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Chapter

Production, Processing, Commercialization and Analysis of Costumer Preferences of Sheep Cheese in Chile

María C. Barrón Rivas, Carlos Palacios Riocerezo, Ignacio A. Dominguez Vara, Manuel Gonzalez Ronquillo and Sergio Radic Schilling

Abstract

The constant increase in the demand for dairy products and their derivatives has generated a higher consumption of dairy products (113.5 t/year). Chile has not been the exception; in 2017, it presented an average per capita consumption of 11.1 kg of cheese, making it the largest consumer in Latin America, followed by Argentina (7.5 kg) and Uruguay (5 kg). Although Chile does not have a strong tradition of consuming sheep's milk cheese compared with other (European) countries, in recent years, there have been changes in the demands and expectations of cheese consumers, who demand higher quality and a wider range of varieties, thus establishing the potential for further products to enter the market. The global cheese industry has taken charge of these trends through the phenomenon of granting a premium value to certain products, adding new ingredients and flavors, producing limited editions of certain products, favoring traditional recipes and craft methods, and highlighting specific localities of origin. Given a greater appreciation for and popularity of locally produced cheeses and value-added products, particularly those with the highly valued "Designation of Origin" label, this would offer a potential for expansion in the Chilean market.

Keywords: sheep, cheese production, marketing, Chile

1. Milk production

1.1 Global production of sheep's milk

The constant population growth and the increase in the demand for dairy products and their derivatives have generated a continuous increase in the world per capita consumption of milk, which reached 111.3 kg in 2015, and an increase of 12.5% is estimated by 2025 [1]. However, there are significant regional disparities among developing countries, where fresh dairy products remain, by a large margin, the most consumed, unlike in developed countries where consumer preferences

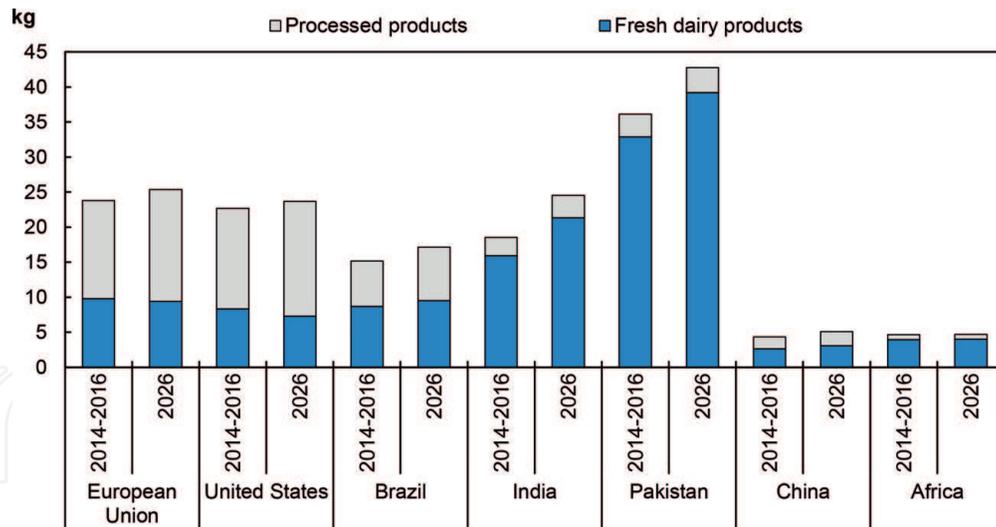


Figure 1. Per capita consumption of processed and fresh dairy products. OECD-FAO, 2016 (adapted from [2]).

incline toward processed products (butter, cheese, skimmed milk powder and whole milk powder) (**Figure 1**) [2].

The world production of milk of all species has followed an upward trend in recent decades, reaching in 2015 approximately 818 million t [1]. The highest percentage of dairy production is derived from the dairy industry (82.6%), followed by buffaloes (13.9%), goats (1.9%), sheep (1.3%), and finally, camels, which contribute only 0.3% of the total [2] (**Figure 2**).

The dairy industry is markedly regionalized and is associated with a long tradition of production and consumption of dairy products, mainly cheeses. The world production of fresh sheep’s milk registered in 2016 by FAO estimates 10,366,980 t. This is mainly produced in the Asian region (44.6%), which houses the two main producing countries: China (1,361,360 t) and Turkey (929,432 t). In the European continent (32.7%), Greece (711,577 t) and Romania (631,419 t) stand out, ranking as the third and fifth largest producers of sheep’s milk, respectively. The African

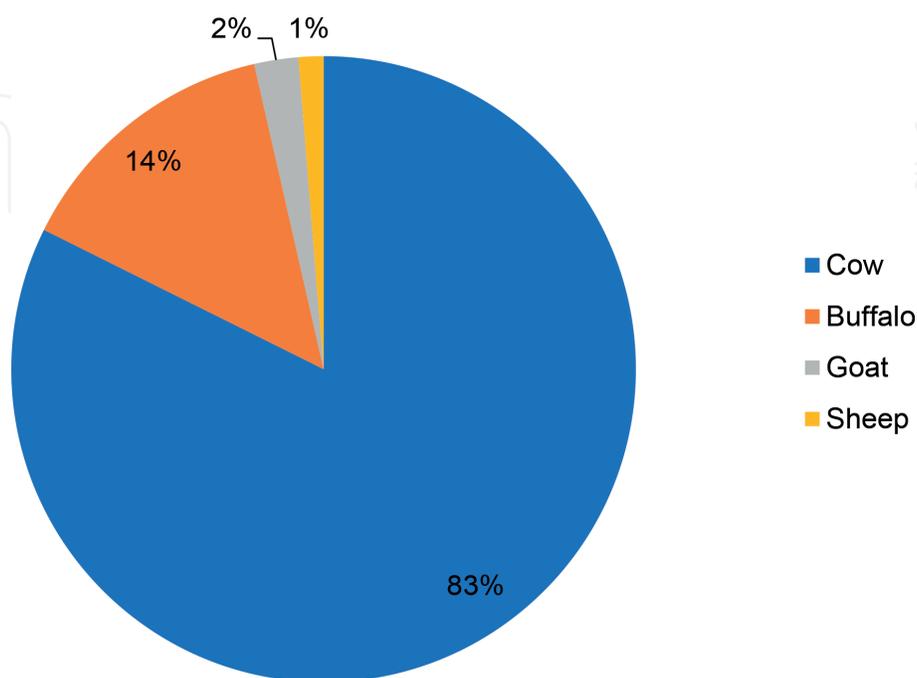


Figure 2. World milk production by species. FAO 2016 [2].

