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Acceptance of a food of animal origin obtained through genetic modification and cloning in South America: a comparative study among university students and working adults

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Abstract

With the aim of comparing the acceptance of milk obtained from cloned, genetically modified (GM) and conventionally bred cows among working adults and university students, and identifying and characterizing typologies among both subsamples in terms of their preferences, a survey was applied to 400 people in southern Chile, distributed using a simple allocation among the subsamples. Using a conjoint analysis, it was found that consumers preferred milk from a conventional cow. Using a cluster analysis, in both subsamples two segments sensitive to production technology were identified. Rejection of cloning was greatest among university students, whereas a higher proportion of working adults rejected GM. The segments differed in terms of area of residence, knowledge about GM, and milk consumption habits. Contrary to what was expected, no differences were found according to education, gender or degree of satisfaction with food-related life.

Keywords: animal cloning; GM animals; milk; developing countries; consumer acceptance.

Practical Application: Information on relative consumer acceptance regarding genetically modified or cloned origin of animal products may allow the production sector, government agencies and sellers to project which technology may be most successful in the market, both in the medium and long term.

1 Introduction

New food technologies enable innovations in the food sector, though consumers do not equally accept all technologies (Saeed et al., 2015; Siegrist, 2008). Consumers may express concerns and fears about novel technologies such as genetically modified (GM) foodstuffs, nanotechnology and animal cloning, rejecting those technologies (Bánáti, 2011) which otherwise may provide useful solutions that are also in the consumers' interest (Bánáti, 2011; Mandaci et al., 2014; Ghazaei et al., 2015). This study compares acceptance of food obtained from genetically modified (GM), cloned and conventionally bred cows. Most available studies have assessed acceptance of GM foods and those from cloned animals separately; this investigation will contribute to the knowledge about the relative consumer acceptance of both technologies. This may provide orientation for the production sector, government agencies and sellers as to which technology may be most successful in the market, both in the medium and long term. For this reason, the study is conducted using two subsamples: working adults (WA) who represent current and medium-term acceptance, and university students (USt) who may tend to acceptance over a longer period, considering that young people search for new food experiences and become increasingly neophile, attempting to distinguish themselves from their parents' food-related values (Nørgaard et al., 2014). In line with previous studies, it is expected that WA will be less receptive to the two technologies than the USt (Mucci et al., 2004; Nayga et al., 2006; Rollin et al., 2011). Based on the make-up of this sample, it is expected that differences will be detected according to the knowledge of these technologies (Christoph et al., 2008; Cardello et al., 2007) and the level of education (Kimenju & De Groote, 2008; Šorgo & Ambrožič-Dolinšek, 2010; Schnettler et al., 2012).

Consumer response to the commercial use of GM food varies in different countries (Rodríguez-Entrena & Salazar-Ordóñez, 2013). It has been reported that developing countries tend to have positive attitudes towards novel food technologies, in particular towards GM (Rollin et al., 2011), and among the developing countries there is evidence of consumer groups that have a positive attitude towards GM foods, like in China (De Steur et al., 2010), Kenya (Kimenju & De Groote, 2008) or Brazil (Costa et al., 2000), but in other developing nations the perceptions are generally more negative than positive, like in Argentina (Mucci et al., 2004) and Chile (Schnettler et al., 2010, 2012). The term "genetically modified animals" is rather broad, and may apply to animals fed with feed containing GM additives

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or enzymes, those given GM vaccines and hormones, and those that are GM themselves (Novoselova et al., 2007). Consumers have been found to have higher acceptance of GM technologies using plant-based products rather than animal-based products (Mora et al., 2012; Nayga et al., 2006), although other authors report the opposite (Schnettler et al., 2012). While European consumers are concerned about the use of GM in animal production (Lähteenmäki et al., 2003), in terms of environmental sustainability, human health and animal welfare (Mora et al., 2012), in the US there is no evidence of this concern (Cox et al., 2011).

