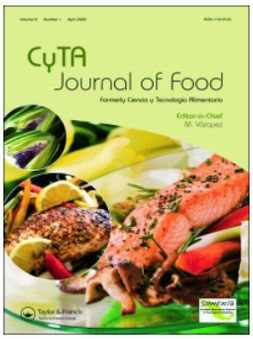

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Changes in consumers interest on cheeses with health benefits and different manufacture types over the last decade

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ABSTRACT

This work aimed to study the response of Uruguayan consumers to cheeses with different nutritional and commercial characteristics and determine changes over the last decade. Conjoint analysis was used to establish the value that consumers gave to different health benefits (low-fat, salt-reduced, fibre-enriched, probiotic) and to different manufacturing processes (traditional and industrial) for two different types of cheese (spreadable and semi-soft). Results indicated that consumers' interest varied depending on the proposed health benefit. In general consumers' interest in cheese with specific nutritional benefits was lower than for the regular product. Consumers were interested only in the low-fat cheeses with no change in 2010 and 2018. Manufacture type became significant between years, nowadays consumers are more interested in traditional manufacture. Consumer segmentation in 2018 showed that some groups were willing to consume cheeses with health benefits, among the different options, nowadays there are new opportunities for functionality in cheeses.

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Cheese; healthy diet; conjoint analysis; consumers; time-lapse; manufacture type

Introduction

A poor diet is related to poor healthy food choices and leads to ill health. It has been estimated that about 11 million deaths a year worldwide are attributable to deficient diets (Kaur et al., 2017). That is the reason for an increasing awareness about the strong relationship between diet and human health, this has changed food preferences in developed societies that leads consumers to choose a concrete food product over another with the view to obtaining some desirable health end-state (Bogue et al., 2017).

Dairy products can be an interesting preventive target for maintaining cardiometabolic health, as they are a rich source of calcium, potassium, and vitamins. Dairy proteins have been associated with favourable body composition and improved insulin sensitivity (Mozaffarian & Wu, 2018). Dietary guidelines of many countries worldwide recommend consuming one to four servings of dairy foods daily, focusing on selecting low-fat options to lower SFA intake (Slurink et al., 2022). According to Feeney et al. (2021), about cheeses, growing evidence suggests that the nutrients present appear to work in concert to reduce markers of cardiovascular diseases risk compared to other dairy products when matched for fat content. However, a detailed mechanistic understanding on how the cheese matrix influences health outcomes is still lack in are a concentrated source of saturated fats. Functional products are excellent food options as they are aimed to improve life quality by preventing nutrition-related diseases (Domínguez Díaz et al., 2020). Functional foods have been shown to enhance the quality of the human diet, decrease the potential risks of some chronic diseases, and effectively improve public health at a relatively low cost, thereby contributing to existing health interventions (Tian et al., 2022). The launch on the market of new foods developed by adding functional ingredients to carrier foods provides potential benefits for consumers' diets and new business opportunities for producers.

Many studies have focused on consumer awareness and acceptance of functional foods. A common result of these studies is that consumer acceptance of functional foods is far from being unconditional. A wide range of influential factors in acceptance have been reported, primary health concerns, consumers' familiarity with the concepts and ingredients, the nature of the carrier product, the communication mode of health effect, etc. (Baker et al., 2022). Evidence from previous studies has shown that food products bearing nutritional claims and health claims are seen as healthier alternatives and consumers are willing to pay a premium for achieving such benefits (Ballco et al., 2020).

The functional food market is dominated by carotenoids, dietary fibers, fatty acids, minerals, vitamins, prebiotics, probiotics, and synbiotics (Turkmen et al., 2019). Dairy products are considered by consumers as one of the most credible product carriers to host functional ingredients, and consumers' acceptance and preferences towards nutrition-modified and functional dairy have been largely investigated in the literature (Ares & Gámbaro, 2007; Awaisheh, 2011; Fritzen-Freire et al., 2010; Guttierrez & Barreto, 2010; Rodrigues et al., 2011). In Uruguay, as in the rest of the world, dairy is the sector that has expanded most with the introduction of functional products (Bimbo et al., 2017). Ares et al. (2008) showed that Uruguayan consumers were in general willing to consume food products with a positive impact on their health, particularly those that could reduce the risk of cardiovascular diseases or cancer or boost their immune system. Bimbo et al. (2017) show a consensus among the literature reviewed that the brand increases the acceptance and motivates consumers' choice of nutrition-modified and functional dairy products over conventional

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ones. Such influence is particularly strong among consumers who are less likely to engage in a healthy lifestyle, while they have poor effect on the choices of consumers with high interest in health.

In the line of dairy products, cheese is widely consumed, and it is also an interesting alternative to develop healthy products. So, it should be important to identify which health benefits of cheese interest consumers most. Also, it may be considered that consumers could be concerned with the type of cheese manufacturing process employed. In many countries, cheeses are produced by both big dairy industries and small producers, which consumers relate with industrial and traditional manufacture, respectively. For some consumers, traditionally manufactured products are linked to cultural heritage and to the sustainability of rural areas (van Loo et al., 2019). Soares et al. (2017) report that "Manufacturing method" was one of the main responsible for differentiating Brazilian consumers' perceptions in coalho cheese.