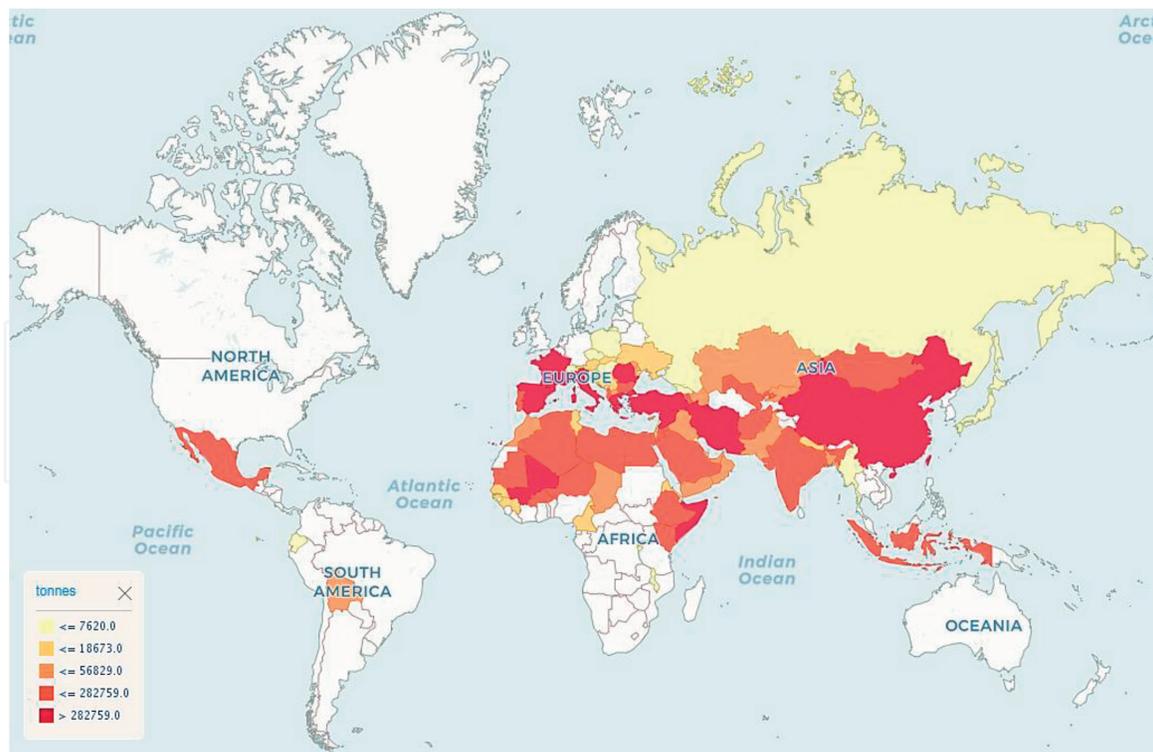


Figure 3.
Geographical distribution of sheep's milk production. FAO 2016 [3].

continent produces almost a quarter of the international sheep milk inventory (21.8%), with subsistence production systems; countries such as Syria (651,867 t), Mali (529,373 t) and Sudan (403,008 t) are among the top 10 producing countries worldwide. The American continent has a relatively minimal participation in the world production of sheep's milk (0.9%); only the following countries provide official productivity data: Mexico (57,589 t), Bolivia (29,617 t) and Ecuador (3617 t) (**Figure 3**) [3].

Sheep's milk production in the North American countries is not significant; it is estimated that Mexico, the United States and Canada have approximately 200 production units dedicated exclusively to the production of milk, with less than 10,000 sheep each [3, 4]. Data from associations of producers estimate that in 2010, there were 20 production units with the potential to milk sheep with an approximate inventory of 6000 animals distributed in the states of Coahuila, Guanajuato, State of Mexico, Puebla, Querétaro and Veracruz (**Table 1**). In 2009, Querétaro was the state that presented the highest production, with 30,000 liters. Likewise, in this state, the first association of dairy sheep called "Producers of Milk and Derivatives of Sheep S.A. of C.V." united 13 producers and integrated the collective brand "Del Rebaño" [5].

In Chile, the sheep cheese market, unlike that for goat cheeses, is very underdeveloped, given the low national consumption tradition and the low consumer culture regarding this product. However, in the country, there are foreign colonies of immigrants from Mediterranean countries that have favored the expansion of these products. In 1995, the first exploratory imports of sheep's milk cheese were carried out, with a volume of 1.25 t, and a positive evolution was observed, which was manifested the following year with an increase to 3.88 t. In 1998, the total national supply in the sheep cheese market reached 7.2 t, of which two were of national origin and the rest imported mainly from Spain and France. Currently, the national demand is less than 6 t per year, a figure that represents a volume of milk of less than 40,000 liters. The national production of sheep's milk associated with its industrialization and cheese making is estimated between 20,500

Local name	Localization
Rancho Santa Marina	Queretaro
Rancho San Josemaría	Queretaro
Quesos del Rebaño	Queretaro
Rancho San Francisco de Mariana	Queretaro
Escuela de Pastores	State of Mexico
Rancho Tierra Nueva	Puebla

Table 1.
Some units of sheep milk production in Mexico [8, 16].

and 22,000 liters per year, equivalent to between 3 and 4 t of cheese [6]. In 2014, the *El PASO* location assessed five regions that produce most of the country's cheeses: Los Ríos (49,394 t), Los Lagos (30,939 t), La Araucanía (6202 t), Biobío (906) and Metropolitana de Santiago (273 t) [7].

