

ACCEPTANCE OF TRANSGENIC MILK IN LA ARAUCANÍA REGION, CHILE

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ABSTRACT

Considering the high level of concern caused by genetically modified foods (GMF) in developed countries, the relevance of this variable in decision-making about the purchase of fluid milk among consumers in Temuco (La Araucanía Region, Chile) was determined. By means of a personal survey of 400 people and using conjoint analysis, it was determined that the presence of genetic modifications in food was more important (44.7%) than brand (29.5%) and price (25.5%) in the decision-making process. By cluster analysis three segments were identified; the largest group (46.5%) gave similar relevance to food production and brand, preferring genetically modified milk. For the second group (41.5%), the presence or absence of genetic modification was the most important variable in the purchase, with a strong rejection of milk produced by genetic manipulation and preference for non-transgenic milk. The minority segment (12.0%) placed a higher value on price. These three segments prefer national brand milk, reject the product with private brands and react positively to lower prices. The most sensitive segment to genetic food manipulation had a higher proportion of people under 35 years of age and with no children. It is concluded that the absence of genetic manipulation in food is a desirable condition, mainly for young consumers of La Araucanía Region.

Key words: genetically modified foods (GMF), fluid milk, cluster analysis, conjoint analysis.

INTRODUCTION

In recent years a debate has emerged about the risks to human health and the benefits associated with consuming genetically modified food (GMF), or transgenic foods. In transgenic foods a gene is sought from a living being (animal, plant, bacteria or virus) that codifies a protein; such as an enzyme that interferes with the maturation of fruits, inhibits viral multiplication or causes a structural or organoleptic characteristic that confers an increase in nutritive content or greater resistance to a herbicide. This gene is introduced into the genetic material that is to be improved or modified. The desired characteristics are obtained by this means, avoiding the slow process of selection and crossbreeding of crops or animals that has been done traditionally.

Nevertheless, there are potential risks with GMF, such as provoking allergies, increasing resistance to antibiotics, loss or modification of the nutritional value of foods, presence of toxic compounds, the appearance of new and untreatable diseases, damage to wild plants (Reyes and Rozowski, 2003) and the appearance of resistant weeds (Frewer *et al.*, 2004), which are the basis of the rejection of genetic modification by ecological organizations.

The only specific standard in Chile in relation to transgenic foods is found in a resolution of the Agricultural and Livestock Service (SAG) on Standards and Regulation on Transgenic Materials (Ríos, 2004). According to this decree, the only transgenic products permitted as imports are seeds for production for the export market. The use of transgenic products for food consumption in Chile is not permitted. The General

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Environmental Law considers the use of transgenic products as an activity that should be subject to an obligatory environmental impact study, but this is not applied. Chile is currently importing transgenic food, in particular corn (*Zea mays* L.) and soya (*Glycine max* L.) from Argentina and the United States. It is not known with exactitude the quantity of transgenic food that is entering the country, given that grains arrived with transgenic and non-transgenic grains mixed together, while elaborated products arrive unlabeled (Ríos, 2004).

Numerous studies recognize consumer preference for foods without genetic manipulation and a rejection of transgenic foods (Lusk *et al.*, 2001; Mendenhall and Evenson, 2002; Lusk *et al.*, 2003; Larue *et al.*, 2004; Ganiere *et al.*, 2006; Ho *et al.*, 2006), while other research suggests that consumers may not be concerned about the transgenic condition of a food product (Townsend and Campbell, 2004; Townsend, 2006). In effect, consumer resistance to genetic modifications is not universal (Mucci and Hough, 2003). Attitudes toward biotechnology depend on what organism is applied and the type of modification made. Genetic modifications of microorganisms are more acceptable than modifications to animals (Frewer *et al.*, 1997). Roosen *et al.* (2003) determined that European consumers are not only concerned about the direct consumption of GMF, but also about indirect consumption through the use of GMF in animal feed. Lusk *et al.* (2003) determined that European consumers are more willing than US consumers to pay a higher price for beef from animals that were not fed with genetically modified corn. Likewise, modifications that tend toward reducing the use of pesticides is more accepted than if it imply a reduction in costs (Kaye-Blake *et al.*, 2005) or benefit the consumer as well as producers and agro-industry (Lähteenmäki *et al.*, 2003).