The launch of new niche foods developed by enhancing nutritious or fortifying functional ingredients to carrier foods on the market not only improves dietary nutrition and health of people but also provides producers new business opportunities (Tian et al., 2022) Recent years have witnessed a strong increase in the number of products offered in the market, incorporating new ingredients such as fiber, prebiotics, probiotics, etc., or those with reduced content of certain components like fat, sodium, or sugar or others indicating its origin or type of manufacturing method. But, depending on consumers' origin they may be predisposed differently to consume those kinds of foods, explained by their cultural differences, habits, and customs (van Trijp & van der Lans, 2007). These could explain that time can also influence consumer response, some places could need more time or not to accept "new products". In this way (Ngapo & Dransfield, 2006), reported that fatness of beef cuts has been an important characteristic in consumer preferences at purchase for the last 50 years, but the level of fat preferred by the consumer has not remained static, most British consumers nowadays prefer leaner meat than their predecessors.

To determine which characteristics of a product are most interesting or attractive to a consumer, conjoint analysis results in a useful technique, often used in market research (Moskowitz & Silcher, 2006). It can be applied to determine which functional benefits of nutritional claims consumers may consider more attractive or reliable (Drewnowski et al., 2010; Moskowitz et al., 2004). Guiné et al. (2020) investigated the consumption habits of the most relevant types of dairy products in Brasil and Portugal and relate them to sociodemographic factors, for example, age, sex, education, and country as well as with some anthropometric and behavioural aspects. They found the influence of country was not a meaningful discriminant, in relation to the other variables included in the classification analysis.

With respect to the presence of cheeses with functional characteristics in the Uruguayan market, in 2010, there was mainly low-fat cheeses, followed by the salt-reduced ones. In 2018, in addition to low-fat and salt-reduced, there was cheese with probiotics as the most recent. Although the effects of health benefits of spreadable type cheeses on the consumers' perception have been reported (de Melo et al., 2022), there is a lack of studies dealing with the effect over time on consumers interest on cheeses with different attributes (as health benefits and different manufacture types).

The aim of this work was to determine the value that Uruguayan consumers give to different health benefits and commercial characteristics on spreadable and semi-soft cheese (Danbo cheese) and to evaluate if this response changes over a period.

Materials and methods

Conjoint analysis

A rating-based conjoint task was carried out for two types of cheese: a spreadable cheese and a semi-soft cheese (Danbo cheese), both widely consumed in several countries (de Melo et al., 2022; Hynes et al., 2017; Lucera et al., 2018; Repajić et al., 2019). The study was carried out in two different periods of time. It was done first in 2010, and it was repeated in 2018.

For each type of cheese two factors were considered: different health benefits and different types of manufacturing process. The first factor comprised five levels: four different health benefits (low-fat, salt-reduced, fiber-enriched, and probiotic) and a regular product. In the second factor, the traditional and industrial type of manufacture were considered (Appendix 1). The two factors varied independently following a full factorial design of 5×2. So, 10 vignettes with the description of the product combining both factors were created for each type of cheese.

Survey

An online survey was shared among Uruguayan consumers (application Google Docs-Home of Google). In the survey, each one of the 10 vignettes generated was presented monadically following a Williams Latin square design, the respondent had to indicate the degree of interest in each hypothetical product by using a 9-point scale, from "I'm not interested at all" to "I'm very interested". After that, participants completed the General Health Interest questionnaire proposed by Roininen et al. (1999) using the Spanish version reported by Villegas et al. (2008) (Table 1). Finally, respondents completed some demographic questions. Participants did not receive monetary compensation.

In the survey done in 2010 one hundred and sixty-two people completed the survey. 61% were women and 39% were men. The 67% of the participants were from 18 to 40 years old and the 33% from 40 to 66 years old.

In the survey done in 2018 one hundred and fifty-six people completed the survey. 62% were women and 38% were men. The 53% of the participants were from 18 to 40 years old and the 47% from 40 to 66 years old.

Data analysis

A mixed ANOVA of three factors, two fixed (health benefit and type of processing) with interaction and one random (consumer) was applied to study the variability in consumers' interest in cheeses (A1) and to know which factor was significant. The utility value for each factor level, for the total consumer panel, was obtained from the Partial Least Square Regression (PLSR), being acceptability the regression variable. For this analysis, only consumer with $R2 \geq 0.66$ were

Table 1. General health interests multiple scale. Extracted from Roininen et al. (1999).

		Items
1.	R[1]	The healthiness of food has little impact on my food choices.
2.		I am very particular about the healthiness of food I eat.
3.	R	I eat what I like and I do not worry much about the healthiness of food.
4.		It is important for me that my diet is low in fat.
5.		I always follow a healthy and balanced diet.
6.		It is important for me that my daily diet contains a lot of vitamins and minerals.
7.	R	The healthiness of snacks makes no difference to me.
8.	R	I do not avoid foods, even if they may raise my cholesterol.

