

Consumers' Food Choosing Behavior under Nested Structure

Maurizio Canavari¹, Seyed Mojtaba Mojaverian², Hamid Amirnejad², Sina Ahmadi Kaliji³

¹ Associate Professor of Agricultural Economics, Alma Mater Studiorum University of Bologna, Italy

² Associate Professor of Agricultural Economics, Sari Agricultural Sciences and Natural Resources University, Iran

³ PhD Candidate of Agricultural Economics, Sari Agricultural Sciences and Natural Resources University, Iran

maurizio.canavari@unibo.it, mjojaverian@yahoo.com, sina_ahmadikaliji@yahoo.com

Abstract

This study aims to investigate the consumers' dairy food choice behaviours and preferences and their affecting factors based on a sample collected in Sari, Iran in 2018. This research used the nested logit model. The results revealed that yoghurt, milk and cheese were the most preferred among dairy products and older consumers were more interested in low-fat dairy products. Affecting factors on consumers' preferences indicated that price and family expenses decreased the probability of their choice, while variables such as age, education and attention to exercise increased this probability. Marketing mix variables (the 4Ps) also had significant effects on the selection of dairy products.

Keywords: consumer preferences, agricultural marketing, nested logit model, marketing mix, dairy products.

Introduction

Investigation of consumer's behaviour and preference as a controversial and challenging topic is one of the most important issues in the marketing field. These behaviours and preferences include a set of decision procedures that should be taken before and after some physical, emotional and mental activities (Kardes et al., 2011). Consumer behaviour is not just about the buying time, but it is rather a continuous process. To better understand these behaviours, the marketing manager should be able to identify and meet the needs of the consumers (Spacey, 2016). This helps marketers to investigate and understand how consumers behave so that they can present their products to a specific group of people or targeted individuals.

Food as one of the basic needs of human beings influences a wide range of sciences including social sciences. Over the last years, consumers' food choice behaviour had changed greatly (Naier et al., 2014). This has resulted in producers opting for modifications in food production, processing and distribution. Therefore, producers need to focus on consumers' behaviour. What do consumers think of when they are in front of a supermarket shelf? Do people notice that they are eating low fat or full-fat foods? Do producers prepare a product in the way the consumers had in mind? Factors affecting food choice among individuals should be taken into consideration to investigate these behaviours.

Discrete choice models represent a valid approach for the analysis of consumers' behaviours and preferences as these models offer the opportunity to investigate many aspects that influence consumer behaviour, especially if

applied in the field of food marketing research (Louviere et al., 2000). Some discrete choice models have been specified for particular purposes. The nested logit model as a flexible discrete choice model includes a partial relaxation on assumptions that limit other logit models such as normal and multinomial logit models. The classification of alternatives regarding their similarities into nests and the thus resulting tree structure does not have anything in common with a stochastic valuation of alternatives within the scope of a decision tree (Hensher et al., 2005).

This paper will focus on dairy products as one of the most important products of livestock that can affect people's health (Rahnama and Rajabpour, 2017). The survey has been administered in Sari, Mazandaran province (Southern coast of the Caspian Sea). This area has the most share in production and a variety of dairy productions in Iran (Beldman et al., 2017).

Some studies examined social-demographic factors, consumer behaviour, and preference to buy and consume dairy products (Shokrvash et al., 2015). Empirical results of Yayar (2012) indicated that better-educated household heads, higher income, larger households, and households with children under seven years of age consumed more milk than others. Allen and Goddard (2012) by using of ordered probit regressions showed that several aspects of the Health Belief Model as well as general nutrition knowledge could predict purchasing and consumption intentions of milk and yoghurt products. Milk consumption in Bousbia et al., (2017) study was affected by geographical location, the number of children per household, price and monthly income. In the Bhanu et al. (2017) study, the reasons for preferring whole milk were taste, satisfaction, quality, availability, low price and bulkiness. Assan (2017) findings revealed that demographic characteristics of households, such as household size, household composition, the gender of the household head and marital status greatly affected consumption patterns of milk and milk products and households with high-income levels spent more on milk and milk products.