The attitude of consumers toward GMF is determined by the perceived risks and benefits, which are in turn determined by levels of knowledge about GMF (Verdume and Viaene, 2003; Hossain *et al.*, 2003; Townsend, 2006; Chen and Li, 2007). Substantial benefits, such as lower prices (Noussair *et al.*, 2002; Hossain *et al.*, 2003; Jaeger *et al.*, 2004; Noussair *et al.*, 2004), greater nutritive value (IFIC, 2001; Lähteenmäki *et al.*, 2003), benefits for health or for the environment (Frewer *et al.*, 1996; Mucci and Hough, 2003; Lähteenmäki *et al.*, 2003) or better flavor (Lähteenmäki *et al.*, 2003), compensate for the perceived risk, resulting in a positive attitude toward GMF. Consumers are more willing

to buy GMF with brand names known in relation to generic GMF foods because the known brands inspire more confidence (Verdume and Viaene, 2003). On the other hand, while some research reveals a greater willingness to purchase GMF among men and the middle-aged (Gamble *et al.*, 2000; Mendenhall and Evenson, 2002; Verdume and Viaene, 2003; Hossain *et al.*, 2003), there is a greater level of rejection among older persons and those with a lower level of education (Baker and Burnham, 2002; Ganiere *et al.*, 2006), others studies indicate acceptance of GMF is not related to the social-economic and demographic characteristics of consumers (Lusk *et al.*, 2001; Hossain and Onyango, 2004) or that the impact of these factors is low (Lähteenmäki *et al.*, 2003).

The objective of this study was to distinguish different segments among consumers in the city of Temuco, capital of La Araucanía Region, Chile, in relation to the relative importance of relevant attributes of the product (price, brand name) and the transgenic condition in the decision to purchase a food product of animal origin.

MATERIALS AND METHODS

A personal survey was carried out with a sample of 400 consumers over the age of 18 in the city of Temuco, capital of the La Araucanía Region. The number of consumers was obtained through the simple random sample formula for an infinite population ($N > 100\,000$; Temuco: 245 347 inhabitants in the 2002 census (INE, 2003), considering a 95% level of confidence and 5% estimation error, with p and q of 0.5 (Fernández, 2002).

A questionnaire was used as the instrument to gather information, with closed questions in relation to whether the respondent had received information about GMF, if they knew the significance of the concept and frequency in reading labels of the food products they purchase. Subsequently, respondents were requested to read the following definition of genetically modified food: “transgenic foods are those to which a foreign gene has been introduced artificially at the level of the embryo, such that with reproduction, the new characteristic is maintained, for example, to eliminate the need to use pesticides, fungicides and herbicides” (adapted by the authors drawing on the work of Reyes and Rozowski, 2003), and they were then asked if they considered it necessary that labels indicate that the food contains genetically modified ingredients. Questions were included to classify the respondents: gender,

age, area of residence, presence of children and their ages, occupation, the level of studies of the head of the household and the ownership of 10 domestic goods. The last two variables were included to determine the socioeconomic group corresponding to ABC1 (high and medium high), C2 (medium-medium), C3 (medium-low), D (low) and E (very low) (Adimark, 2004). The survey was applied in two supermarkets in Temuco between April and June 2006, following validation of the questionnaire through a pre-test with 10% of the sample.

To determine the importance of the transgenic condition of a food in the purchasing decision, a conjoint analysis was used, corresponding to a decomposition method that allows for estimating the relative importance of the attributes of a product and the partial utility values (preference) for each level of an attribute (Hair *et al.*, 1999). The analysis was made to determine the importance of the attributes: the presence or absence of genetic manipulation, brand and price in the purchase of fluid milk. The choices of brand and price as attributes to evaluate were made with the objective of determining if the presence of a known brand (Verdume and Viaene, 2003; Finucane and Holup, 2005) or a lower price (Noussair *et al.*, 2002; Hossain *et al.*, 2003; Jaeger *et al.*, 2004; Noussair *et al.*, 2004) succeed in compensating for the perceived risk in purchasing a transgenic food product. As well, the results of a previous study in Temuco by Viñuela *et al.* (2007) were considered, which determined that the brand was more important than the container or the price in the purchase of fluid milk.