[1]Negative statements (marked with an "R" after the statement number) are recoded for the final score.

considered, according to their individual PLSR model. An ANOVA of two factors (health benefits and type of processing) was applied, in each year studied, to know which factor was significant. When the effects were significant, differences were calculated using Tukey's test ($\alpha = 0.05$).

To identify groups of consumers, hierarchical cluster analysis considering Euclidean distances and with Ward's aggregation method were applied. Composition of each cluster according to consumer gender, age and interest in a healthy diet were compared using the Chi-square test. Significant differences among proportions were determined using Marascuilo procedure (Levy, 1975).

For each characteristic, differences in the utility values obtained in 2010 and 2018 for both cheeses were determined by t-student test ($\alpha = 0.05$).

Data analyses were performed using the software XLSTAT 2020.3.1 Version (Addinsoft, France).

Results

Consumers' interest in spreadable cheese with different benefits and type of manufacture

Survey conducted in 2010

ANOVA results (Table 2) of the total dataset showed that in general the interest of consumers in spreadable cheese varied significantly depending on the health benefit. The manufacture type and the interaction effects were not significant indicating that their interest in the nutritional benefit of spreadable cheeses did not depend on the manufacture type.

Utility values (Table 3) showed that in general consumers were interested in low-fat products as well as the regular one.

To identify possible different patterns in consumers' interest for the different cheeses, cluster analysis was applied. ANOVA showed that the effect of health benefit and manufacture type was significant in all the three clusters (Table 4). However, the size and sense of these effects were different depending on the cluster as it is shown by the utility values (Figure 1a).

Consumers in C1, mostly composed of young women medium-high interested in a healthy diet, showed to slightly increase their interest when cheese was low fat while having fibre and bifidus decreased their interest compared to regular cheese. These consumers showed to be more interested in traditional manufactureConsumers in C2, mostly composed of young women medium-low interested in a healthy diet), were interested in low-fat cheeses as much as in regular cheese and they clearly preferred industrial manufacture over traditional. Consumers in cluster C3, mostly composed of men medium-low interested in a healthy diet, were interested in low-fat and salt-reduced cheeses.

Survey conducted in 2018

Similarly, to 2010, ANOVA showed that in general the interest of consumers in spreadable cheese varied significantly depending on the health benefit. According to the utility

Table 2. Influence of information about health benefit and manufacture type on consumer interest on spreadable and Danbo cheeses in 2010 and 2018. Results of Analysis of Variance. F (4, 1, 4) ratio and probability (p) values.

		2010 Survey		2018 Survey	
Type of cheese	Factor	F	p	F	p
Spreadable	Health benefit	21.7	.000	28.7	.000
	Manufacture type	2.5	.111	3.5	.063
	Health benefit × Manufacture type	0.4	.820	0.5	.744
Danbo	Health benefit	59.8	.000	47.5	.000
	Manufacture type	0.5	.460	9.2	.003
	Health benefit × Manufacture type	0.7	.617	1.0	.385

Table 3. Values of the parameters of the utility model for spreadable cheeses in relation with health benefits and processing type.

		Utility values	
Factor	Level	2010	2018
Health benefit	Low-fat	0.61[a]	0.56[a]
	Fiber-enriched	−0.43[b,c]	−0.44[b]
	With Bifidus	−0.33[b]	−0.41[b]
	Salt-reduced	−0.50[c]	−0.42[b]
	None (regular)	0.66[a]	0.70[a]
Process	Industrial	0.07	−0.09
	Traditional	−0.07	0.09

Value of the constant in the model was 5.17 and 5.49 for spreadable cheese in 2010 and 2018 respectively.
[a,b]Within each column and for each factor, mean values followed by different letters are significantly different ($p \leq .05$).
Parameters with * correspond to those with significant difference between years according t-student test.

Table 4. Influence of information about health benefit and manufacture type on consumer interest on spreadable cheeses in 2010. Results of Analysis of Variance. F (4, 1, 4) ratio and probability (*p*) values.

	2010						2018					
	Cluster 1 (20%)		Cluster 2 (58%)		Cluster 3 (28%)		Cluster 1 (20%)		Cluster 2 (51%		Cluster 3 (29%)	
Source	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*
Health benefit	11.9	<.001	20.7	<.001	28.3	<.001	8.3	<.001	4.5	.001	5.6	<.001
Manufacture type	28.1	<.001	50.3	<.001	8.4	.004	1.1	.302	5.0	.026	1.0	.311
Health benefit × Manufacture type	0.9	.486	0.6	.663	3.1	.016	0.2	.944	0.1	.981	0.2	.960

values, they were interested in low-fat products as well as the regular one and not interested in the other health benefits. According to t-test, there was no significant difference between the utility values of 2010 and 2018 (Table 3)

Three different groups of consumers were identified. In this case, the interest of consumers varied with the health benefit in the three clusters and the manufacture type only was significant in C2 (Table 4). Size and sense of utility values are shown in Figure 1b.