In Chile, two sheep dairy breeds have been introduced: Milchschaaf and Latxa, which have been fostered through the crossing of dairy males with sheep from Chilean cattle ranchers, with the aim of reducing the initial investment costs. The dairy breed of the male or the genetic improvement program that is chosen will basically depend on three aspects: forage potential, adaptation of the dairy breed that is being introduced to the area, and the reproductive and productive characteristics of each one [8]. Within the dairy production and ovine cheese industry, a highlight is the initiative developed by the University of Magallanes in the city of Puerto Natales (Chilean Patagonia) that produces the southernmost cheese of Chile [9].

1.2 Sheep's milk: physicochemical characteristics and nutritional properties

Recent studies have determined that the chemical composition of milk varies depending on the feeding of the sheep, modifying the percentages of fat, protein, lactose and the fatty acid profile of the milk depending on the ratio of forage to concentrate in the diet or of the supplementation with protected fat. The results show that diets with the highest forage content (>40% DM) have a significantly lower milk yield (0.8 g/kg), but with a higher fat content (0.32 g) and concentration of conjugated linoleic acid (CLA) (2.28 mg/kg). The addition of protected fat in the rumen in the diets has a positive effect on the concentration of fat (0.22 g/100 g) and CLA (3.98 mg/g) in milk, but the protein concentration is reduced ($P < 0.001$). On the other hand, diets with a higher proportion of concentrate (>40% DM) affect the biodegradation processes and the synthesis of CLA (**Table 2**) [10].

The particular characteristics in the chemical composition of sheep's milk, mainly in relation to its high levels of total solids and protein, make it especially suitable for transformation into yogurt and cheese. About 95% of sheep's milk is converted into dairy products, which also acquire a regional connotation of origin and quality [11, 12]. For this reason, when we refer to the quality of sheep's milk, we must concentrate mainly on its ability to be transformed into high-quality dairy products, generate high yields of these products per liter of milk and ensure the safety of these foods [11]. In this way, three types of "quality" can be distinguished when analyzing products of animal origin: hygienic and sanitary quality, dietetic and nutritional quality and gustatory and gastronomic quality [12].

The unique characteristics of sheep's milk have been discussed in extensive reviews of literature [11–15], in which the quality of sheep's milk is evaluated in terms of its technological and coagulation properties. High concentrations of

Variable		Mean	Median	SD	Min	Max	Skewness	Kurtosis
Forage: concentrate ratio (F:C)								
Milk yield (L/d)	F	1.29	1.01	0.72	0.58	2.58	0.66	-1.26
	C	1.43	1.18	0.86	0.63	2.85	0.7	-1.27
Fat content (g/100 g)	F	6.17	5.95	0.75	5.1	7.31	0.16	-1.49
	C	5.87	5.97	0.76	4.5	6.88	-0.49	-1.13
Protein content (g/100 g)	F	5.48	5.34	0.7	4.9	6.85	1.12	-0.4
	C	5.56	5.45	0.79	4.8	7.04	0.76	-0.89
Lactose content (g/100 g)	F	4.72	4.69	0.12	4.6	4.98	0.96	-0.43
	C	4.79	4.77	0.15	4.55	5.05	0.23	-0.76
CLA content ¹	F	7.57	8.8	3.88	0.79	13.7	-0.41	-1.08
	C	5.4	6.4	2.48	1.33	8.6	-0.35	-1.55
Protected fat supplementation (S) or un supplemented (U)								
Milk yield (L)	S	1.58	1.56	0.75	0.18	3.17	0.3	-0.94
	U	1.56	1.52	0.79	0.2	3.06	0.39	-1.03
Fat content (g/100g)	S	7.45	6.47	2.21	4.35	12.1	0.46	-1.21
	U	7.03	6.48	1.7	4.8	9.91	0.34	-1.28
Protein content (g/100g)	S	5.2	4.93	0.87	3.74	7.49	0.77	0
	U	5.44	5.2	0.86	4.38	7.52	0.77	-0.3
CLA content ¹	S	1.89	1.59	1.2	0.33	5.6	0.93	0.46
	U	1.18	0.68	0.84	0.35	3.0	0.85	-0.81

¹mg/g of methylated fatty acids; F, forage based rations; C, concentrate based ration; S, protected fat supplemented rations; U, unsupplemented fat protected rations.

Table 2.
 Descriptive statistics of data used in forage:concentrate ratio and protected fat supplementation meta-analysis [10].

protein, fat and total solids in milk are associated with high yields in the production of dairy products; therefore, the aforementioned studies conclude that sheep's milk has higher yields compared to goat's milk and cow's milk because of its superior chemical composition (**Table 3**) [13].

Milk proteins include caseins and whey proteins; caseins are a family of phosphoproteins synthesized in the mammary gland in response to lactogenic hormones [17], which represent the highest protein share of sheep's milk (76–83%) [18]. The heterogeneity of the caseins is determined mainly by the presence of genetic variants; four genetic variants of caseins are recognized: α s1-CN, α s2-CN, β -CN and κ -CN. Sheep's milk has higher concentrations of the four casein variants compared to sheep and goat milk [17]. Whey proteins represent 17–22% of the total protein content; 75% of whey proteins are albumins (α -lactalbumin and β -lactoglobulin), with a high content of the AA phenotype of β -lactoglobulin, which has been shown to provide greater efficiency in the manufacture of sheep cheese [19, 20].

In recent decades, there has been an increase in interest in foods with specific nutritional properties. The nutritional advantages of sheep's milk over other species does not derive from its content of protein, minerals or vitamins; the superiority as a functional food lies in its lipid content, more specifically in its fatty acid profile; ovine products have received direct attention due to the possibility of being enriched with fatty acids' potential benefits to health, especially vaccenic acid (VA, C18: 1 t11), c9, t11CLA, also