For the first attribute, the levels transgenic and non-transgenic were defined. For the attribute of brand, the levels of national brand and store brand were defined, understanding store or private brand as a brand created for, controlled by and/or sold by retailers, while a product with a brand sold by the producer through wholesalers is understood as a national brand (Sethuraman and Cole, 1999). A well-known brand was used for the national brand, in this case named Lactea. The price levels were established based on the average market price in Temuco at the time of the survey (\$400 L⁻¹ fluid milk), over which 10% was added and subtracted, giving the levels of \$440 L⁻¹ and \$360 L⁻¹. Eight combinations were obtained based on these attributes and levels (2 x 2 x 2) identified with letters from A to H: A) transgenic fluid milk -Lactea- \$440 L⁻¹; B) transgenic fluid milk -Lactea- \$360 L⁻¹; C) transgenic fluid milk -store brand- \$440 L⁻¹; D) transgenic fluid milk -store brand- \$360

L⁻¹; E) non-transgenic fluid milk -Lactea- \$440 L⁻¹; F) non-transgenic fluid milk -Lactea- \$360 L⁻¹; G) non-transgenic fluid milk -store brand- \$440 L⁻¹; and H) non-transgenic fluid milk -store brand- \$360 L⁻¹.

The function of preference corresponded to the Ideal Point Model (Hair *et al.*, 1999). The total profile procedure was used to collect data, for which eight cards were prepared with a specification for each attribute. Survey respondents were asked to order the cards from the most preferred to the least preferred, using a scale of 1 to 8 (1 = most preferred; 8 = least preferred). A lineal relationship was established for the price attribute, given that generally the higher the price, the lower the utility or preference. The remaining variables were considered as discrete variables. The Pearson correlation was used to determine the goodness of fit of the model, and the Kendall Tau was used to determine if the estimated ordering of the stimuli corresponded to the real ordering of the survey respondents (Hair *et al.*, 1999).

Based on the results of the conjoint analysis, the marginal willingness to pay (Mg-WTP) for food without genetic manipulation was calculated. In accordance with Gan and Luzar (1993), the Mg-WTP was estimated by means of the negative quotient between the coefficient (partial utility value) of each level of an attribute and price attribute coefficient (valor β). The calculation procedure was the following:

$$Mg - WTP = - \left(\frac{\text{Nontransgenic utility}}{\beta \text{ price}} \right) \quad [1]$$

To determine the consumer segments according to the importance and utility of the presence or absence of genetic manipulation, brand name and price, a cluster analysis of hierarchical conglomerates was used, with Ward's method of linkage and squared Euclidean distance as a measure of the similarity among objects (Hair *et al.*, 1999). The number of clusters was obtained through observation of the dendrogram and was confirmed with determination of the percentage of change of the recomposed conglomeration coefficients. To describe the segments, a Chi² test was applied for the discrete variables and one-factor analysis of variance for values of importance of the attributes and utilities of the levels of the attributes, with a confidence level of 99%. The variables whose variance analysis gave a significant difference ($P \leq 0.001$) were submitted to the Tukey Multiple Comparison Test (Lea *et al.* 1997). The SPSS 14.0 Program (SPSS, 2005) for Windows was used.

RESULTS AND DISCUSSION

The percentage description of the sample of surveyed consumers and the general results on knowledge about GMF and the attitudes toward labeling of foods is presented in Table 1. While the distribution by gender was practically the same, consumers between the ages of 35 and 54 predominated, belonging to families composed of three or four members, without children or with children between the ages of 13 and 17, farmers and independent workers, married, with completed secondary and completed university studies and more, and from the socioeconomic groups with higher incomes. Approximately 60% of those surveyed indicated having received some type of information about GMF, but only 26% knew what it meant. With regard to the label the majority stated that they “generally” or “occasionally” read the label. The majority of respondents were in agreement that the label should indicate the use of genetically modified ingredients in the preparation of the food.