Compared to what is known about consumer response to GM food in general, there is limited information about consumer attitudes toward food derived from animal clones (Aizaki et al., 2011). Animal cloning shares some similarities with GM technology in terms of consumer awareness and acceptance (Rollin et al., 2011). Some studies indicated that between 40 and 50% of consumers would not purchase meat or milk derived from cloned animals (International Food Information Council, 2008; The Gallup Organization, 2008; Aizaki et al., 2011; Brooks & Lusk, 2011). Other studies found that consumers place a higher value on non-cloned products than on cloned products (Butler et al., 2008; Brooks & Lusk, 2010, 2012; Aizaki et al., 2011). However, The Gallup Organization (2008) reported that acceptance of foods obtained from cloned animals differed between countries. To our knowledge, in contrast to other studies that have assessed acceptance of GM foods in developing countries, there are no studies on the acceptance of animal cloning in these nations.

Some authors indicate that acceptance of GM foods is not related to consumer socio-demographic characteristics (Lähteenmäki et al., 2003), yet several studies report greater willingness to purchase GM foods in men and young people (Mucci et al., 2004; Nayga et al., 2006; Rollin et al., 2011), and those with a higher education (Kimenju & De Groote, 2008; Schnettler et al., 2012). Other papers conclude that the type of the consumer's higher education plays a moderating role in GM food acceptance (Rodríguez-Entrena & Salazar-Ordóñez, 2013). In terms of food from cloned animals, recent studies have reported that older people (Butler et al., 2008) and those with high school education (Brooks & Lusk, 2011) are less supportive of cloning than younger people and those with a bachelor's degree or higher level of education. Additionally, some studies explore neural reactions behind consumers' choice on food technologies (Lusk et al., 2015) and relate psychological aspects to preferences for certain foods. Recent studies have reported that satisfaction with food-related life is associated with the preference for foods produced with new technologies, such as nanotechnology (Schnettler et al., 2013, 2014). Therefore, it is expected that the acceptance of foods obtained from GM or cloned animals will differ according to consumer satisfaction with food-related life. The aims of this study were: to compare the acceptance of milk obtained from cloned, GM and conventionally bred cows, taking Chile as a case study in developing countries; to compare preferences for these products in working adults (WA) and university students (USt); and to identify typologies among WA and USt in terms of preferences and characterize them according to their knowledge of these new technologies, socio-demographic characteristics, and level of satisfaction with food-related life.

2 Materials and methods

2.1 Sample and procedure

A personal survey was administered in Temuco, Chile, to a sample of 400 people. This number was obtained using the stratified random sampling formula with simple allocation for non-finite populations (N> 100,000), considering 95% confidence and 5% estimation error with p and q of 0.5 (Fernández, 2002). Thus, 200 USt and 200 WA were surveyed. The survey was applied in July and August 2013 in person, after the questionnaire had been validated by means of a preliminary test with 10% of the sample. The Bioethics Committee of the Universidad de La Frontera approved the present study.

2.2 Information collection instrument

A questionnaire with closed-ended questions was used to collect information to determine whether the respondents understood the meaning of a cloned or GM animal and the frequency of milk consumption. The questionnaire included the Satisfaction with Food-related Life (SWFL) scale, proposed and tested by Grunert et al. (2007) in eight European countries (Cronbach's α: 0.81-0.85); the five items on the scale are grouped into a single dimension. The respondents were asked to indicate their degree of agreement with the five items using a 6-point Likert scale (1= disagree completely, 6= agree completely). The Spanish-language version of the SWFL was used, which has shown good levels of internal reliability in previous studies conducted in Chile (Schnettler et al., 2013, 2014). In this study, Cronbach's α coefficients were 0.89 in the USt subsample and 0.83 in the WA subsample. Classification questions were included to establish gender, age, family size, area of residence, level of education of the head of the household, and possession of 10 household goods. The combination of these two latter variables in a matrix determines the socio-economic level, classified as ABC1 (high and upper middle), C2 (middle-middle), C3 (lower middle), D (low) and E (very low) (Adimark, 2004). The USt subsample was also asked about the study program in order to classify them as social science or natural science.