Component	Sheep	Goat	Dairy cattle	Human
Fat (%)	7.9	3.8	3.6	4.0
Non solid fat (%)	12.0	8.9	9.0	8.9
Lactose (%)	4.9	4.1	4.7	6.9
Protein (%)	6.2	3.4	3.2	1.2
Casein (%)	4.2	2.4	2.6	0.4
Albumin-globulin (%)	1.0	0.6	0.6	0.7
NNP (%)	0.8	0.4	0.2	0.5
Ash (%)	0.9	0.8	0.7	0.4
Calories/ml	105	70	69	68
Ca (mg)	1950–2000	1260	1200	320
P (mg)	1240–1580	970	920	150
Cl (mg)	1100–1120	1600	1100	450
Na (mg)	440–580	380	450	200
K (mg)	1360–1400	1900	1500	550
Mg (mg)	180–210	130	110	40
Zn (μ g)	5200–7470	3400	3800	3000
Fe (μ g)	720–1222	550	460	600
Cu (μ g)	400–680	300	220	360
Mn (μ g)	53–90	80	60	30
Iodine (μ g)	104	80	70	80
Se (μ g)	31	20	30	20
Vitamin A (mg) ¹	0.8	0.04	0.04	0.06
Vitamin D (μ g)	0.18	0.06	0.08	0.06
Vitamin E (mg) ²	0.11	0.04	0.11	0.23
Vitamin B1 (mg) ³	0.08	0.05	0.04	0.02
Vitamin B2 (mg) ⁴	0.35	0.14	0.17	0.03
Vitamin B3 (mg) ⁵	0.42	0.20	0.09	0.16
Vitamin B5 (mg) ⁶	0.41	0.31	0.34	0.18
Vitamin B6 (mg) ⁷	0.08	0.05	0.04	0.01
Vitamin B8 (μ g) ⁸	nd	2.0	2.0	0.70
Vitamin B9 (μ g) ⁹	5.0	1.0	5.3	5.2
Vitamin B12 (μ g) ¹⁰	0.71	0.06	0.35	0.04

NNP, non-protein nitrogen. ¹Retinol. ²Tocopherol. ³Thiamine. ⁴Riboflavin. ⁵Niacin. ⁶Pantothenic acid. ⁷Pyridoxine. ⁸Biotin. ⁹Folic acid. ¹⁰Cobalamin.

Table 3.

Comparison of the chemical composition of different species (adapted from [13, 18, 22]).

called rumenic acid, and α -linolenic acid (ALA, C18: 3, n3). Sheep's milk, compared to cow's milk, contains three to four times the amount of VA and CLA c9T11 [15].

The milk of small ruminants and their derivatives are the largest source of CLA in human food [21]. The content of CLA in ruminant milk decreases in the following order: sheep > cow > goat, with contents 1.08, 1.01 and 0.65%, respectively [22]. However, the particular management conditions of sheep herds determine seasonal oscillations in CLA concentrations due to the variability in the availability and quality of forage [23].

1.3 Processing of milk

Milk is a food that has a reduced shelf life and is highly perishable: it is an excellent medium for the growth of microorganisms, especially bacterial pathogens that can cause the deterioration of the product and diseases in consumers. The processing of milk allows it to be kept for days, weeks or months and helps to reduce the diseases transmitted by this food [24].

The production of dairy products offers small dairy producers greater cash income than the sale of raw milk and greater opportunities to reach regional and urban markets. In addition, it helps to cope with the fluctuations caused by the seasonality of the milk supply that limits the elaboration and commercialization of dairy products in many developing countries, causing important variations in the supply. The transformation of milk, as in the case of cheese making, contributes to the generation of jobs both in production unit to obtain the raw material and outside the production unit, involved in the collection, processing and marketing of the product [24].

2. Cheese production

2.1 World production of sheep's cheese

Within the top 10 countries that produce sheep's cheese are mainly European countries: Greece (125,000 t) is the top producer of sheep's cheeses worldwide, followed by Spain (65,544 t) and Italy (57,595 t) at third and fifth place, respectively. There are also France (26,448 t) and Romania (24,000 t) in the eighth and ninth places, respectively (**Figure 4**). The Asian continent is the second highest producer of sheep's cheese; countries such as China (108,000 t), Syria (60,500 t), Turkey (39,600 t) and Iran (18,750 t) are positioned in the second, fourth, sixth and tenth place, respectively. In Africa, Niger is the seventh highest producer of sheep's cheese globally, with 27,927 t. The American continent has a minimal participation in the production of cheeses; the countries of interest for this chapter lack official records on the production of cheeses, so only the total production of the continent is considered (7843 t) [25].

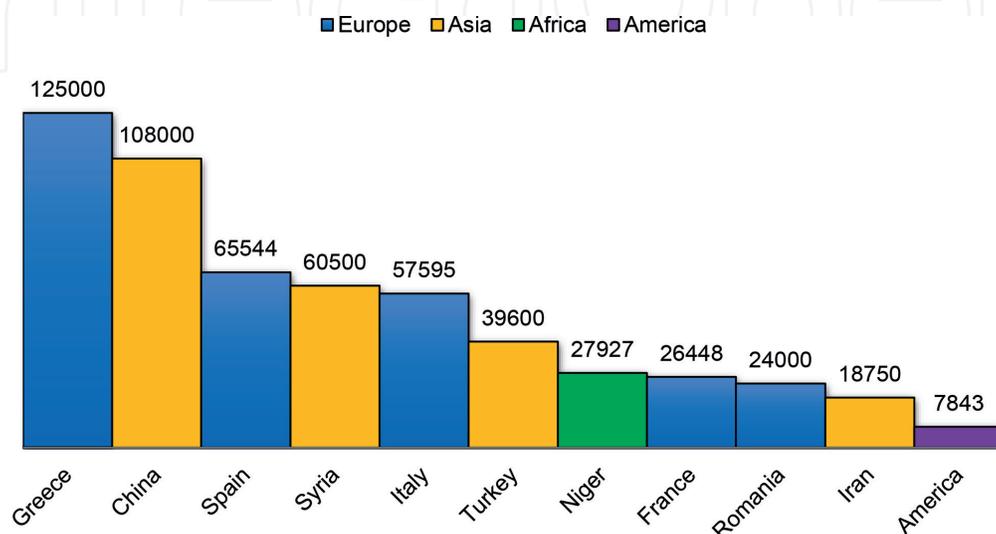


Figure 4. World production of sheep cheeses in tons. FAO 2016 (adapted from [25]).