Results of recent studies revealed that demographic factors such as education, income, kid number, and products futures such as taste, satisfaction, quality and availability affected consumers' purchasing behaviour. We try to investigate the "marketing mix" (4Ps) variables product, price, place and promotion in addition to these factors, using a hierarchical structure and a nested tree model.

Methodology

This research considered the consumers' preferences under the Nested Logit model. This model groups similar alternatives into nests and creates a hierarchical structure for decision (Ben-Akiva and Lerman, 1985). Let c denote a dairy product and P_{ct} be the probability that product c is chosen by someone who decides to purchase a type of dairy product (denote t). Suppose that this probability is influenced by factors of X as independent variables. The independent variables of this study are factors that affected consumer's choice. The consumer characteristics considered in the questionnaire are age, gender, household size, education (based on 7 levels of education degrees), occupational status (based on 6 levels), average of monthly family life costs (based on 5 levels) as disposable income, importance level of exercise for consumers (5 levels based on a semantic scale), awareness about importance of dairy products (3 levels), their dairy products brand preferences (rated with scores from 1 to 9), dairy products price, and finally, the 4 marketing mix elements affecting brand choosing. The marketing mix is most commonly executed through the so-called 4 P's of marketing: Price, Product, Place and Promotion. Price is about dairy products value, Product as quality, packing, etc., Place as access to shopping and Promotion as brand reputation, loyalty and advertising. In our model, these four variables are measured as dummy variables (0 or 1), where the value is 0 if the element does not affect consumer preference and 1 if it does affect it.

In our specific case, we can describe the process in which a customer chooses the dairy products we are considered using a tree. The tree has 4 levels, corresponding to the 16 products (Figure 1).