In order to evaluate acceptance of milk obtained from conventionally bred, GM and cloned cows, a conjoint analysis (CA) was performed (Hair et al., 1999). Table 1 shows the attributes and levels defined for the milk. The price levels were established based on current prices in the Temuco market for 1L of milk at the time of the survey. From these attributes and levels, a total of 243 combinations (3×3×3×3×3) were obtained; however, to facilitate the respondents' answers, it was decided that a fractional factorial design would be used, obtained with the macro MktEx from the SAS Institute (Kuhfeld, 2010). This allowed the number of stimuli to be reduced to twelve with one specification for each attribute. The stimuli were presented to respondents on cards. Each participant ranked twelve cards from most to least preferred using a scale from 1 to 12 (1 = most preferred; 12 = least preferred). Prior to asking the respondents to put the cards in order, the following definitions were read to them: "A GM organism is that in which the genetic material (DNA) has been altered in a way that does not occur naturally. It allows selected individual genes to be transferred from

Table 1. Design of the conjoint experiment.

Card	Brand name	Fat content	Package	Production Technology	Price (US$/L)
A	Nestlé	Skimmed	Tetra Pak easy-to-open	Conventional	1.5
B	Nestlé	Semi-skimmed	Tetra Pak easy-to-open	GM	1.3
C	Nestlé	Whole	Basic flat-top carton	Conventional	1.2
D	Nestlé	Whole	Tetra Pak screw-cap	Cloned	1.3
E	Soprole	Skimmed	Basic flat-top carton	Cloned	1.3
F	Soprole	Semi-skimmed	Tetra Pak easy-to-open	Cloned	1.2
G	Soprole	Semi-skimmed	Tetra Pak screw-cap	Conventional	1.5
H	Soprole	Whole	Basic flat-top carton	GM	1.5
I	Soprole	Whole	Tetra Pak easy-to-open	Conventional	1.3
J	Surlat	Skimmed	Tetra Pak screw-cap	Conventional	1.2
K	Surlat	Semi-skimmed	Basic flat-top carton	GM	1.3
L	Surlat	Whole	Tetra Pak easy-to-open	Cloned	1.5

GM: genetically modified.

one organism to another, even between non-related species" (World Health Organization, 2009); "Cloning is the process of multiplying single organisms by means of asexual reproduction to create a population of identical individuals" (European Group on Ethics in Science and New Technologies to the European Comission, 2008).

2.3 Statistical analysis

A conjoint analysis was carried out using the TRANSREG procedure by SAS (SAS Institute Inc., Cary, NC, USA). The relative importance consumers gave to the different attributes and the utility values obtained for each level of the selected factors were determined. The root mean square error (RMSE) was calculated to measure the difference between the observed and the predicted data. An independent sample t-test was applied to investigate potential significant differences in the mean responses for USt and WA. A hierarchical cluster analysis was chosen to determine consumer segments according to the partial utility scores of the attribute levels. A cluster analysis was carried out separately in the USt and WA subsamples. Ward's procedure, which calculates the squared Euclidean distance, was carried out using the CLUSTER procedure by SAS. To describe the segments, the Chi-squared test was applied to the discrete variables and a one-factor analysis of variance to the continuous variables (99% and 95% confidence level). Since the Levene's statistic indicated non-homogeneous variances in all of the continuous variables analyzed, the variables for which the analysis of variance resulted in significant differences ($P<0.001$) were subjected to Dunnett's T3 multiple comparisons test.

3 Results and discussion

Table 2 shows the sample description. The sample was balanced according to gender, and was composed principally of people from families with three or four members, people residing in urban areas, people from the ABC1 and C2 socio-economic groups, and people belonging to families where the head of the household had a high-school education. The greatest proportion of participants consumed milk daily or occasionally. A large number of respondents stated they knew the meaning of cloned or GM. 49% of the students was studying in the area of social sciences and 51% in natural sciences. The mean score of the SWFL in the total sample was 24.6 (SD=3.76) from a theoretical maximum of 30. The RMSE of the conjoint analysis was 0.16, which indicated a good goodness-of-fit. According to the conjoint analysis (Table 3) for the entire sample, the attribute of greatest importance during the purchase process was the production technology, followed by the price, brand, fat content, and finally the package. The signs of the utility values indicate preference for milk from a conventional animal in keeping with previous studies that have evaluated the acceptance of GM foods (International Food Information Council, 2014; Lähteenmäki et al., 2003; Mucci et al., 2004; Siegrist, 2008; Schnettler et al., 2010, 2012) in both developed and developing countries, and cloned (Aizaki et al., 2011; Creative Research, 2008; International Food Information Council, 2008; Brooks & Lusk, 2010, 2011, 2012; Saeed et al., 2015) in developed countries. Nevertheless, in the case of GM foods, it contradicts the results of studies carried out both in developing (Costa et al., 2000; Kimenju & De Groote, 2008; De Steur et al., 2010) and developed countries (Cox et al., 2011). Using conjoint analysis, Cox et al. (2011) found in an US sample that consumers reported preferences for milk from cows fed with GM oilseed. Our findings confirm, however, that consumers may perceive new food technologies as riskier than traditional food technologies (Siegrist, 2008). Barcellos et al. (2010) concluded that invasive technologies tending to deviate from conventional processing practices are widely rejected. In addition, the rejection of GM and cloning can be explained by the food used in this study. The more a product is seen as natural or healthful, as is the case with milk, the less acceptable a GM version of that product will be (Tenbült et al., 2005). Therefore, future research must include other foods obtained from GM or cloned animals, to assess whether the response is associated with the food studied.