Relative importance of genetic manipulation of the food product in purchasing

Through conjoint analysis it was determined that among the total sample the factor of greatest importance in the purchase of fluid milk was the presence or absence of genetic manipulation (44.7%), followed by the brand (29.8%) and the price (25.5%) (Table 2), which is contrary to what was determined by Baker and Burnham (2002) in the USA, where the price was more important than the presence of genetic modification in the food and the brand in the purchase of breakfast cereals. Nevertheless, in general terms, it concurs with the concern about the indirect consumption of genetically modified foods, such as the use of GMF in animal feed, as detected by Roosen *et al.* (2003) among European consumers. Parallel to this, the greater relative importance of brand in relation to price in the purchase of fluid milk was verified, in accordance to the results previously obtained by Viñuela *et al.* (2007). The lower importance of price in the purchase of milk can be attributed to the relatively low importance that this product occupies in family budgets, given that milk, cheese and eggs together account for an average of only 9.2% of total household spending on food (INE, 1997).

In general, consumers found positive utility or preference for milk produced without genetic manipulation and negative utility in the presence of genetic manipulation, both with the same magnitude, but of opposites signs. Positive utility was obtained with a national brand

and utility was lost with a store brand. Both levels of price reported loss of utility, which increased (more negative utility figures) when accepting to buy the product at a higher price, which indicate that there is no association between price and quality. In accordance with the preceding, it can be argued that in general the purchasing choice was dominated by the existence of genetic manipulation in the milk, with a preference toward non-transgenic food, preferring at the same time a more trusted brand (national brand, Lactea) and the lowest price available. This result suggests that consumers make milk purchases seeking to minimize the purchasing cost of the product that contains the most appreciated characteristics, which would explain the lower importance of price in the purchasing choice in a similar manner to the purchasing of beef (McCarthy *et al.*, 2003).

The Pearson correlation coefficient (0.999) and Kendall Tau (1.000) were very close to or equal to 1, which indicates the goodness of fit of the conjoint model and that the ordering of the stimulus presented in the cards corresponded to the global ordering of respondents, both being statistically significant ($P = 0.000$).

Consumer segments

Using cluster analysis it was possible to distinguish three groups of consumers with statistically significant differences ($P \leq 0.001$) in the importance and utility of the presence or absence of genetic manipulation, brand and price (Table 2). The groups presented significant differences according to the presence and age of children ($P \leq 0.001$), age, family size, occupation, education and frequency of reading food labels ($P \leq 0.05$) (Table 3). No significant differences were observed ($P > 0.05$) according to gender, knowledge on GMF and attitude toward the labeling of GMF.

The majority group (Group 2; 46.5% of the sample, $n = 186$) gave similar importance to the presence or absence of genetic manipulation in the food (39.6%) and the brand (38.8%) in the purchasing decision. The importance assigned to genetic manipulation was significantly lower than Group 3, but higher than Group 1 ($P \leq 0.001$), with significantly higher positive utility or preference for transgenic milk than the other groups ($P \leq 0.001$), and rejection of milk without genetic manipulation, expressed in a significantly lower negative utility value than Groups 1 and 3 ($P \leq 0.001$), which presented positive values. In comparison, this group assigned more importance to the brand than the other groups ($P \leq 0.001$), with the greatest preference

Table 1. Percentage description of the sample of usual buyers surveyed in supermarkets of Temuco, Chile. June, 2006.