Consumers in C1 were interested in cheeses fibre-enriched next to the regular cheese and then by the low-fat and with bifidus. They were not interested in salt reduced. These consumers preferred industrial manufacture more than traditional. Consumers in C2 showed to slightly increase their interest when cheese was with bifidus while having fibre and low-fat decreased their interest compared to regular cheese. These consumers showed to be more interested in traditional manufacture.

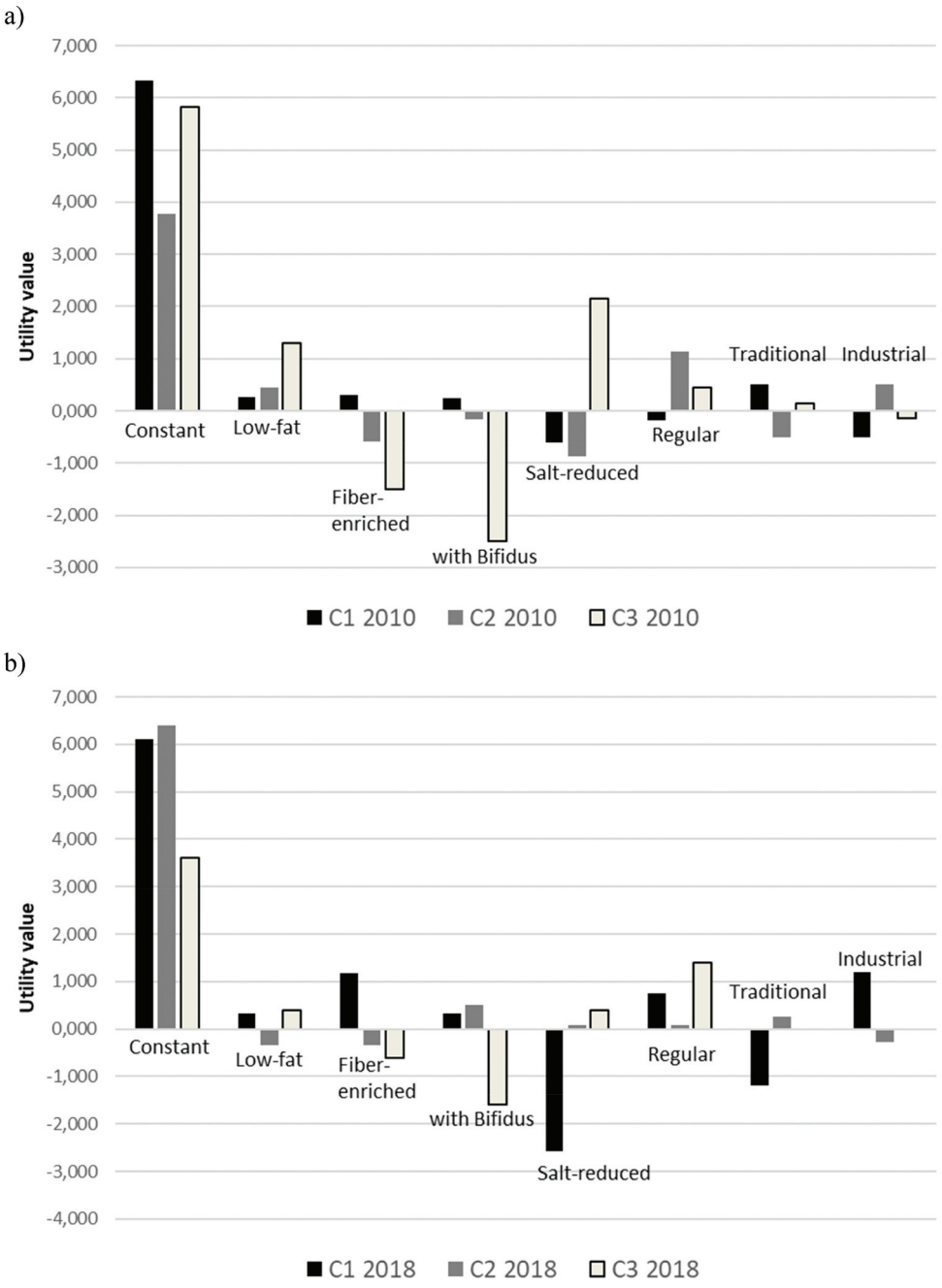

Figure 1. Utility value for clusters in spreadable cheese in 2010 (a) and 2018 (b).

Consumers in cluster C3 were interested in regular cheese followed by low-fat and salt reduced. They were not interested in fibre or bifidus. These consumers were indifferent to the type of manufacture.

Consumers' interest in semi-soft cheese with different benefits and type of manufacture

Survey conducted in 2010

ANOVA results (Table 2) of the total dataset showed that in general the interest of consumers in semi-soft cheese varied significantly depending on the health benefit. In this case, although the utility value of low-fat benefit was positive, it was significantly lower than for the regular cheese (Table 5). Compared to regular cheese low fat slightly increased the interest of these consumers while having fiber and bifidus slightly decreased the interest. In general, they showed to be more slightly interested on industrial manufacture.