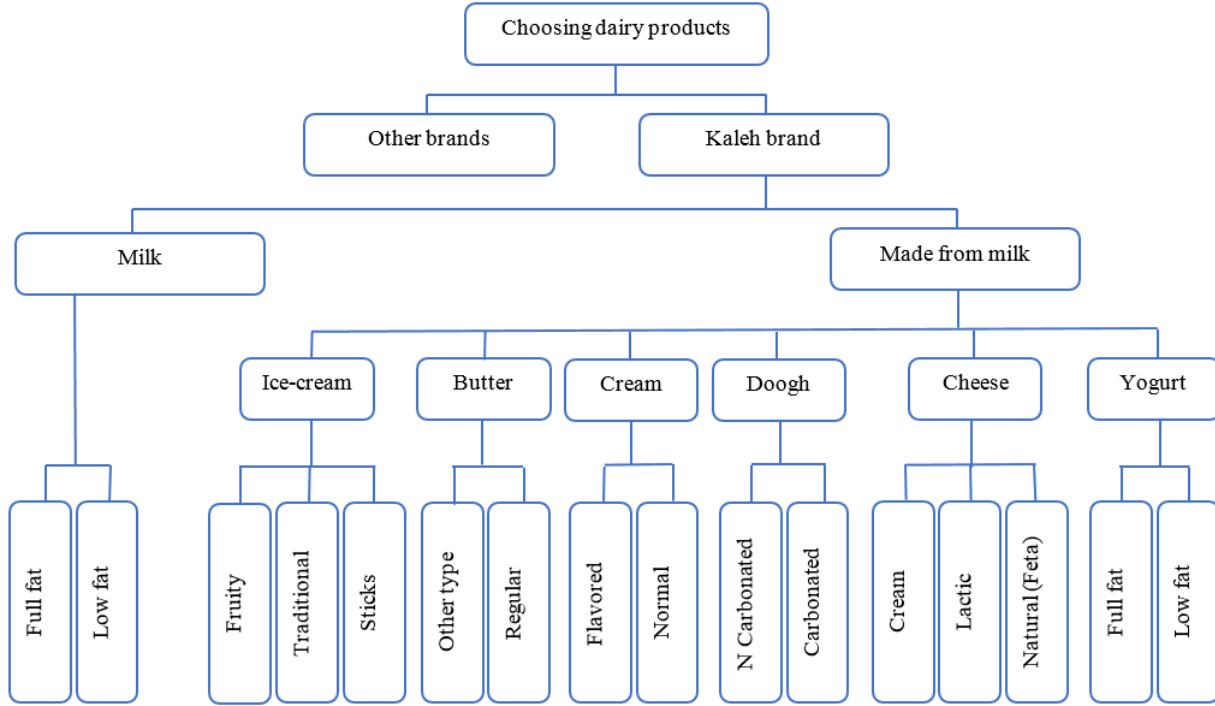


Figure 1. Suggested Nested Logit tree for dairy products in our survey.

Under the usual multinomial logit model, the choice of dairy products (c) conditional on the type of products is (Danaher and Dagger, 2012):

$$P_{ct} = \frac{e^{\beta_c x_c}}{1 + \sum_{i=1}^C e^{\beta_{ci} x_{ci}}} \quad (1)$$

Where c ranges from 1 to 16, which is the indicator of the main suggested dairy products in the last level of the tree (such as low-fat and full-fat yoghurt, natural and lactic cheese, see Figure 1). In a nested logit structure, the probability of choosing any of these products is given by (Danaher and Dagger, 2012):

$$P_t = \frac{e^{\beta_c x_c + \eta I_t}}{1 + e^{\beta_c x_c + \eta I_v}} \quad (2)$$

Where I_v is the expected maximum utility (Known as the inclusive value) that a person derives from purchasing types of dairy products that are defined as (Ben-Akiva and Lerman, 1985):

$$I_v = \log\left(1 + \sum_{i=1}^C e^{\beta_{ci} X_{ci}}\right) \quad (3)$$

This parameter is a dissimilarity parameter. It can be considered as a measure of the dissimilarity of alternatives or nests. McFadden (1980) showed that the nested logit model is consistent with the random utility maximization. Borsch-Supan (1990) revisited the compatibility of the nested logit model with the utility maximization principle

and showed that the nested logit model can still be compatible with a random utility-based choice model for dissimilarity parameters greater than one (Davis et al., 2014).

The data was collected using a face to face survey administered in winter 2018 in Sari, Iran. The respondents were selected using a Cochran's sample size Formula and the simple random sampling method. To estimate the sample variance, about 30 pre-test questionnaires were collected, and the calculated variance was 0.179. Based on this value and the Cochran formula, the sample size has been set to 275. To estimate this model, we used the NLOGIT (5) software (Greene, 2002).

Results and Discussion

Descriptive statistics for the sample are presented in Table 1. The median of respondents' age was middle age. Men were more than women. The median family size was about 3 persons. In terms of education level and occupation status, bachelor degree was the most frequent degree, and most of the respondents had a non-government job. Family expense level was mainly between 1 to 2 million Tomans (200-400 EUR) monthly. Regarding respondents' willingness to exercise and awareness about the importance of using dairy products, most of the respondents had a moderate tendency to exercise, and their awareness was low. Among dairy producers' brands, the Kaleh company brand was the most preferred among other dairy brands.

Table 1. Statistical description of the used variables in the model (N=275)

Independent variables	Percent of total	Independent variables	Percent of total
Age		Occupational status	
Young (20-34)	25	Unemployed	5
Middle (35-50)	28	Academic student	10
Adults (51-65)	26	Free job (private)	32
Old (>65)	21	Farmer	14
Gender		Employee (government)	39
Man	57	Life expense	
Woman	43	< 500 thousand Tomans	9
Family size		500 th - 1 million T	24
1-2 members	24	1 - 2 million T	33
3-4 members	41	2 - 3 million T	23
5-6 members	28	> 3 million T	11
More than 6 members	7	Willingness to exercise	
Education level		Very low	10
Illiterate	1.5	Low	24
Before diploma	9	Moderate	40
Diploma	23	High	21
Associate	18	Very high	5
Bachelor	29	Consumers awareness	
Master	12	Low	64
Doctoral	7.5	Moderate	21
Willingness to brand		High	15
Low (1-3)	13		
Moderate (4-6)	40		
High (7-9)	47		