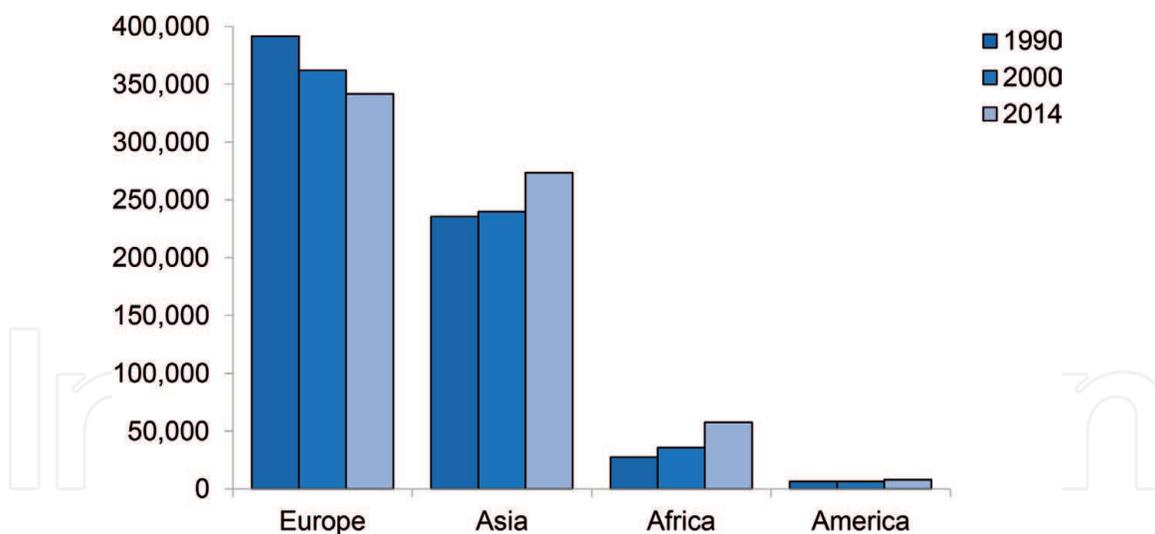


Figure 5. Production trend in tons of sheep cheeses per continent in the years 1990, 2000 and 2014. FAO 2014 (adapted from [25]).

In 1990, Asia, Africa and the Americas had lower production than the most recent data released by the FAO in 2014, evincing a tendency toward an increase in the production of sheep's cheeses on these continents. In Europe, in contrast, production has been declining since 1990 (**Figure 5**). From 1990 to 2014, it fell 12.74% and is the only continent showing this trend. Asia, on the other hand, has increased its production by 15.99%, and Africa has considerably expanded its production of sheep's cheese, doubling the amount produced in the last century, increasing production by more than 110%. America has increased its local production of sheep's cheese more modestly, from 1990 to 2014 by 21.92% [25].

2.2 National production

PASO registered that during the January–May 2017 period, production in Chile was 33,300 t, with an increase of 5.4% compared to the same period of the previous year [26]. Despite this increase in national production, it continues to focus mainly on basic and mass-produced varieties, such as Gouda and Chanco, which in 2012 accounted for 90% of the total national production [27]. The remaining 10% corresponds to industrial Mozzarella cheeses (which are booming due to the growth of fast food chains that offer pizzas), melted cheeses, spreadable cheeses, Edam-type cheeses and, in smaller volumes, gourmet profile cheeses as well as craft companies engaged in the production of so-called “field cheeses” [26].

2.3 Sheep cheese: physicochemical characteristics

Cheese is a product derived from milk that is obtained by the coagulation of the milk protein (casein) that is partially separated from the whey. Cheeses can be hard, semi-hard, soft ripened or unripened [28]. The differences in composition between sheep's milk and that produced by cattle and goats determine their milk coagulation properties (**Table 2**). Milk coagulation is the most important factor in cheese making, which is affected by the following properties of milk—pH, casein concentration, amount of calcium (Ca) per casein and concentration of other minerals—that define the differences in coagulation time, coagulation rate, firmness of the curd and amount of rennet used [29]. The high concentrations of protein, fat and total solids present in sheep's milk result in high yields in the production of dairy products; this species has the best cheese yield compared to goat and cow milk due to

its superior chemical composition [16]. Approximately 5.5 liters of milk are needed to make 1 kg of sheep's cheese, while twice as much milk is required to make 1 kg of cow's cheese [30]. Sheep's milk produces a hard curd, the result of higher levels of casein. In general, cheese products have a particular appearance and flavor: the pasta is white and the appearance of bitter flavors is difficult [31].

The nutritional and organoleptic characteristics of the cheeses depend on the properties and nutritional qualities of the milk with which they were made, as well as the procedure in their preparation [32]. The cheese of sheep is a cheese of intense aroma, given by the volatile fatty acids present in the milk; its color is determined by the masking of the fat globules, responsible for the yellow pigmentation present in the milk of other species. For this reason, sheep cheeses are whiter and have slight grayish tones compared with cheeses made with milk from other species [30].

3. Foreign cheese trade in Chile

3.1 Imports

According to data from the "Office of Agricultural Studies and Policies" ODEPA 2011 [33], Chile began a significant increase in import of cheese, which reached its annual maximum in the 2012 season, when 18,400 t were imported. The partial figure up to May 2013 shows an increase of more than 40% with respect to the previous year's period [6]. In 2017, the following imports were made: mainly from the United States (8955 t), followed by the Netherlands (8637 t), Germany (7692 t), New Zealand (6830 t), Argentina (5584 t), Mexico (1367 t), Uruguay (1257 t), Spain (1076 t), France (1040 t), Brazil (0.872 t) and other countries (1105 t), registering a total of 44,439 imported tons (**Figure 6**) [33].

