingly, 72% of the respondents indicated "yes" they had increased their consumption of dairy in the last three years. This is not surprising considering the projections discussed in the literature earlier (Prescott et al., 2002; Warr et al., 2008). The percentage of respondents indicating they had increased consumption of each of the six dairy products are displayed in Figure 1. Nearly one-third (32%) of consumers indicated they increased their consumption of fluid milk, roughly one-fifth (21%) increased

consumption of powdered milk (21%), 15% increased consumption of ice-cream and approximately 10% increased consumption of yogurt, butter and cheese.

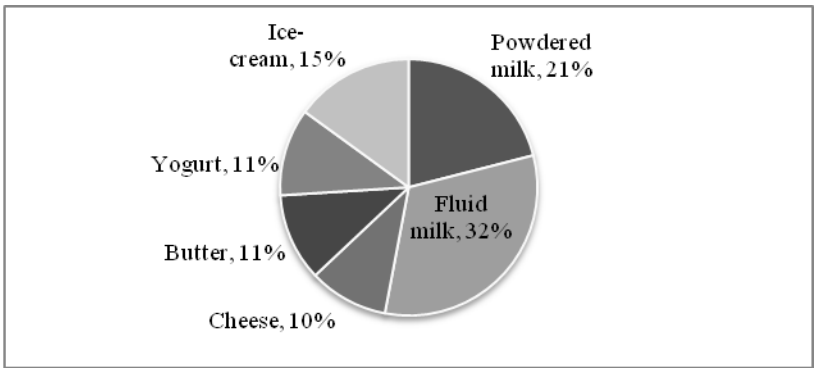

Figure 1. Share of Malaysian consumers who increased consumption of dairy products over last three years

3.3. Empirical analysis

The logit model results are shown in Table 7 and Table 8. Both of the models were significant at $\alpha = 0.01$ and with the Chi Square values equal to 45.76 and 47.21, respectively.

3.3.1 Factors influencing increased consumption of dairy products

The results of the logit estimation of Equation 2 are presented in Table 7, including estimated coefficients and marginal effects. In total, only four of the independent variables were significant in predicting consumers who were more likely to have increased their consumption of dairy products in the past three years. Two demographic variables and two factors were significant and positive: *Age, Malay, Nutrition* and *External* . As *Age* increases by one category the probability the consumer increased their consumption of dairy products in the last three years increased by 7%. Thus, older consumers in this study tend be more likely than young consumers to have increased their consumption of dairy products. This outcome is consistent with previous dairy consumption behaviour research by Bus and Worsley (2003), Jensen et al. (1992), Robb et al. (2007).

With respect to ethnicity, *Malay* was significant at the $\alpha = 0.05$ level and based on the marginal effects, consumers who were Malay in ethnicity were 11% more likely to have increased their consumption of dairy products in the last three years than consumers from other ethnic backgrounds. The result suggests that Malays, the largest ethnic category in Malaysia, are

changing their lifestyles toward healthy and nutritional food. This finding is supported by Quah and Tan (2010) who found that Malay and Chinese were highly concerned with the healthiness and nutrition of their food.

Table 7:

Estimated coefficients and marginal effects for equation estimating the probability consumers increased their consumption of dairy products

Variable	Coefficient	Std. Error	Marginal Effects	Std. Error	z	P>z
Highedu	-0.46	0.32	-0.09	0.07	-1.35	0.18
Age	0.36	0.12	0.07	0.02	3.03***	0.00
Wchild	0.23	0.26	0.04	0.05	0.91	0.36
Female	0.14	0.24	0.03	0.05	0.57	0.57
Chinese	-0.36	0.33	-0.07	0.07	-1.03	0.30
Malay	0.63	0.28	0.11	0.05	2.43**	0.02
Income	0.18	0.13	0.03	0.02	1.38	0.17
Elderly	0.15	0.15	0.03	0.03	1.03	0.30
Nutrition	0.22	0.12	0.04	0.02	1.82*	0.07
External	0.26	0.14	0.05	0.03	1.88*	0.06
DairyNegative	-0.04	0.12	-0.01	0.02	-0.34	0.73
Packaging	-0.14	0.14	-0.03	0.03	-1.04	0.30
Constant	0.22	0.27				
Number of obs	=	435				
LR chi2(12)	=	45.76				
Prob> chi2	=	0.00				
Pseudo R2	=	0.09				
Log likelihood	=	-233.33				