Cluster analysis was applied, three groups of consumers were identified (Table 6). ANOVA showed that the effect of health benefit was significant in all the three clusters, but manufacture type was significant only for one cluster (C1) (Table 6). Size and sense of utility values are shown in Figure 2a.

Consumers in C1 were interested in the low-fat cheese as much as the regular cheese and rejected fibre and bifidus. They preferred traditional manufacture to industrial. Consumers in C2, like consumers in C1, were interested in low-fat as much as in regular cheese and rejected fibre and bifidus. They slightly preferred industrial manufacture to traditional. Consumers in cluster C3 were only interested in the regular cheese, rejecting the others and this consumer preferred traditional manufacture.

Survey conducted in 2018

Similarly, to 2010, ANOVA showed (Table 2) that in general the interest of consumers in Danbo cheese varied significantly depending on the health benefit. Compared to regular cheese low fat slightly increased the interest of these consumers while having fibre and bifidus slightly decreased the interest. In general, they showed to be more slightly interested in traditional manufacture.

C1 was interested only in the regular cheese, and highly rejected salt-reduced. C2 liked Danbo cheese in general (a high constant value), being indifferent to health benefits and C3 were interested only in the regular and low-fat cheese, and highly rejected fibre and bifidus. All clusters showed preference to traditional manufacture than industrial.

Impact of time on the interest of new products with different nutritional benefits and type of manufacture

According to t-test, there were significant differences between the utility values of low-fat and none benefit and type of manufacture between 2010 and 2018 (Table 5) Regarding the health benefits, ANOVA results of 2010 show a significant effect on consumers' interest in spreadable cheese and Danbo cheese (Table 2). For both cheeses, the manufacture type had no significant effect on consumers interest. For the two types of cheeses, the interaction between the two factors was not significant indicating that their interest in the nutritional benefit of the cheeses did not depend on cheese processing type.

The passage of time did not affect both cheeses in the same way. For the spreadable cheese, the same results were observed 8 years later (2018). In the case of Danbo cheese, manufacture type effect became significant in 2018.

To determine the utility value for each of the studied characteristics for 2010 and 2018 for spreadable cheese and Danbo cheese, a model relating consumers´ interest and the different factor levels were obtained (Tables 3 and 5 respectively). For both types of cheeses and both periods of time, positive utility values were obtained for low-fat and

Table 5. Values of the parameters of the utility model for Danbo cheeses in relation with health benefits and processing type.

		Utility values	
Factor	Level	2010	2018
Health benefit	Low-fat	$0.68^{b,*}$	$0.40^{b,*}$
	Fiber-enriched	-0.46^{c}	-0.62^{c}
	With Bifidus	-0.67^{c}	-0.53^{c}
	Salt-reduced	-0.73^{c}	-0.48^{c}
	None (regular)	$1.34^{a,*}$	$1.23^{a,*}$
Process	Industrial	$0.12^{a,*}$	$-0.20^{a,*}$
	Traditional	$-0.12^{a,*}$	$0.20^{b,*}$

Value of the constant in the model was 5.22 and 5.47 for Danbo cheese in 2010 and 2018 respectively.
Within each column and for each factor, mean values followed by different letters are significantly different ($p \leq 0.05$).
Parameters with * correspond to those with significant difference between years according t-student test.

Table 6. Influence of information about health benefit and manufacture type on consumer interest on Danbo cheeses in 2010 and 2018. Results of Analysis of Variance. F (4, 1, 4) ratio and probability (p) values.

	2010						2018					
	Cluster 1 (42%)		Cluster 2 (38%)		Cluster 3 (20%)		Cluster 1 (42%)		Cluster 2 (39%)		Cluster 3 (19%)	
Source	F	p	F	p	F	p	F	p	F	p	F	p
Health benefit	20.2	<.001	32.6	<.001	51	<.001	7.1	<.001	9.1	<.001	8.4	<.001
Manufacture type	19.2	<.001	2.7	.102	0.0	.900	3.0	.049	0.9	.348	1.0	.328
Health benefit × Manufacture type	0.9	0.459	0.8	.502	2.6	.038	0.2	.933	0.7	.596	0.2	.953