Sample	Composition	Total sample
Gender	Female	51.8
	Male	48.3
Age	< 35	33.3
	35-54	45.3
	55 or over	21.5
Family size	1-2 members	8.0
	3-4 members	66.3
	5 or more	25.8
Presence and age of children	Without children	28.3
	Children under 5	9.0
	Children between 5 and 12	10.0
	Children between 13 and 17	30.3
	Children over 18	22.5
Occupation	Self-employed	22.0
	Businessperson	10.5
	Agricultural producer	29.8
	Private sector worker	19.3
	Public sector worker	12.5
	Retired	2.3
	Unemployed	3.8
Education	Without studies	0.8
	Primary incomplete	2.5
	Primary complete	6.0
	Secondary incomplete	7.8
	Secondary complete	26.3
	Technical incomplete	8.5
	Technical complete or university incomplete	17.0
	University complete or more	31.3
Social economic group	ABC1	34.8
	C2	33.0
	C3	17.3
	D	12.8
	E	2.3
Has received information about transgenic foods	Yes	59.0
	No	41.0
Knows the significance of the word transgenic	Yes	26.3
	No	73.8
Frequency of reading food labels	Always	12.3
	Generally	28.8
	Occasionally	31.3
	Almost never	20.6
	Never	7.0
The label should indicate the presence of genetically modified ingredients	Yes	99.3
	No	0.8

Table 2. Importance (%) of the attributes: presence of genetic manipulation, brand and price in the decision-making process of fluid milk purchase utility of each attribute level, and marginal willingness to pay (Mg-WTP) for non-transgenic milk in groups obtained through cluster analysis in Temuco, Chile, June, 2006.

	Total sample	Group 1 n = 48	Group 2 n = 186	Group 3 n = 166	F	P
Importance of attributes						
Presence/absence of genetic manipulation	44.7	19.5c	39.6b	57.7a	111.115*	0.000
Brand	29.8	20.5b	38.8a	22.2b	61.737*	0.000
Price	25.5	60.0a	21.6b	20.1b	288.097*	0.000
Utility levels of attributes						
With genetic manipulation	-0.569	-0.027b	0.576a	-2.000c	352.198*	0.000
Without genetic manipulation	0.569	0.057b	-0.576c	2.000a	352.198*	0.000
National brand	0.777	0.557b	1.002a	0.587b	15.018*	0.000
Private brand	-0.777	-0.557a	-1.002b	-0.587a	15.018*	0.000
Price \$360 L ⁻¹	-0.964	-3.760c	1.142a	-1.394b	238.351*	0.000
Price \$440 L ⁻¹	-1.928	-7.520c	2.284a	-2.789b	238.351*	0.000
Mg-WTP milk without genetic modification	0.690	0.010	-0.036	1.618	131.975*	0.000

* Significant to 1%. Distinct letters horizontally indicate statistically significant differences according to the Tukey test ($P \leq 0.001$).

for the national brand and strongest rejection of the store brand. The importance given to the price of milk was low (21.6%), statistically similar to Group 3 and lower than Group 1 ($P \leq 0.001$). This group stood out as the only one that found positive utility in the price level, significantly higher than the other groups ($P \leq 0.001$), with more preference for the higher price, which would indicate a positive association between price and quality (Table 2). Price can be an important indication of quality when a certain risk is perceived in making an erroneous purchase decision, thus consumers can reject products that are too cheap to avoid the risk of dissatisfaction with the purchase (Kotler, 2002). Considering that existence of genetic manipulation and the brand had similar importance in the purchase decisions for this group, it can be argued that this group of consumers perceives more risk in the purchase of a GMF and/or a store brand. From the demographic perspective (Table 3) this group is characterized by a higher proportion of persons over 35 years of age ($P \leq 0.05$), pertaining to households composed of three to four members ($P \leq 0.05$), with children between 12 and 17 years of age ($P \leq 0.001$), business persons ($P \leq 0.05$) and with college studies ($P \leq 0.05$). According to their preferences, this group could be termed “milk purchasers sensitive to the presence of genetic manipulation and to brand, prone to purchase transgenic products”.