Consumers preferred the brands Nestlé and Soprole (greatest preference for Nestlé) and rejected Surlat, which is the least established brand in the Chilean dairy market. In this regard, some studies report that trustworthy brands reduce the risk associated with the purchase of a food produced with new technologies like GM (Costa et al., 2000; Mucci et al., 2004; Schnettler et al.,

Table 2. Description in percentage of the sample. Temuco, Chile. August, 2013.

	Composition	Total sample (n = 400)	University students (n = 200)	Working adults (n = 200)	P-value
Gender	Male	49.5	55.5	43.5	0.016[a]
	Female	50.5	44.5	56.5	
Family size	1-2 family members	30.0	30.5	29.5	0.141[a]
	3-4 family members	55.3	51.5	59.0	
	5 or more	14.8	18.0	11.5	
Residence	Urban	81.8	86.5	77.0	0.014[a]
	Rural	18.3	13.5	23.0	
Socio-economic status	ABC1	39.3	36.5	42.0	0.261[a]
	C2	40.5	40.0	41.0	
	C3	12.0	14.0	10.0	
	D-E	8.3	9.5	7.0	
Education	Primary school	5.5	6.0	5.0	0.568[a]
	High school	37.0	36.0	38.0	
	Tech degree	28.5	30.5	26.5	
	Undergraduate	29.0	27.5	30.5	
Age	Mean age	31.8	23.7	40.0	0.000[b]
Frequency of milk consumption	Daily	33.3	35.5	31.0	0.647[a]
	2-3 times/week	21.3	19.0	23.5	
	1 time/week	10.8	10.0	11.5	
	Occasionally	25.5	25.0	26.0	
	Other frequency	9.3	10.5	8.0	
Knows what it means that an animal is cloned	Yes	97.5	98.5	96.5	0.200[a]
	No	2.5	1.5	3.5	
Knows what it means that an animal is GM	Yes	86.3	93.0	79.5	0.000[a]
	No	13.8	7.0	20.5	
SWFL	Mean score	24.5	24.5	24.7	0.474[b]

[a]P value corresponds to the (bilateral) asymptotic significance obtained in Pearson's Chi squared test. [b]P value correspond to Student's t-test to related samples (paired). GM: genetically modified.

2012) or nanotechnology (Schnettler et al., 2014), although such an interaction effect cannot be studied in the present design.

In contrast to what was expected, significant differences were only detected between the subsamples in the importance assigned to brand and fat content (P≤0.05) and not in the preferences for milk from a conventional, GM or cloned cow.

This result contradicts studies that indicate that young people have a more positive attitude to GM foods (Mucci et al., 2004; Nayga et al., 2006; Rollin et al., 2011) and those obtained from cloned animals (Butler et al., 2008). The results of this study suggest that acceptance of foods derived from GM or cloned animals is negative in the study sample, and it is expected that this will not change in the future when the current USt are charge of food purchases for their homes. These attitudes are noteworthy, as stated by Šorgo & Ambrožič-Dolinšek (2010), because public acceptance may play a major role in determining the advancement of biotechnology development.