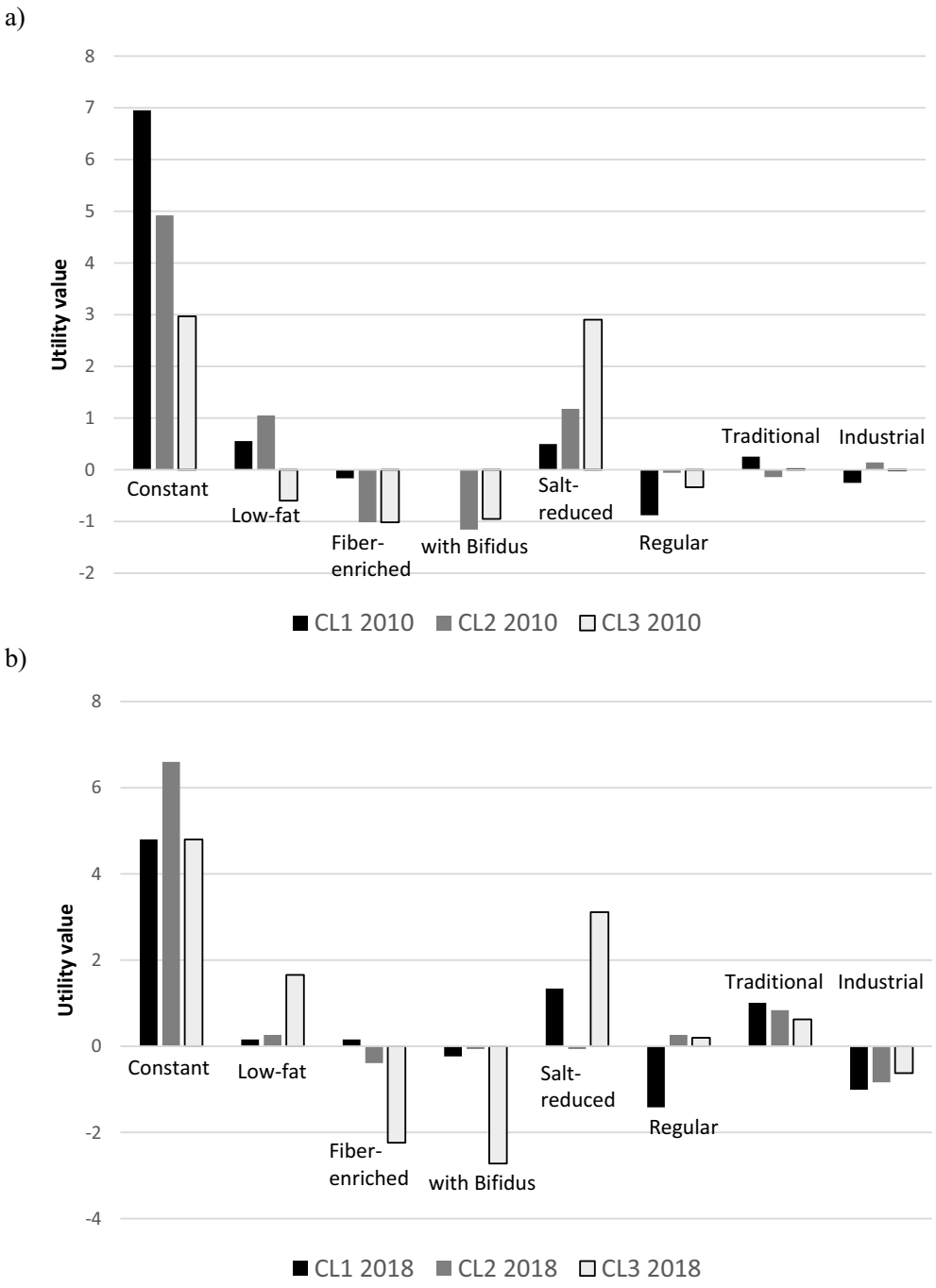

Figure 2. Utility value for clusters in Danbo cheese in 2010 (a) and 2018 (b).

regular products and negative utility values for the other three options (probiotic, fibre-enriched, and salt-reduced).

Consumer characteristics affecting response to cheeses with health benefits

In the present study, consumer distribution according to gender, age, and the interest in a healthy diet in each cluster was analysed for the spreadable and the Danbo cheese in 2010 and 2018 (Tables 7 and 8). For all cases, differences in consumer behaviour was not related with the variation in age. To determine the interest in a healthy diet, a previous approach (unpublished data) was assay and the dimensionality of the responses to the General Health Interest Questionnaire was studied. These showed that for these Uruguayan consumers, the items corresponded to two different dimensions. The first dimension related to the theoretical importance that consumers gave to the diet–health relationship (items 2, 4, 5, and 6; Table 1) and a second dimension related to their actual eating behavior (items 1, 3, 7, and 8; Table 1). According to these two dimensions, consumers were classified into three groups: high, medium, and low interest. The group of consumers with high interest were those that considered the diet–health relationship to be important (sum of scores in dimension $1 > 14$) and consequently ate healthily (sum of scores on dimension $2 > 14$). The group of consumers who showed medium interest were those that did not follow a healthy diet (sum of scores on dimension $2 \leq 14$), despite considering the diet-health relationship important (sum of scores in dimension $1 > 14$). Finally, consumers with low interest were those that did not consider as important the relation diet-health and did not eat healthily (sum of scores ≤14 for the two dimensions).

Table 7. Distribution of consumers (%) on clusters for spreadable cheese in 2010 and 2018, according to gender, age, and interest on healthy diet. Difference among proportions test, χ^2 and probability (p) values.