Source: Research findings

To investigate and compare consumers' dairy products preferences, Figure 2 presented an average of preferences' rate from 1 to 100. This rate calculated from 1 to 10 dairy products preferences in third level (yogurt, cheese, dough and etc.) and fourth level (low-fat and full-fat yogurt, natural, lactic and cream cheese and etc.). We found that in the case of milk and yoghurt, consumers preferred to use low-fat products. Yoghurt, milk and cheese were the most preferred among other dairy products. Products such as flavoured cream, other types of butter and fruity ice-cream as varied dairy products were the least preferred. There is evidence that consumers prefer to use low-fat products instead of full fat. We look for factors that affect these choices.

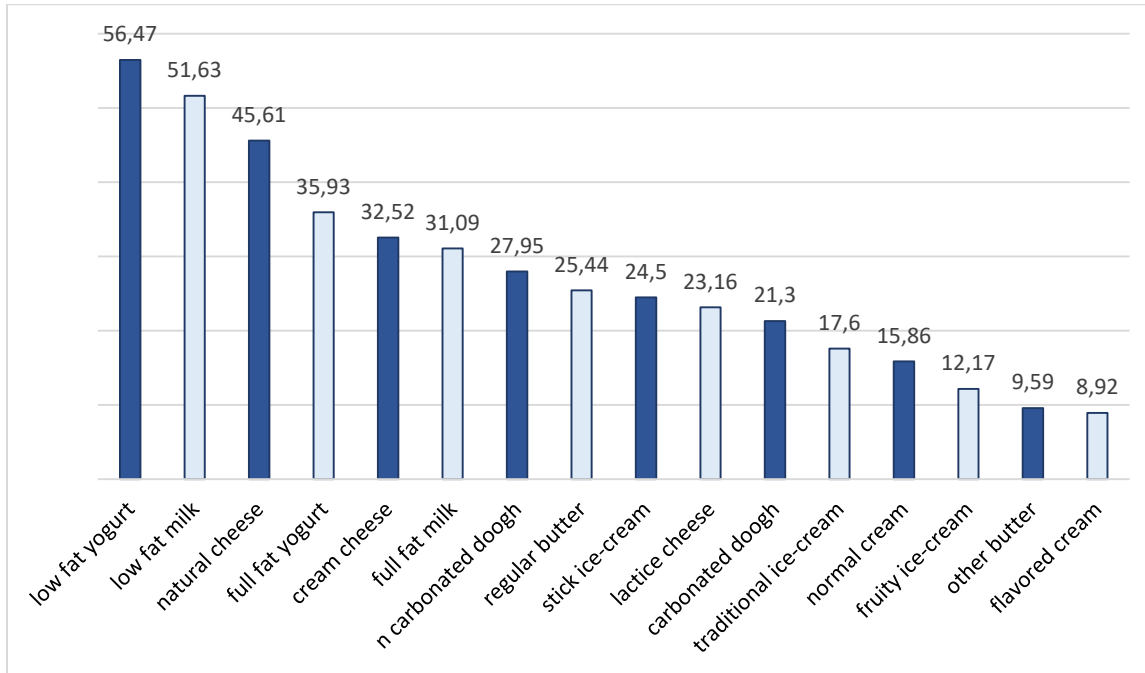


Figure 2. Comparing the consumption preferences of dairy products

We asked respondents to rate each type of last dairy products in last level of the tree based on their preferences, with consumers' preferences ranging from 1 to 10. We then compared the ratings with consumer characteristics. The first variable affecting consumer purchase behaviour was respondents' age. The results show that with the increase of age, the probability of choosing low-fat milk increased and the choice probability of full-fat milk decreased. The same happens for yoghurt. It would be because of illness or sickness increase during old ages and their special diets particularly require consumption of low-fat foods. The results of analyses regarding other dairy products revealed that cream cheese and carbonated doogh were more preferred among young and middle age consumers, respectively. With the increase of age, preferences for flavoured cream decreased, and traditional ice-cream had more preference among middle and adult age groups. Younger consumers were more likely to use new taste products such as fruity ice-cream and flavoured cream, and an increase of age changed preferences towards the use of traditional and old-style products.