The second group in numeric importance (Group 3; 41.5% of the sample, $n = 166$) clearly assigned more

importance to the presence of genetic manipulation in the milk (57.7%), significantly higher than the other groups ($P \leq 0.001$). This group presented rejection towards transgenic products and preference for milk produced without genetic manipulation. The figure for positive utility toward non-transgenic milk was significantly higher than with the other groups ($P \leq 0.001$) and the negative utility associated with milk with genetic manipulation was significantly lower than with the other groups ($P \leq 0.001$), which implies a rejection toward this condition. While the importance of the brand was low (22.2%), this group preferred the national brand with a utility figure statistically similar to Group 1 and lower than Group 2 ($P \leq 0.001$), and rejected the private brand with a negative utility figure statistically similar to Group 1 and higher than Group 2 ($P \leq 0.001$) (Table 2). This group had the largest proportion of persons under 35 years of age ($P \leq 0.05$), from households composed of one or two members ($P \leq 0.05$), without children ($P \leq 0.001$), public employees ($P \leq 0.05$) and with primary and secondary education ($P \leq 0.05$). This group stood out as having the highest proportion of consumers who read the food label “occasionally” before making a purchase (Table 3). According to their preferences, this group can be termed “milk consumers who reject genetic manipulation”.

The minority group (Group 1; 12% of the sample, $n = 48$) gave more importance to price in the purchase of milk (60%), significantly higher than Groups 2 and 3 ($P \leq 0.001$), with the greatest rejection toward both price

Table 3. Characteristics with significant differences between groups obtained with cluster analysis in Temuco, Chile, June, 2006.

Sample	Group 1 n = 48	Group 2 n = 186	Group 3 n = 166
Age		P = 0.002	
< 35	31.3	24.2	44.0
35-54	52.1	51.6	36.1
55 or over	16.7	24.2	19.9
Family size		P = 0.009	
1-2 members	6.3	4.3	12.7
3-4 members	72.9	72.6	57.2
5 or more	20.8	23.1	30.1
Presence and age of children		P = 0.000	
Without children	25.0	16.7	42.2
Children under 5	6.3	8.6	10.2
Children between 5 and 12	14.6	10.2	8.4
Children between 12 and 17	33.3	41.9	16.3
Children 18 and over	20.8	22.6	22.9
Occupation		P = 0.008	
Self-employed	20.8	22.0	22.3
Businessperson	4.2	16.1	6.0
Farmer	25.0	29.6	31.3
Private sector worker	25.0	17.2	19.9
Public sector worker	14.6	7.5	17.5
Retired	2.1	3.8	0.6
Unemployed	8.3	3.8	2.4
Education		P = 0.018	
Without studies	0	1.1	0.6
Primary incomplete	2.1	0.5	4.8
Primary complete	6.3	5.9	6.0
Secondary incomplete	8.3	5.4	10.2
Secondary complete	33.3	18.8	32.5
Technical incomplete	8.3	11.3	5.4
Technical complete or univ. incomplete	10.4	20.4	15.1
University complete or more	31.3	36.6	25.3
Frequency of reading labels		P = 0.026	
Always	16.7	12.9	10.3
Generally	31.3	33.3	23.0
Occasionally	22.9	25.8	40.0
Almost never	14.6	22.6	20.0
Never	14.6	5.4	6.7

levels expressed in negative utility figures that were significantly lower than those of the other groups ($P \leq 0.001$). While the importance of genetic manipulation (19.5%) and brand (20.5%) are low for this group in making a purchasing decision, a preference for milk without genetic manipulation and rejection of the transgenic product were observed, in a manner similar

to Group 3. Parallel to this, there was a preference for the national brand and rejection of the product with a store brand (Table 2). This group is characterized by a higher proportion of persons over 35 years of age ($P \leq 0.05$), from households composed of three or four members ($P \leq 0.05$), with children between 5 and 12 years of age ($P \leq 0.001$), private employees

and unemployed ($P \leq 0.05$), and with completed secondary education ($P \leq 0.05$). This group had the highest proportion of consumers who “always” check the label of a food product, or “never” do this (Table 3). Considering their characteristics, the groups can be termed “milk purchasers sensitive to price who reject transgenic foods”.

While the existence of genetic modification was the most important variable in the total sample, and in Group 3 (41.5% of the sample) followed by brand and price, this attribute was of less importance in the purchasing decision for Group 1, in accordance with what was determined by Baker and Burnham (2002) in the United States with breakfast cereals. Nevertheless, it is important to note the similar level of importance assigned to brand and the existence of genetic manipulation by the consumers in Group 2, which according to Baker and Burnham (2002) indicates that none of these attributes dominate consumer preferences.