		2010					2018				
Characteristics	Level	C 1	C 2	C 3	χ^2	p	C 1	C 2	C 3	χ^2	p
Gender	M	28^{a}	37^{ab}	57^{b}	9.3	.011	8^{a}	39^{b}	55^{b}	50.1	.001
	F	72^{b}	63^{ab}	43^{a}			92^{b}	61^{a}	45^{a}		
Age	18 to 40	66	78	55	5.9	.051	54	57	55	0.2	.910
	41 to 66	34	22	45			46	43	45		
Interest in a healthy diet	High	47^{b}	22^{a}	30^{ab}	10.2	.006	50	46	36	4.2	.121
	Medium	41	41	36	0.3	.883	50	51	64	4.9	.085
	Low	12^{a}	37^{b}	34^{b}	10.8	.004	0^{a}	3^{b}	0^{a}	6.1	.048

[a-b]Within each row for each characteristic, percentage values followed by different letters are significantly different ($p \leq .05$).

Table 8. Distribution of consumers (%) on clusters for Danbo cheese in 2010 and 2018, according to gender, age an interest on healthy diet. Difference among proportions test, χ^2 and probability (p) values.

		2010					2018				
Characteristics	Level	C 1	C 2	C 3	χ^2	p	C 1	C 2	C 3	χ^2	p
Gender	Male	26^{a}	41^{ab}	58^{b}	9.1	.011	43^{ab}	31^{a}	52^{b}	9.1	.01
	Female	74^{b}	59^{ab}	42^{a}			57^{ab}	69^{b}	48^{a}		
Age	18 to 40	77	63	55	5.4	.068	55	53	61	1.4	.499
	41 to 66	23	37	45			45	47	39		
Interest in a healthy diet	High	44^{b}	31^{ab}	19^{a}	6	.049	49	33	43	5.4	.071
	Medium	41	40	32	0.7	.700	49^{ab}	65^{b}	48^{a}	7.3	.026
	Low	15^{a}	29^{ab}	49^{b}	11.9	.003	2^{a}	2^{a}	9^{b}	7.9	.019

[a–c]Percentage values in rows followed by different letters are significantly different ($p \leq .05$).

Discussion

For spreadable cheese, consumers were interested in low-fat products as well as the regular one, with no change between 2010 and 2018. For Danbo cheese, the utility for low-fat products was significantly lower than that for the regular product, for both 2010 and 2018. Danbo cheese is a popular semi-hard-pressed cheese, smear-ripened with 30% or 45% fat in dry matter and a distinctive flavour (Sorensen & Benfeldt, 2001). This characteristic, in comparison with a spreadable cheese may influence Danbo cheese´s consumers to be less liable to accept changes in the concept of the product. Spreadable cheese is a fresh cheese which is frequently consumed as milk-based commodities. It has been studied as a carrier of bioactive compounds. Lucera et al. (2018) enriched spreadable cheese with flours from by-products as sources of fibre and antioxidant compounds and Repajić et al. (2019) investigate sensory properties of spreadable cheese fortified with olives reporting. These authors reported that products have good potential as a functional product with favorable sensory characteristics that can satisfy consumer's demands.

In general, results show that consumers were interested only in the low-fat cheeses with no change for both 2010 and 2018, and they were not interested in the other nutritional alternatives considered in this study. Similar results for reduced fat cheeses were observed by Szakály et al. (2020). They found that the "health halo" effect worked in the case of cheese tested in Hungary. In this case, these authors show that reduced fat and salt cheeses were perceived as healthier, but they were associated with considerably less sensory pleasure, these may affect the purchase intention in some group of people. They inform that between health promoting variants they would be willing to purchase primarily the one with reduced fat.

With respect to the effect of the processing type, it was not significant for spreadable cheese for any period. In the case of Danbo cheese, processing type effect became significant in 2018, being positive for the traditional type. Soares 2017 found that manufacturing method was one of the main categories for differentiating consumers' perceptions from different areas from Brazil.

To identify different patterns in consumer response, hierarchical cluster analysis may be performed to segment consumers according to their interest. In this way, Almli et al. (2015) studied the preferences of Norwegian consumers on semi-hard cheese and reported that consumers were divided in two groups. One that, on average, prefers cheeses of new (healthier) fat composition, organic production and lower price to cheeses of regular fat composition, conventional production and higher price. Consumers in the New fat segment are health-conscious, whereas consumers in the Regular fat segment are attracted by conventional cheese and lower prices. About manufacture type, Nicolosi et al. (2019) studied buying purchase habits of Swedish consumers, showing that there were two large groups among which were those who prefer to continue buying industrial cheeses and another emergent group that purchase local artisan cheeses. This last group appreciates artisan cheeses and choose them for their versatility, and because they wish to contribute to supporting the local economy.