3.2 Exports

Worldwide, about 82% of exports of dairy products come from developed countries and it is expected that this rate will increase to 83% by 2026 [2]. In Chile, of the

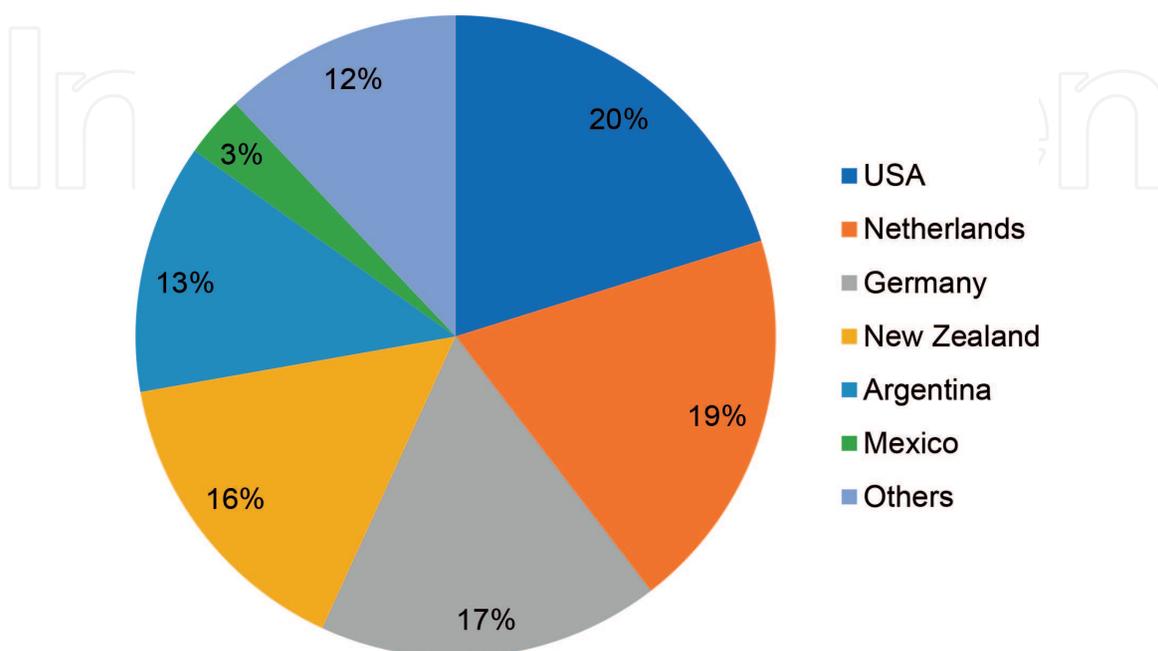


Figure 6.
Imports of cheese by country of origin. ODEPA 2017 [33].

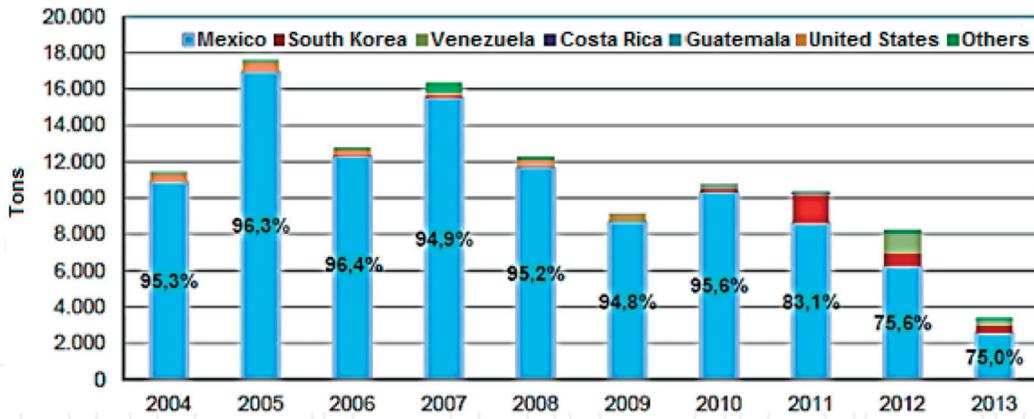


Figure 7. Chilean export of cheeses by destination country from 2004 to 2013 [27].

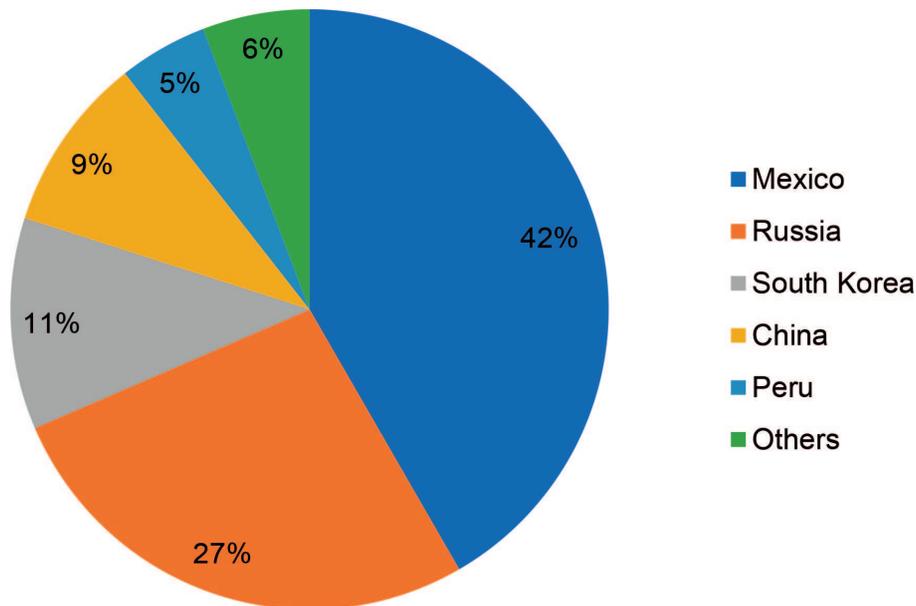


Figure 8. Chilean export of cheeses by destination country [33].

total of dairy products exported between 2004 and 2005, Mexico bought over 60%. Between 2008 and 2010, exports to Mexico declined, and as of 2011 and 2012, exports and sales of dairy products were diversified. The importance of cheese in exports is even greater: between 2004 and 2010, 95% of the total exported cheese went to Mexico. In 2011, this share fell to 83.1%, as well as in 2012, and in 2013, fell to 75% of the total volume. At the same time, the volumes exported to Korea, Venezuela, Costa Rica, Guatemala and the United States increased. However, it must be recognized that Chilean cheese exports are still Mexico-dependent (Figure 7) [27].