The preference for milk without genetic manipulation and the rejection of transgenic products obtained in the total sample and in Groups 1 and 3 (12% and 41.5% of the sample) concur with the results of several authors (Lusk *et al.*, 2001; Mendenhall and Evenson, 2002; Lusk *et al.*, 2003; Larue *et al.*, 2004; Ganiere *et al.*, 2006; Ho *et al.*, 2006), and are in line with the results obtained by Lusk *et al.* (2003), with regard to the preference of European consumers for beef from animals that had not been fed on genetically modified grains. Nevertheless, the existence of an important group of consumers (Group 2; 46.5% of the sample) who preferred transgenic milk confirms the non-universality of resistance to genetic modifications (Mucci and Hough, 2003). Considering that the majority of those surveyed did not know the meaning of the word transgenic (73.8%), this result is probably attributable to the definition given to consumers prior to the presentation of the stimulus developed for the conjoint analysis: “transgenic foods are those to which a foreign gene has been introduced artificially at the level of the embryo in a manner such that upon reproducing itself this new characteristic is maintained, for example, to eliminate the use of pesticides, fungicides and herbicides”, owing to the benefits for the environment (Frewer *et al.*, 1996; Ganiere *et al.*, 2006) as the reduction in the use of pesticides (Kaye-Blake *et al.*, 2005) results in a positive attitude on the part of consumers toward transgenic products. In the same manner, this result is in line with what was reported by Lähteenmäki *et al.* (2003) with regard to a positive attitude toward transgenic cheese of consumers from

Nordic countries owing to the fact that the product was genetically modified to achieve a better flavor and a lower fat content than the conventional product.

Consequently, it is possible to suggest that a positive evolution of the market of transgenic foods in the country will be conditioned by access to information on the theme by consumers, as has been the case in other countries. Chen and Li (2007) in Taiwan and Costa-Font and Mossialos (2007) in United Kingdom, concluded that greater knowledge about GMF reduces the perception of risk, resulting in a more positive attitude among consumers towards genetically modified foods. Nevertheless, it should be noted that the results of this study are limited to a specific type of food of animal origin, without having made explicit the type of genetic modification in the studied product, because of which future researchers should consider the possibility of discriminating the reaction of consumers in the contexts of different types of genetic modifications, or with different objectives (lower cost, greater nutritive value, among others).

The values of the marginal willingness to pay (Mg-WTP) for milk without genetic manipulation were positive in the total sample and in groups that show preference for non-transgenic products (Groups 1 and 3), with the opposite occurring in Group 2 (Table 2). Nevertheless, upon calculating the Mg-WTP percentage on the average price used ($\$400 \text{ L}^{-1}$), depreciable values were obtained corresponding to 100.17% in the total sample; 100.003% in Group 1; 99.99% in Group 2 and 100.405% in Group 3. This implies that consumers who present more Mg-WTP (Group 3) would be willing to pay $\$401 \text{ L}^{-1}$ for milk without genetic manipulation, which is in contrast to studies in developed countries where Lusk *et al.* (2003) determined that European and American consumers would be willing to pay on average US\\$7.8 and US\\$3.31 more, respectively, per pound of beef from animals that were not fed with transgenic grains.

On the other hand, the obtaining of three groups of consumers with differentiated acceptance toward GMF of animal origin and with distinct demographic profiles in terms of age, family size, presence and age of children, occupation and education, is in contrast to research that indicates that acceptance of GMF is not related to the demographic characteristics of consumers (Lusk *et al.*, 2001; Hossain and Onyango, 2004). The age profile of the groups that reject transgenic milk (Group 1 and Group 3) is in contrast to the results of

Baker and Burnham (2002) and Ganiere *et al.* (2006) in terms of a greater rejection among older persons, given that Group 1 had the lowest proportion of persons over 65 and Group 3 was composed mainly of person under 35. Nevertheless, this coincides with greater rejection of GMF on the part of persons with less education (Baker and Burnham, 2002; Ganiere *et al.*, 2006), a situation observed in Groups 1 and 3, contrary to what was obtained with Group 2, which presented the largest proportion of persons with technical and university studies and prefer transgenic milk. With regard to the greater willingness of men to purchase GMF detected in other studies (Gamble *et al.*, 2000; Mendenhall and Evenson, 2002; Verdume and Viaene, 2003; Hossain *et al.*, 2003), the groups identified in this research did not present significant differences according to gender ($P > 0.05$).