In this work, hierarchical cluster analysis was performed to segment consumers according to their interest for the different cheeses. It was considered both type of cheese, the spreadable and Danbo and both years, 2010 and 2018. For spreadable cheese, three groups of consumers were identified. For all of them, both factors significantly affected their interest in the product in 2010 (Table 4). In 2018 for the three-group health benefit was significant but for manufacturing type there were two groups where this effect was not significant. The utility values obtained from the model for each group and for both years were calculated, and a principal component analysis was assay (Figure 1). For spreadable cheese, the clusters analysed in 2010 have a similar behavior that clusters analysed in 2018. A group of consumers (C1 2010 and C2 2018) where the value of the constant of the model was high (6.3 and 6.4 respectively).

The high value of the constant indicates that these consumers were interested in spreadable cheeses in general. They were also slightly interested in cheeses with bifidus and fiber enriched and rejected low fat and salt-reduced cheeses. A second group of consumers (C2 2010 and C1 2018) were the most relevant was that they preferred industrial cheeses over the traditional ones. And the third group of consumers composed by C3 2010 and C3 2018 that prefer low fat (and salt reduced to C3 2010) and reject fiber enriched and bifidus.

For Danbo cheese, three groups of consumers for each year analyzed were identified too (Table 6). Health benefits were significant for all groups in 2010 and 2018. For manufacturing type in both years only 1 group was significantly affected by manufacturing type in 2018. The utility values were calculated, and a principal component analysis was assay (Figure 2). In this case, clusters found in 2010 have different behaviors than those found in 2018. In 2010, we found two groups (C2 2010 y C3 2010) interested in industrial danbo cheese and salt reduced and C1 2010 interested in fiber enriched and bifidus. In 2018 (C1 2018 and C2 2018) were interested in traditional cheese and C3 2018 only interested in normal low fat Danbo cheese.

According to Ares et al. (2010), Uruguayan consumers have a greater intention of purchasing functional yogurts than regular yogurts. However, the results of the present study showed that for cheeses the information about the health benefits did not provide a higher utility value than that of the regular product. This suggests that a health benefit in these two types of cheese, spreadable and Danbo cheese was not considered as an added value by Uruguayan consumers, or they do not find cheeses as an interesting carrier for functional ingredients. And this behavior remained mostly unchanged after 8 years. Uruguayan cheese consumers did not change their habits in this period of time. This is in accordance with Sampalean et al. (2020), whose analysed consumer preference for Italian cheese products and find, that in general, Italian consumers prefer to purchase Provolone cheese non-lactose-free claimed. For them, only brand was significant.

Differences observed between consumer response to yogurt and cheese would confirm the idea that consumers react differently to functional benefits among different food types (Urala & Lähteenmäki, 2007). Yogurt can be considered a healthy product, and consumers are familiar with new varieties of the product (taste and composition) while cheese is considered a more traditional product, which is well accepted in itself. When consumers made choices between conventional and functional food products, their reasons to choose functional food are different within the different food categories (Urala & Lähteenmäki, 2004).

For both, the spreadable cheese and the Danbo cheese, same behavior was observed. There were two clusters in each year (for 2010 C1 and C2; for 2018 C1 and C2) composed mostly by women with a high to medium interest in a healthy diet. For the other side, C3 2010 and C3 2018 was mostly composed by men with a medium (to low in 2010) interest in a healthy diet, which were only interested in the ow-fat and salt-reduced functionality. This agrees with previous studies reporting that the acceptability of functional foods varies with gender in Uruguay (Ares & Gámbaro, 2007). Martins et al. (2020) showed that women expressed greater interest in consuming organic foods enriched with functional properties compared to men in Brazil. It is widely reported women are more interested in eating healthily than men (Gök & Ulu, 2019).

Although the general trends in 2010 remains in 2018, it is interesting to note how the interest in a healthy diet grew from low to medium high over this period of time.

One limitation of this work is the non-probabilistic nature of the consumer's sample. Consumers are not representative of any socioeconomic group, which does not allow generalization of the results. Anyway, as methodology was developed in a period of 8 years, conclusions over the time period are valuable to known consumer behavior in time.

All data were self-reported based on the evaluation of pictures of package, additional research is needed to evaluate consumers' perception of products including information and sensory characteristics.

Conclusions

This study shows the importance of considering consumer opinion during a product life. Even traditional products as cheeses should be suitable repositioned to be successful in a changing market, many factors influence consumer perception, and these may change over the years. Type of product influenced response of consumer to different nutritional benefits and also manufacture type. The interest of consumers in spreadable and Danbo cheese significantly varied when a health benefit is indicated. In Danbo cheese, health claims did not cause an increase in Uruguayan consumers' interest over the regular product in 8 years, but manufacture type became significant between years, nowadays consumers are more interested in traditional manufacture. However, there is a group of consumers who were willing to consume cheeses with certain health benefits; low-fat cheese was the most appealing to consumers, especially in the case of spreadable cheese. In this work could be observed how consumers were more liable to accept changes in a spreadable cheese, a fresh cheese which is frequently consumed as milk-based commodities, despite a Danbo cheese, a popular semi-hard-pressed cheese. One of the great values of this work is to study the effect of time in consumer response. Further work is necessary to know the magnitude of consumer changes in different countries or age and socioeconomic strata during a time period to know in depth the effect of time in consumer behaviour.

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