Table 2. Dairy products preferences by age group¹

	Dairy products	Average	Age groups				F-ANOVA
			Young	Middle-aged	Adult	Old	
Milk	Low fat	7.16	6.54	7.04	7.75	8.60	3.26**
	Full fat	6.10	7.67	6.92	7.00	6.40	4.57***
Yoghurt	Low fat	5.11	7.21	6.78	7.45	8.40	6.21***
	Full fat	7.46	7.42	7.58	7.48	6.00	3.13**
Cheese	Natural	6.99	7.35	6.76	7.09	7.10	1.62
	Lactic	5.46	7.47	6.98	7.72	6.90	4.53***
	Cream	7.28	6.00	5.65	4.81	4.00	2.93**
Doogh	Carbonated	5.57	5.47	6.56	5.62	5.10	0.03
	N-carbonated	7.21	6.74	7.16	6.93	7.70	2.52**
Cream	Normal	6.73	6.83	6.38	7.35	6.40	3.64**
	Flavored	4.25	4.83	4.12	3.97	3.90	1.05
Butter	Regular	7.58	7.60	7.32	7.81	7.80	0.77
	Other type	3.59	4.50	3.62	3.43	3.10	0.99
Ice-cream	Sticks	6.29	6.07	6.34	6.49	5.70	3.39**
	Traditional	7.15	7.09	7.24	7.13	6.60	2.37*
	Fruity	6.12	6.30	6.24	5.83	5.50	2.69**

1. Preferences rating based on 1 to 10 (1=low preference)

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Source: Research findings

Fat is an important source of both pleasure and calories in the diet. Bakke et al. (2016) revealed that dairy products are a major source of fat in the diet, and understanding preferences for fat in dairy products can potentially inform efforts to change fat consumption patterns or optimize consumer products. "Notice to exercise" or respondent tendency to do exercise is one of the variables that could affect people's fat preferences. The results of this variable are indicated in Figure 3. We classified people's willingness to exercise to 5 levels based on a 5-point semantic scale (very low, low, moderate, high and very high) and compared with their dairy preferences. We found that increasing this willingness decreased preference of full-fat milk and yoghurt. For example, consumers with very high willingness to exercise had 8.6 (from 10) preferences to use of low-fat milk. The Spearman correlation test confirmed our results (correlation estimated about 0.61 and 0.47 with significant at 1 percent level).



Figure 3. The relation between the importance of exercise and dairy products' preferences

Source: Research findings

We investigated respondents' knowledge about the importance of dairy products. We measured respondent's information. The nutrition values of milk and dairy products, dairy products advantages and required minimum amount of dairy products for the body. We found that about 64 per cent of consumers had low awareness about these topics. "Increasing of awareness", improved using of dairy products (research findings). The correlation test effect of this variable on age, life cost, exercise and education revealed that "awareness" variable had a negative correlation with age and had a positive correlation with exercise and education.

Table 3. Results of Spearman correlation test

Correlation coefficient	Age	life cost	exercise	education
awareness	-0.38***	0.11	0.26***	0.32***

*** significant at the 1% level

Source: Research findings

Dairy products brand and last 4P variables (marketing mix) influenced consumers’ preferences. Kaleh brand is known as one of the best dairy brands in Iran and with this survey we confirm that it had the most tendency among other brands. Factors such as quality, freshness, price, availability, fame, were effective to choose dairy brand. Figure 4 illustrates the results of consumers’ preferences among these factors, rated from 1 to 10 by respondents. The quality, freshness, price of products and availability were rated among the most important.