Notes: *** significant at 0.01, ** significant at 0.05, * significant at 0.10

The variables *Nutrition* and *External* were both significant at $\alpha = 0.10$ level and carry the expected positive sign. The *Nutrition* factor is composed of respondents' level of agreement with statements such as 'dairy products are a good source of nutrients' and 'a good source of protein.'

Considering the marginal effect, consumers who perceive dairy products to be a good source of nutrients are 4% more likely to have increased their consumption of dairy in the last three years. This finding suggests that Malaysian consumers are well aware of the health benefits and nutrition gained in consuming dairy products and this awareness is positively impacting their consumption of dairy. This finding is positive considering several researchers emphasize the vital roles of dairy products in sustaining health and reducing the risk of critical health problems such as breast cancer and osteoporosis (Heaney, 2000; McGill et al., 2008; Wang, et al, 2008).

The factor *External* was derived from statements related to the influence of family or friends, social status and embedded with *halal* logo on dairy consumption. Based on the marginal effect, consumers who believe that their decision to consume dairy products is influenced by these external factors are 5% more likely to have increased dairy product consumption in the last three years. Other studies also found Malaysian consumers' food consumption decisions to be very much influenced by their peers and family (Kamaruddin & Mokhlis, 2003; Quah & Tan, 2011). Furthermore, Quah and Tan (2011) explain that some consumers tend to buy organic food for their sick family member or friends. The outcome further indicates that family and friends play a significant role in influencing dairy consumption.

3.3.2 Factors influencing increased consumption of fluid milk

An additional objective of the research was to understand consumer perceptions of buying fresh milk. It is important to note that in Malaysia, "fresh milk" is used to describe fluid milk that can either be pasteurized or UHT (long-life) milk. Often it is not clear to consumers whether the milk is UHT or pasteurized, yet the shelf-life for UHT milk is relatively long compared to pasteurized milk. Focus groups and pre-testing of the questionnaire revealed consumers were generally unaware of the differences and therefore the term fluid milk is used. Equation 3 was estimated using a logit model to investigate the factors which help explain the probability that a consumer increased their consumption of fluid milk in the past three years.

The results of the logit estimation are shown in Table 8. Interestingly the same independent variables that were significant in explaining the probability consumers increased their consumption of dairy were also significant in this estimation. However, in all cases the marginal effects are larger. As age increases by one category, the probability a consumer

increased their consumption of milk increases by 9%. Consumers who are Malay in ethnicity are 13% more likely to have increased their consumption of fluid milk in the past three years.

Table 8:

Estimated coefficients and marginal effects for equation estimating the probability consumers increased their consumption of fluid milk

Variable	Coefficient	Std. Error	Marginal Effects	Std. Error	z	P>z
Highedu	-0.19	0.31	-0.05	0.08	-0.62	0.53
Age	0.35	0.10	0.09	0.02	3.45***	0.00
Wchild	0.23	0.23	0.06	0.05	1.04	0.30
Female	-0.01	0.22	0.00	0.05	-0.06	0.95
Chinese	-0.26	0.33	-0.06	0.08	-0.77	0.44
Malay	0.56	0.25	0.13	0.06	2.36**	0.02
Income	0.04	0.11	0.01	0.03	0.33	0.74
Elderly	0.08	0.13	0.02	0.03	0.65	0.52
Nutrition	0.24	0.12	0.06	0.03	1.98**	0.05
External	0.24	0.11	0.06	0.03	2.13**	0.03
DairyNegative	0.38	0.40	0.09	0.10	0.95	0.34
NegativeMilk	-0.59	0.41	-0.14	0.10	-1.43	0.15
FluidMilkExpense	0.10	0.08	0.02	0.02	1.32	0.19
Constant	-0.69	0.41				
Number of obs	=	435				
LR chi2(13)	=	47.21				
Prob> chi2	=	0				
Pseudo R2	=	0.08				
Log likelihood	=	-273.62				