The cluster analysis distinguished three consumer types in the USt subsample and four groups in the WA subsample. In the USt subsample the groups differed significantly in terms of preference for almost all attribute levels (P≤0.001 or P≤0.05), except in the preferences for the Tetra Pak with the basic flat top (P>0.1) (P≤0.001 or P≤0.05). The groups also differed in terms of importance assigned to all the attributes (Table 4). These groups differed significantly (Table 5) in terms of area of residence (P≤0.05): **Sensitive to the technology, rejection of cloning. Group USt 1 (37.5%):** This group assigned greatest importance to the production technology. They preferred milk from a conventional animal, although significantly less than Group 2. It stands out as the group with the greatest rejection of milk from a cloned animal (Table 4). **Sensitive to the technology, rejection of GM. Group USt 2 (31.5%):** This group placed greatest importance on the production technology and showed the greatest preference for milk from a conventional animal, significantly more than the other groups. This group stood out for the significant rejection of milk from a GM animal and the lowest rejection of milk from a cloned animal (Table 4). **Sensitive to price. Group USt 3 (31.0%):** This group assigned significantly greater importance to the cost of the milk. They stood out as being the only ones who preferred milk of a GM animal. Also, it was the group that showed the least preference for milk from a conventional animal (Table 4). This group had a higher number of people living in an urban area (Table 5).

In the WA subsample the groups differed significantly in terms of preference for almost all attribute levels (P≤0.001 or P≤0.05),

Table 3. Relative importance for overall sample and subsamples based on preferences to milk produced conventionally, by cloning or by GM.

Attribute and Levels	Total sample (n = 400)	University students (n = 200)	Working adults (n = 200)	P-value
Brand				
Nestlé	0.520	0.632	0.408	0.070
Soprole	0.239	0.203	0.274	0.507
Surlat	-0.759	-0.835	-0.683	0.244
Relative importance (%)	16.2	17.6	14.9	0.024
Fat content				
Skimmed	0.262	0.297	0.226	0.591
Semi-skimmed	-0.322	-0.259	-0.386	0.276
Whole	0.060	-0.044	0.155	0.104
Relative importance (%)	15.8	16.8	14.8	0.050
Package				
Tetra Pak easy-to-open	-0.282	-0.301	-0.264	0.703
Tetra Pak screw-cap	0.242	0.198	0.286	0.426
Basic flat-top carton	0.040	0.104	-0.022	0.306
Relative importance (%)	13.6	13.6	13.5	0.946
Production Technology				
Conventional	2.192	2.042	2.290	0.285
GM	-1.311	-1.226	-1.397	0.396
Cloned	-0.881	-0.869	-0.893	0.869
Relative importance (%)	35.1	34.0	36.1	0.310
Price				
US$ 1.2/L	0.525	0.539	0.711	0.275
US$ 1.3/L	0.222	0.196	0.245	0.713
US$ 1.5/L	-0.847	-0.738	-0.955	0.145
Relative importance (%)	19.4	18.0	20.7	0.065

P value correspond to Student-t test to related samples (paired). GM: genetically modified.

except in the preferences for semi-skimmed and whole milk (P>0.1). The groups also differed in terms of importance assigned to all the attributes (P≤0.001 or P≤0.05) (Table 4). These groups differed significantly (Table 5) in terms of whether they knew what an animal being GM meant and in the frequency of milk consumption (P≤0.05): **Sensitive to price. Group WA 1 (11.0%):** This group gave greatest importance to the price. It was the only group that preferred milk from a cloned animal (Table 4). It comprised a greater proportion of people that did not know the meaning of a GM animal (Table 5). **Sensitive to the technology, rejection of GM. Group WA 2 (55.0%):** This group assigned high importance to the production technology, although significantly less than Group 3. They preferred milk from a conventional animal and showed the greatest rejection of milk from a GM animal. **Sensitive to the technology, rejection of cloning. Group WA 3 (14.0%):** This group assigned the greatest importance to the production technology, significantly higher than the other groups. They showed to the greatest preference for milk from a conventional cow and the greatest rejection of cloning. The rejection of milk from a GM animal was less than in Groups 1 and 2 (Table 4). **Sensitive to brand, price and production technology. Group WA 4 (20.0%):** This group gave significantly greater importance to the brand. This group stood out as being the only group that preferred milk from a GM animal. The rejection of milk from a cloned animal was lower than in Groups 2 and 3. Group 4 comprised a smaller proportion of people who consume milk daily (Table 5).