Cheese exports by variety, according to PASO 2018 records during the January–August period, are as follows: Gouda cheese and Gouda type (3038 t), followed by Parmesan and Parmesan type (1013.1 t), Mozzarella (271.8 t), Edam and Edam type (110.6 t), and finally, other varieties or types, including sheep and goat cheeses (65.4 t) [33].

Cheese exports in 2017 were as follows: Mexico (3898 t), Russia (2512 t), South Korea (1061 t), China (886 t) and Peru (447 t) (Figure 8) [33].

4. Cheese consumption

In recent years, according to a study conducted in 2016 by the consultancy Euromonitor, the cheese market in Chile has experienced a sustained increase,

reaching a total consumption of 201,000 t in 2016, which represents 34.4% growth in the last 5 years. During this same period, sales in value increased from US \$ 1449.6 million to US \$ 2378.9 million, which represents an increase of 64.1% [26].

Currently, Chile is the largest per capita consumer of cheeses in Latin America, with an average of 11.1 kg per capita, a figure that represents an increase of 27.6% compared to 2011, during which consumption was 8.7 kg. Two countries with a strong dairy tradition follow: Argentina (7.5 kg) and Uruguay (5 kg). The same study indicates that Chile also leads the average expenditure per capita in this category, reaching US \$ 131.2 in 2016, a figure that represents a growth of 55.6% in relation to the US \$ 84.3 expense for the year 2011. At the second and third places are Argentina (US \$ 73.8) and Uruguay (\$ 65.9), respectively [26].

During the last 5 years in Chile, there have been two important changes with respect to the cheese market. The first refers to consumer behavior patterns, which are demanding higher quality cheeses and a wider range of varieties. The second is related to the development of dairy agroindustries specialized in the production of goat cheese and, to a lesser extent, sheep cheese [6].

Chilean consumers prefer fresh and soft cheeses, and sheep and goat cheeses are generally considered to be gourmet products, with a higher price compared to cow's milk cheeses [33]. The FIA indicates that the consumer segment of sheep cheeses is very small but stable. The consumption and commercialization of sheep's cheese traditionally corresponds to consumers of foreign origin and niches determined as gourmet stores, hotels or restaurants, with a high influx from among the foreign public. Of these places, restaurants are where there is the highest consumption of sheep cheeses, by including this product in their dishes [30]. Another type of consumer is one with some type of intolerance to cow's milk; ovine products, being more digestible, represent an option for this niche of the population [6].

4.1 Expansion of the market and its relationship with the consumer

The Chilean population is mostly urban (87%), with around 40% residing in the metropolitan region around the capital, Santiago de Chile. This is the great center of Chilean consumption, from which the vast majority of importers and distributors from all over the country operate. It is also where most of the transforming industries are concentrated. It is a market in which a large number of international companies compete, so the buyer is used to comparing a wide range of products and assessing the technical information provided by the supplier. The Chilean consumer is also one of the most demanding exercisers of purchasing power in Latin America, particularly appreciative of the quality-price ratio of products [35].

Along with the increase in cheese consumption in Chile, there have also been changes in consumer expectations and the setting of a premium value for a certain product. The Chile gourmet study carried out by the consultants iCuadrado, Contexto and Whizzy, seeking to recognize the preferences and trends of the market, points out the appearance of a phenomenon of consumerization among the consumers of medium and high groups; among consumers of socioeconomic groups C1 and C2, aged 25 and over, 45% describe themselves as gourmet. Cheeses rank second in the list of products most perceived as gourmet by this consumer profile. Gourmet foods are characterized by high quality, craftsmanship and limited availability. Among the attributes that consumers value most are the outstanding flavor, the mixture of flavors, the quality of the ingredients and a higher price. The panel also included experts in gastronomy who pointed out that this consumer will opt in the medium term for authentic and natural foods, few ingredients and sustainable production [26].

For its part, the global cheese industry has taken over these trends through the phenomenon of granting a premium value to products, adding new ingredients and flavors, producing limited editions of certain products, preferring recipes and

methods of traditional craftsmanship and highlighting specific localities of origin. A higher value and popularity of locally produced cheeses have been observed, with the cheeses that have “Designation of Origin” being very valued and value-added products [36]. Therefore, the implementation of a denomination of origin in sheep cheeses would offer potential for expansion in the Chilean market.

Other studies have focused on measuring consumer preferences through surveys in order to expand the market to the consumption of sheep’s milk cheese. Within an analysis of potentials and limitations to evaluate the weak and strong points of the product in the Punta Arenas region, surveys and analyses of the cheese supply data were carried out by questioning potential purchasers of cheese such as hotels, restaurants and supermarkets. A test of consumers’ preference according to the type of milk used in cheese preparation revealed that 55% preferred cow, 26% cow with goat, 3% prefer sheep’s cheese, another 3% cow’s cheese with sheep and the rest (13%) did not differentiate between one product and the other [30].

With regard to cheese from cows, 76% of respondents prefer it because it is the most demanded by customers and more used in preparations, 6% prefer it for being cheaper in comparison to cheeses of other species and the rest (18%) named both options in choosing the product. Among the brands most consumed by respondents, including Quillayes and Colun, are brands that offer more varieties of cheese (15 and 7, respectively); respondents agree that less-consumed brands are those that offer fewer varieties of product [30].

The population of consumers was classified as 56% local and national population as the main consumers of cheese, while 11% indicate that it is foreign tourists who most want the product and 33% said it makes no difference. In terms of knowledge of the product, 16% indicate that they do not know about sheep’s cheese, the remaining 84% are familiar with sheep’s cheese, with the main reason for familiarization being current or past consumption (44%), because they use or sell the product (41%) or because they have heard it mentioned (15%). Regarding the brand, 34% of consumers are not aware of brands of sheep’s cheese, while 66% do know about one, chiefly the brand Universidad de Magallanes (UMAG) (50%) followed by the brand Péré André, with 7%. The regional elaboration of such cheese represents for 90% of the respondents an added value to the product, indicating that they would prefer this cheese over others if it is elaborated in the region. The remaining 10% do not consider the origin of the cheese as an important reason when choosing. According to the prices collected in the market of gourmet cheeses similar to sheep’s cheese, 57% of the sources state that they would buy the product at the suggested price. On the contrary, 33% said they would not buy it and the remaining 10% believe it unlikely [30].