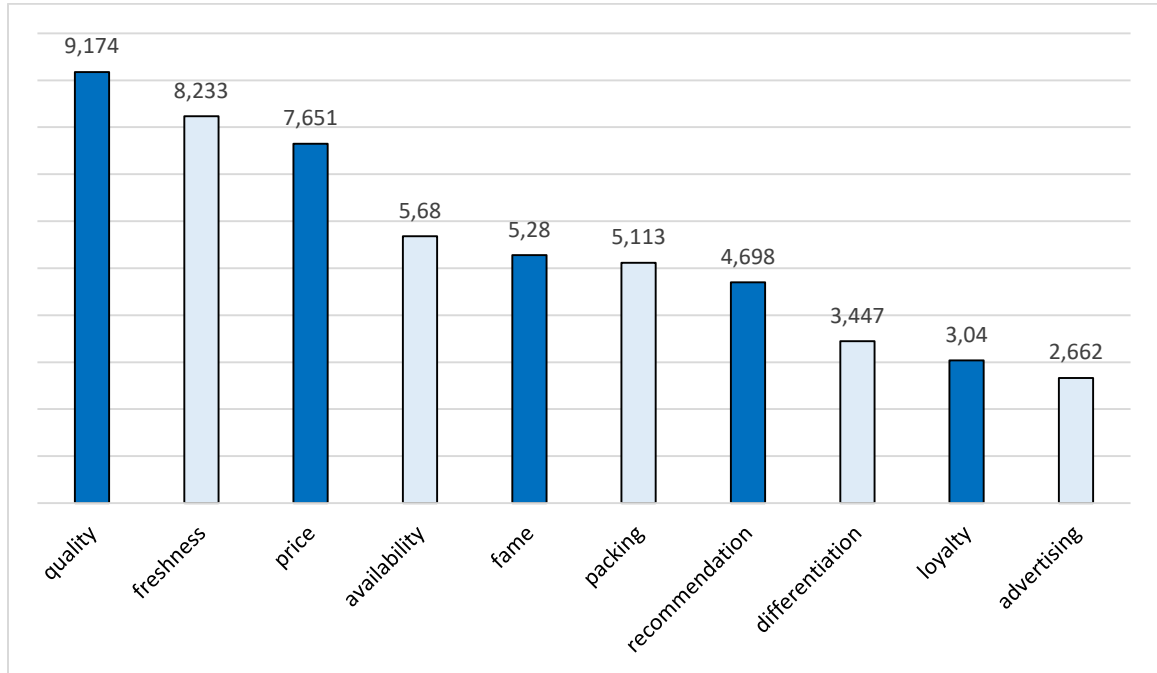


Figure 4. Affecting factors on choosing a brand of dairy products

Source: Research findings

To test the quality vs price orientation of consumers, we asked them to rate from 1 to 10 (1=low preference) three alternative options labelled as “low quality-15 per cent discount”, “moderate quality-10 per cent discount” and “high quality-5 per cent discount”. The results revealed that the third option (“high quality-5 per cent discount”) was the most preferred, with an average of 8.7. This result suggests that the consumers were quality-oriented. In order to investigate the effect of the age variable on this choice, we compared these options among the four age groups. The results are presented in Table 4. We found that increasing age groups changed consumers’ willingness to trade-off price with quality and young consumers were more quality oriented than old consumers.