In summary, in both subsamples there were two segments sensitive to production technology (USt subsample: 62.5%, WA subsample: 69.0%, in total), one with greater rejection of cloning (USt: 37.5%, WA: 14.0%) and the other with greater rejection of GM (USt: 31.5%, WA: 55.0%). Both subsamples revealed a type sensitive to the price, with a high preference for the lowest. Only the WA subsample contained a type sensitive to the brand, price and production technology, which showed a preference for milk from a cloned animal. Therefore, even though the overall test of differences between the subsamples, in their preferences for the technology associated with the animal from which the milk was obtained, did not yield any significant differences, the results of the cluster analysis suggested a greater rejection of cloning among the USt and a greater rejection of GM among the WA. However, it is worth noting that all the types identified in both subsamples preferred milk from a conventionally bred animal. The majority preferred the best-established brands in the market (except Group 1 WA subsample), confirming that brand helps reduce the risk of buying foods produced with new technologies (Frewer et al., 2011; Rollin et al., 2011; Schnettler et al., 2012, 2014), such as GM and cloning. The results concerning significant differences between the groups are in line with studies that

indicate that acceptance of GM foods is not related to consumer characteristics (Lähteenmäki et al., 2003).

However, the greatest presence of participants resident in urban areas in Group 3 of the USt subsample is consistent with a qualitative study that found that urban consumers were more prone to accept innovations in traditional food products (Guerrero et al., 2009). The lower frequency of daily milk consumption in Group 4 by the WA subsample seems to confirm that the preferences for GM foods are related to food consumption habits (Schnettler et al., 2010). The greater presence of people

Table 4. Distribution and relative importance for clusters in both subsamples based on preferences to milk produced conventionally, cloned and GM.

Attribute and Levels	University students					Working adults					
	Group 1 (n=75)	Group 2 (n=63)	Group 3 (n=62)	F	P-value	Group 1 (n=22)	Group 2 (n=110)	Group 3 (n=28)	Group 4 (n=40)	F	P-value
Brand											
Nestlé	0.967 a	0.629 ab	0.229 b	5.725	0.004	-0.005 b	0.304 ab	0.391 ab	0.935 a	4.220	0.006
Soprole	0.159 ab	-0.095 b	0.560 a	5.799	0.004	-0.063 b	0.202 b	-0.177 b	0.975 a	10.228	0.000
Surlat	-1.127 b	-0.533 a	-0.789 ab	3.277	0.040	0.068 a	-0.505 b	-0.214 ab	-1.910 c	24.659	0.000
Relative importance (%)	21.3 a	13.0 b	17.9 a	7.623	0.001	8.8 c	13.5 b	12.3b	23.7 a	15.654	0.000
Fat content											
Skimmed	1.027 a	0.267 b	-0.555 c	25.337	0.000	0.116 ab	0.441 a	-0.187 b	-0.015 ab	2.973	0.033
Semi-skimmed	-0.610 b	-0.019 a	-0.080 a	5.502	0.005	-0.323	-0.541	0.114	-0.346	2.598	0.054
Whole	-0.417 b	-0.258 b	0.625 a	14.022	0.000	0.177	0.098	0.073	0.356	0.544	0.653
Relative importance (%)	20.9 a	11.6 b	17.2 a	11.712	0.000	14.5 ab	16.0 a	9.9 b	14.9 ab	4.271	0.006
Package											
Tetra Pak easy-to-open	-0.377	-0.306	-0.205	0.521	0.595	0.253 a	-0.425 b	-0.141 b	-0.193 b	3.346	0.020
Tetra Pak screw-cap	0.449 a	-0.052 b	0.148 ab	3.829	0.023	-0.835 b	0.454 a	0.144 a	0.542 a	10.090	0.000
Basic flat-top carton	-0.072	0.358	0.057	2.172	0.117	0.582 a	-0.029 b	-0.002 b	-0.394 c	2.833	0.039
Relative importance (%)	15.1 a	11.0 b	14.3 a	4.701	0.010	13.3 ab	13.6 ab	8.8 b	16.9 a	5.121	0.002
Production Technology											
Conventional	1.958 b	3.584 a	0.745 c	64.682	0.000	0.467 c	3.036 b	3.774 a	0.204 c	75.172	0.000
GM	-0.398 a	-3.499 b	0.084 a	140.656	0.000	-0.737 b	-2.692 c	-0.390 b	1.096 a	92.813	0.000
Cloned	-1.560 c	-0.084 a	-0.829 b	20.472	0.000	0.270 a	-0.344 b	-3.384 d	-1.300 c	84.741	0.000
Relative importance (%)	30.5 b	51.8 a	20.0 c	71.248	0.000	11.6 d	40.9 b	57.0 a	21.6 c	49.784	0.000
Price											
US$ 1.2/L	0.376 ab	0.278 b	1.005 a	4.789	0.009	3.852 a	0.745 b	0.072 c	-0.664 d	82.848	0.000
US$1.3/L	-0.278 b	0.018 b	0.952 a	20.265	0.000	-0.216 b	-0.208 b	0.245 b	1.743 a	30.078	0.000
US$ 1.5/L	-0.098 a	-0.301 a	-1.957 b	45.877	0.000	-3.636 c	-0.537 ab	-0.318 a	-1.079 b	46.230	0.000
Relative importance (%)	12.2 b	12.6 b	30.6 a	55.748	0.000	51.8 a	16.0 c	12.0 c	22.9 b	91.208	0.000