Although there is no refusal on the part of the respondents in the Region of Magallanes and Chilean Antarctica to commercialize sheep’s cheese in their respective establishments, the characteristics of that possibility differ between groups. For hotels and pubs, the possibility of purchase is associated with the market behavior of supply and demand of the product, where if there is demand, standardized processing characteristics and adequate sales prices, they would include the product in their assortment. Shops, supermarkets and restaurants would incorporate it immediately as they believe that there is a potential demand for sheep’s cheese. However, when informed of the sale price at which it is marketed, the purchase percentages decrease, and the number of respondents that believe that a possible purchase is unlikely or null increases [30].

In another study conducted in the Province of Santiago in Chile, the behavioral response of the respondents was identified in which the processes of acquisition, use and possession of the product were analyzed. By means of questionnaires carried out in supermarkets, the data showed that the highest proportion of people

Potentialities	Limitations
P1. Demand/Intent to purchase and test	L1. Price
P2. Market offer low	L2. Competition (origin and by species)
P3. Brand recognition/regional product	L3. Low popularity
P4. Degree of differentiation with other cheeses	L4. Resistance to change
P5. Positive perception	
P6. New geographic market	
P7. Denomination of origin	

Table 4. *Potentialities and limitations of sheep's cheese and its insertion in the Punta Arenas market [29].*

surveyed turned out to be women (62%) between 20 and 25 years of age (34%). The purchases are made by 52% women and the most important aspects to consider the purchase are: brand and origin (70%) and price (30%). In terms of species, cheese of cow origin is the most consumed (77%), followed by goat cheese (6%), cow and goat cheese (15%) and those who consumed cow, goat and sheep cheese (2%). The main use of cheese is to make sandwiches (81%), indicating the need to find a more appropriate way to enter the cheese market of small ruminants—a more practical and habitual use [34].

4.2 Analysis of potentialities and limitations of sheep's cheese

The aforementioned data establish an analysis of sheep cheese potentialities and limitations that indicate a broader perception of the product and its insertion in the Chilean market (**Table 4**). It is worth mentioning that the mere insertion of the product in the city is not enough; it should be known and generate interest in the consumer to bring the population closer to the demand side [30].

5. Marketing

5.1 Distribution channels in Chile

5.1.1 Traditional channel

The traditional channel of consumption is mainly grocery stores, with little specialization, which offer a limited variety of products and brands. In addition, one has to consider the butchers, fishmongers and greengrocers and the itinerant markets of small traders that have a great importance in the retail distribution of fresh products and, in particular, of fruit and fish [35].

5.1.2 Modern channel

In Chile, there is a huge concentration of retail distribution in a few large business groups, among which DyS and CENCOSUD stand out, with a combined market share of close to 60%. DyS is part of the Walmart group, which currently operates in Chile through the LIDER, Ekono and Super Bodega Acuenta brands. CENCOSUD is one of the largest Latin American distribution groups, with operations in Chile and other countries in the region. In Chile, there are the Jumbo Hypermarkets, the Paris Johnson department stores and the Santa Isabel supermarkets. Other relevant retail distribution groups are the SMU Group, with activity in wholesale and retail distribution and brands such as Construmart, OKMarket or Unimarc Supermarkets, and other relevant retail distribution groups [35].

5.1.3 Institutional channel

Hotel and restaurant supply is very concentrated in a few companies, such as Aramark Central de Restaurantes or Compass Group-Eurest. It is estimated that around 15% of the products consumed in restaurants and hotels are imported. In Chile, this distribution channel is where the sale of sheep's cheese and its consumption are mainly located, being mainly the point of sale of gourmet product stores, hotels or restaurants with a high affluence of the foreign public [35]. The highest consumption is in restaurants that include sheep cheeses in their dishes [30].

5.1.4 Internet

The Internet has expanded rapidly and plays a very important role as a means of advertising and retail. Virtually all the major chains mentioned have very developed websites through which individuals can acquire a wide variety of products, from cosmetics to food. It is estimated that almost 70% of retail outlets allow the online purchase of their products. Chains such as Telemarkets, Jumbo or Lider are very active in the online distribution of their products [35].

5.2 Advertising media in Chile

The main advertising media are, in order of popularity, television, newspapers, radio, specialized magazines and billboards. Direct marketing is not usually very successful in Chile. The enormous importance that the Internet has received as a means of advertising and marketing all types of products in Chile, principally food and consumer goods, should be noted. With regard to industrial inputs, the introduction of new products must be carried out through specialized means and provide ample technical information [35].

6. Cheese products

Some of the brands of sheep cheese found in Chile are the Chilozábal cheese made in Chiloé, a mature cheese made with sheep's milk that simulates the process involved in the making of Idiázabal cheese, a cheese of Spanish origin with designation of origin. It has a stock of 140 Latxa animals and a production of 700 kg/year. A second example of sheep's cheese in Chile is the Boladero cheese manufactured in Aysén, marketed in the local market and in the metropolitan region. This company offers the market cheese made with pasteurized sheep's milk. A third example is the one promoted by Quillayes Peteroa in conjunction with the Universidad Austral de Chile. This facility is located in Futrono XIV region and has approximately 400 sheep of the Latxa breed for cheese production [30].

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Author details

María C. Barrón Rivas¹, Carlos Palacios Riocerezo², Ignacio A. Dominguez Vara^{1,3}, Manuel Gonzalez Ronquillo^{1,3} and Sergio Radic Schilling^{4*}

1 Programa de Especialidad en Producción Ovina, Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma del Estado de México, Toluca, Estado de México, Mexico

2 Área de Producción Animal, Departamento de Construcción y Agronomía, Facultad de Ciencias Agrarias y Ambientales, Universidad de Salamanca, Salamanca, Spain

3 Departamento de Nutrición Animal, Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma del Estado de México, Instituto Literario n° 100, Toluca, Mexico

4 Departamento de Ciencias Agropecuarias y Acuícolas, Universidad de Magallanes, Punta Arenas, Décima Segunda Región de Magallanes y la Antártica Chilena, Chile

*Address all correspondence to: sergio.radic@umag.cl

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