Table 3. Price vs quality preferences by age group

Age categories	first option		second option		third option	
	low quality and 15 % discount	quality and 10 % discount	moderate quality and 10 % discount	good quality and 5 % discount	quality and 5 % discount	quality and 5 % discount
Young (20-34)	3.02		6.62		8.80	
Middle (35-50)	3.08		6.18		8.76	
Adults (51-65)	3.58		6.97		8.52	
Old (>65)	4.12		6.60		7.50	
F test	4.63***		3.52**		6.46***	
p-value	0.010		0.019		0.003	

*** and ** indicate significance at the 1% and 5% level, respectively.

Source: Research findings

We used a four levels nested logit model to evaluate the relationship between dairy food choice and the consumer characteristics (Table 5). Results indicate that a higher price decreased the choosing probability of dairy products and a 1-unit increase of this variable decreased choosing probability by 0.31 percentage points. Bhanu et al. (2017), Assan (2017) and Bousbia et al. (2017) also indicated that an increasing price negatively affects consumers' preferences for the alternative. Results also show that for every product age, family size, education, exercise and product (4p) are statistically significant and increased milk choosing probability. The age variable is the most affecting factor. Family cost decreases choosing probability for low-fat yoghurt, while age and education level variables increase this probability. In other words, according to our results, old people tend to choose low-fat yoghurt more than young people. Meanwhile, the result for full-fat yoghurt showed that factors such as gender variable had a negative and significant effect on consumers' choice. It showed that men had a lower tendency than women to choose full-fat yoghurt. The preferences of Kaleh brand, product and price (as for 4p) variables had positive and significant effects on full-fat yoghurt choice. "Price variable" as one of the marketing mix variables had the most substantial effect on this probability with 0.43 percentage points. Among the variables that affected the choice of cheese, the family cost variable decreased the choice probability of natural and lactic cheese, and variables such as gender and price (4p) decreased the probability of cream cheese choice. Family size and price (4p) increased the choosing probability of natural cheese. Kaleh brand preference increased choosing of lactic cheese and promotion variable (4p) increased choosing of cream cheese. Results of Doogh product revealed that age, family size, education and product (4p) variables increased choosing probability, so that family size had the most effect on this probability. "The gender variable" increased choosing probability for normal cream and family cost and price (4p) variables decreased this probability. "The cost variable" by 0.70 percentage points had the most effect on this probability. In the case of butter products, age, education level, price (4p) variables increased choosing probability of regular butter that age variable had the most effect on this. Factors such as gender and family cost decreased, and Kaleh brand preference and price (4p) increased choosing probability for sticks ice-cream. In the case of traditional ice-cream, four factors of promotion, education, price and place increased choosing probability.

Table 4. Nested logit model estimation results

products	Variables	Coefficient	Standard deviation	Z	Marginal effect (percent)
Total products	Price	-1.417***	0.593	-2.39	-0.308
	Age	5.655***	2.077	2.72	1.230
	Family size	1.254***	0.323	3.88	0.273
Low fat milk	Education	0.482**	0.247	1.96	0.105
	Exercise	-1.226***	0.247	-4.97	-0.267
	Product (4p)	1.326*	0.789	1.68	0.288
	Age	1.261***	0.512	2.47	0.274
Yogurt low fat	Education	0.927*	0.550	1.69	0.202
	Cost	-1.244*	0.715	-1.74	-0.271
	Gender	-4.249*	2.365	-1.80	-0.924
Yogurt full fat	Brand	1.620*	0.881	1.84	0.352
	Product (4p)	1.768*	1.004	1.76	0.384
	Price (4p)	1.965**	0.918	2.14	0.427
	Cost	4.812***	1.549	3.11	1.047
Natural cheese	Family size	5.111***	1.762	2.90	1.112
	Price (4p)	2.052**	0.989	2.07	0.446
Lactic cheese	Cost	-3.664***	1.005	-3.64	-0.797
	Brand	1.729***	0.518	3.34	0.376
Cream cheese	Gender	-1.431***	0.555	-2.58	-0.311
	Price (4p)	-4.061***	1.276	3.18	-0.883
	Promotion (4p)	1.746**	0.884	1.97	0.380
N-carbonated doogh	Age	0.456***	0.201	2.27	0.099
	Family size	3.132**	1.448	2.16	0.681
	Education	0.792*	0.462	1.72	0.172
	Product (4p)	2.165**	1.027	2.11	0.471
Normal cream	Gender	0.965**	0.505	1.91	0.210
	Cost	-3.212***	1.436	-2.24	-0.699
	Price (4p)	-1.846**	0.884	-2.09	-0.401
Regular butter	Age	4.062*	2.284	1.78	0.883