Notes: *** significant at 0.01, ** significant at 0.05, * significant at 0.10

The significance of the *Nutrition* and *External* variables indicate that consumers who believe fluid milk is a good source of nutrition and who are more influenced by external factors such as family and friends are 6% and 9% more likely to have increased their consumption of fluid in the

last three years. The results indicate that both *Nutrition* and *External* factors play an important role in influencing consumers' decision to buy dairy products, particularly fluid milk. The outcomes also indicate that Malaysian consumers are very well aware of the fluid milk nutrition and health benefits.

4. Conclusions and Implications

The objectives of the study were (1) to explore Malaysian consumers' purchasing patterns, perceptions of and preferences for various types of dairy products; (2) to determine the relative importance of various product attributes and information to Malaysian consumers when purchasing dairy products; and (3) to investigate factors influencing Malaysian consumers increasing demand for dairy products and fluid milk. The results support the findings of researchers that suggest demand for dairy products will continue to increase and supersede domestic milk supplies. Fluid milk, ice cream and powdered milk are consumed most frequently by respondents. The largest share of respondents indicated they had increased their consumption of fluid milk (32%) and powdered milk (21%) in the last three years, but only 10% of consumers indicated increasing their consumption of cheese. Modern retail outlets such as supermarket were the main destination to buy dairy products which were influence by the cleanliness, convenient location and availability of higher quality products. Reardon et al., (2003) argue that the rise of supermarkets especially in Asia will be a great challenge and opportunities for local farmers and fresh food suppliers to be part of the "supermarket-oriented" supply chain. The outcomes of this study give some insight of the possibility for local producers to be integrated with the modern retailers.

There are several implications of this study. Modern retailers such as supermarkets may have an advantage of promoting dairy products compared to traditional retailer. Particularly given that they have the advantages of cold storage facilities to stored fresh milk. Processors and producers, for example Sabah producers who are currently producing high milk yields, may consider developing collaborative partnerships with modern retailers, particularly those who want to sell local and fresh milk. To promote their products, milk processors should consider marketing strategies which involve influential factors such as the nutritional quality of the dairy products. They may also try to increase the social status of dairy product consumption using key influencers such as family and friends.

As for the policy implications, considering the influence of external factors, it seems that the government health educational programs such as school milk program should be continued, which in turn are likely to help increase the development of the dairy industry. Considering that consumers generally prefer purchasing dairy products at modern retailers the Government should consider ways to facilitate supply chain coordination between retailers and domestic dairy processers in order to help grow the domestic industry.

The limitations of this research should be considered when interpreting the results and developing further research on understanding Malaysian consumer's perceptions and consumption of dairy products. The first limitation is that this study was done only in the urban city of Kota Kinabalu, Sabah. Expanding the study to include other cities and rural areas may present a more representative overview of the factors influencing change in Malaysian consumers' consumption of dairy products. Furthermore, fluid milk supplies in the supermarket consist of both pasteurized milk and UHT milk. Research on consumers' perceptions of different types of fluid milk, as well as the importance of shelf life, may give some new insight which will aid in domestic dairy industry development and motivate innovation in the Malaysian dairy industry.

Acknowledgments:

We wish to acknowledge Giant (M) SdnBhd, in particularly Mr.HoMunHao (Giant Marketing Director) and the rest of the area manager for they support (respondent's gift) and logistic assistant during the survey.

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