No relationship was obtained between the attitude toward and knowledge of GMF (Verdume and Viaene, 2003; Hossain *et al.*, 2003; Townsend, 2006; Chen and Li, 2007), since no statistical differences were observed on these variables among the groups. Nevertheless, it can be indicated that there was a low level of knowledge about GMF in the surveyed sample. The general approval regarding the need to include information about genetically modified ingredients in the label coincides with the attitudes of Argentine consumers, representing the option of making an informed choice (Mucci and Hough, 2003).

The positive utility of a national brand (Lactea) and the loss of utility or rejection of a store brand in the total sample and in the three segments identified coincide with the results of acceptance of breakfast cereals with and without genetic manipulation in the USA (Baker and Burnham, 2002), and are related to the influence of perceived risk in the purchase of a food product with a store brand (Rajeev and Indrajit, 2000), in accordance with Verdume and Viaene (2003) in regard to the willingness of consumers to buy GMF products with a known brand. Likewise, acceptance of the national brand and rejection of the store brand confirm the results of the study previously done by Viñuela *et al.* (2007) in Temuco, which determined that consumers prefer to buy milk from national brands and reject store brands.

CONCLUSIONS

Through the use of cluster analysis it was determined that consumers in La Araucanía Region, Chile, presented different attitudes toward a genetically modified food of animal origin. The 53.5% that rejected genetic manipulation in fluid milk was divided into a majority segment (41.5%) that conferred great importance on the presence of genetic manipulation in the food and is composed in greater proportion by persons under 35 years of age, belonging to households with one or two members, without children, public employees and with primary and secondary levels of education, and a minority segment (12.0%) that mainly values price in the purchasing decision, composed of persons over 35, belonging to households with three or four members, private sector employees and with completed secondary education. The segment that preferred genetically modified milk (46.5%) gave similar importance to the brand and the presence of genetic manipulation, notable for the greater presence of persons over 35, with children between 12 and 17, businesspersons and with higher levels of education.

RESUMEN

Aceptación de leche transgénica en la Región de la Araucanía, Chile. Berta Schnettler M.^{1*}, Oriana Sepúlveda B.¹, y Danilo Ruiz F.¹. Considerando el debate generado por los alimentos genéticamente modificados (GMF) en los países desarrollados, se determinó la importancia de esta variable en la decisión de compra de leche fluida en consumidores de Temuco (Región de La Araucanía, Chile) y la existencia de diferentes segmentos de mercado, mediante una encuesta personal a 400 personas. Utilizando análisis conjunto se determinó, en general, que la presencia de modificación genética en el alimento fue más importante (44,7%) que la marca (29,5%) y el precio (25,5%) en la decisión de compra. Mediante análisis cluster se distinguieron tres segmentos; el más numeroso (46,5%) dio similar importancia a la forma de producción del alimento y a la marca, con preferencia por leche con manipulación genética. Para el segundo grupo (41,5%) la presencia o ausencia de manipulación genética fue la variable de mayor importancia en la compra, con un elevado rechazo hacia la leche producida con manipulación genética y una elevada preferencia por leche no transgénica. El segmento minoritario (12,0%) presentó la mayor valoración del precio. Los tres segmentos prefieren

leche de marca nacional, rechazan el producto con marca propia, y reaccionan positivamente frente a menores precios. El segmento más sensible a la presencia de manipulación genética en el alimento estuvo constituido en mayor proporción por personas menores de 35 años y pertenecientes a hogares sin hijos. Se concluye que la ausencia de manipulación genética en los alimentos es una condición deseable, principalmente para consumidores jóvenes de la Región de La Araucanía.

Palabras clave: alimentos genéticamente modificados, leche, análisis conjunto, análisis cluster.

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