	Education	2.644***	0.786	3.36	0.575
	Product (4p)	-1.433*	0.764	-1.87	-0.312
	Price (4p)	0.751*	0.414	1.81	0.163
Other butter	Gender	4.026*	2.264	1.78	0.876
	Gender	-6.408*	3.784	-1.69	-1.394
Sticks ice-cream	Cost	-0.782*	0.428	-1.83	-0.170
	Brand	1.335*	0.260	5.12	0.290
	Price (4p)	0.246***	0.076	3.26	0.053
	Family size	2.413***	1.003	2.40	0.525
Traditional ice-cream	Education	1.753***	0.768	2.28	0.381
	Price (4p)	0.761***	0.347	2.19	0.165
	Place (4p)	2.009*	1.138	1.77	0.437
Fruity ice-cream	Family size	7.043*	4.032	1.75	1.532
	Price (4p)	-3.075***	1.246	-2.47	-0.669

***, ** and * indicate significant at the 1%, 5% and 10% significance level, respectively.

Source: Research findings

Results of inclusive value coefficients were illustrated in table (6). These coefficients are known as dissimilarity parameters. It can be considered as a measure of the dissimilarity of alternatives or nests. Results indicated that all of the coefficients were significant and nests were independent. It confirms our nested structure based on Figure (1).

Table 6. Estimation results of inclusive value coefficient

	Nest	Coefficient	Standard deviation	Z statistics
Second level	Yogurt	0.852***	0.261	3.26
	Cheese	0.678***	0.279	2.43
	Doogh	0.468**	0.242	1.93
	Cream	0.497***	0.224	2.22
	Butter	0.503*	0.279	1.80
	Ice-cream	0.566*	0.324	1.75
Third level	Milk products	1.428*	0.87	1.64
	Milk final consumption	0.712**	0.368	1.94
Fourth level	Company brand	2.154***	0.923	2.33
	Other brand	1.514***	0.722	2.10

***, ** and * indicate significant at the 1%, 5% and 10% significance level, respectively.

Source: Research findings

Conclusion

We used a choice model to understand the decision process of individual stated choice preferences for dairy food made in a particular context. This study revealed that by using a nested logit model, it is possible to estimate factors that affect consumers’ choosing behaviour and preferences hierarchically.

The result of consumers’ dairy preferences indicated that yoghurt, milk and cheese were the most preferred among other dairy products. Results of consumers’ preferences in age groups showed that increasing age level from young to old increased their preferences towards low-fat products. We found that young consumers were more willing to try new tastes of dairy products. Not surprisingly, estimated results of the nested logit model revealed that an increasing price decreased the consumers’ choice probability. Among demographic variables, consumers’ age, gender, family size, education level, and life cost had significant effects on their choice and preferences. Increasing age level from young to old, change their preference to choosing low-fat yoghurt, n-carbonated doogh, regular butter and low-fat milk. This could be because of living expenses and health concerns. Results on marginal effects also reveal that the most substantial effect of this variable was on the choice of low-fat milk. An increasing household size affects consumers’ probability to choosing five products, namely low-fat milk, natural cheese, n-carbonated doogh, traditional and fruity ice-cream. Increasing the number of children in the household, shifts consumer preferences toward using other types of ice-cream. Development of education level affected choosing low-fat yoghurt and milk. Actually, in case of education, high-level persons had low-fat products

preferences. Because of the positive correlation between education and importance of the exercise variable, people who did more exercise preferred to choose low-fat milk. Living cost had the most substantial effect on choosing lactic cheese. It means that people's preferences change to using lower price cheese. 4p mix marketing results variable revealed that product (4p) had the most effect on choosing of n-carbonated doogh brand and price had the most effect on choosing cream cheese brand. Marketing managers, especially in the dairy market can improve their products based on consumers' behavior and preferences by using these results.

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