Different letters in the line indicate significant differences according to Dunnett's T3 multiple comparison test ($P \leq 0.05$ or $P \leq 0.001$). GM: genetically modified. The national currency values (Chilean pesos) were converted to dollars using the average 2013 value ($495.71/US$.

Table 5. Characteristics with significant differences in the groups identified by cluster analysis in both subsamples.

Characteristic	University students			Working adults			
	Group 1 (n=75)	Group 2 (n=63)	Group 3 (n=62)	Group 1 (n=22)	Group 2 (n=110)	Group 3 (n=28)	Group 4 (n=40)
Do you know what it means that an animal is GM					P=0.033		
Yes				59.1	80.0	92.9	80.0
No				40.9	20.0	7.1	20.0
Residence		P=0.049					
Urban	84.0	81.0	95.2				
Rural	16.0	19.0	4.8				
Frequency of milk consumption					P=0.030		
Daily				45.5	35.5	28.6	12.5
2-3 times/week				9.1	20.0	25.0	40.0
Once a week				4.5	10.0	17.9	15.0
Occasionally				31.8	27.3	28.0	17.5
Other frequency				9.1	7.3	0.6	15.0

P value corresponds to the (bilateral) asymptotic significance obtained in Pearson's Chi squared Test.

that did not know the meaning of an animal being GM in Group 1 of the WA subsample could partly explain the rejection of GM and the acceptance of cloning. However, results of this type (n=22) must be taken with caution, because it is risky to draw conclusions based on segments with such a low number of consumers (McEwan, 1997). The same criterion must be applied to Group 3 (n=28) of the WA subsample, which was the one that gave greatest importance to the production technology, with the greatest preference for milk from a conventional animal and the greatest rejection of cloning. Therefore, it is possible to indicate that previous knowledge of technologies in this study may not be associated with the acceptance of GM and cloning in the subsamples studied, in keeping with the results of Aizaki et al. (2011). One notable result is that statistical differences between types were not detected according to the education level in either subsample, nor according to the type of program the students are enrolled in in the USt subsample. This contradicts the reports by Kimenju & De Groote (2008). It also contradicts the results of Rodríguez-Entrena & Salazar-Ordóñez (2013), who reported a positive attitude to GM food in natural science students. In this study no differences were detected associated with the respondent's satisfaction with food-related life. This is in contrast to studies that report that people with a high level of satisfaction with food-related life are more receptive to the use of nanotechnology in food production (Schnettler et al., 2013, 2014). This result may indicate that the positive relationship between satisfaction with food-related life and acceptance of nanotechnology cannot be generalized to the other new technologies in food production.

4 Conclusions

In Southern Chile, using a sample of WA and USt, it was found that the attribute of greatest importance in the milk purchase decision process was the production technology, followed by price, brand, fat content, and package. Survey participants preferred milk from a conventional animal and rejected milk from a cloned cow. Although a comparison of the preferences for technologies associated with animals revealed no differences between WA and USt, the cluster analysis performed separately on both subsamples showed that a greater proportion of USt rejects cloning and a greater proportion of WA rejects GM.

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