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A SURVEY ON TRADITIONAL CHEESE PRODUCTION AND DIVERSITY IN KOSOVO

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Abstract

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The objective of this study was to identify the diversity of cheeses produced in Kosovo as well as the processing technology made by small-scale households in traditional form. A random sample consisting of 480 household cheese producers for local consumption were randomly selected, by representing all regions of Kosovo. The study was focused on their mode of cheese production, such as milk pasteurization, temperature when adding of rennet enzyme as a way of coagulation, curdling, cutting, pressing, salting, ripening and the use of cheese produced. For this purpose, the questionnaires with different questions were used. The study show that there was a small variety of cheeses produced in the traditional form and in total two types (soft cheese and hard cheese) were identified and differences were registered in the technology of production in both types of cheeses. Technological cheese production process showed lack of standardization which differed slightly according to the regions of production. In general, in terms of final product attributes 73.0% of small-scale farms in Kosovo produce soft cheese whereas 27.0% were hard cheese. However, in some regions special hard cheese forms were produced (Sharri cheese in the region of Prizren and Rugova cheese from Peja region). This study provides important information on the high diversity on the technological process of cheeses produced in traditional form and shows the need of standardization of the technological process as to achieve the desired quality and simultaneously exclude the food safety issues, especially in the case of Sharri cheese produced without pasteurization of milk.

Key words: cheese diversity; small-scale households; traditional form; technological process

Introduction

Dairy production is a reflection of the country and its inhabitants, the culture and the level of the development. According to Dozet et al. (2004), autochthonous dairy production should be considered as a base for development of novel products and for quality improvements of the existing ones. In this respect, traditional cheeses productions belong to the cultural heritage and are the result of accumulated empirical knowledge passed from generation to generation (Alichanidis et al., 2008) and are usually characterized by taste, aroma, flavor, consistency compared to industrially produced cheeses (Stimac et al., 2003).

Cheese is one of the milk products that enjoys large consumption in Kosovo households. Thus, it has a considerable human nutrition, economic and social impact for this country. Cheese production is spread all over Kosovo, and it is an important component of the traditional diet. Number of Kosovar agricultural households producing cheese is calculated at about 14 289, while the total amount of cheese produced in the country is estimated to be about 17 900 tons, or about 107 900 tons equivalent of milk (Ministry of Agriculture, Forestry and Rural Development, 2015). Out of this, about 90% of cheese is produced by small-scale families and used mainly for the locals and the families own consumption. Although, cheese production is a daily family diet for centuries in Kosovo, no studies has been done identifying traditional production diversity of cheese within the country.

It is well known that production of different types of traditional cheese in the world, is influenced by many factors,

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including agricultural practices, livestock, periods of availability of milk, climate, stages and processing of cheese, eating habits, storage, etc. (Monnet et al., 2000; Bugaud et al., 2001; Boyazoglu and Morand-Fehr, 2001). With considerable influence are the types of animals raised in the country and the feed used in animals for milk production, out of which different types of cheeses are produced (Keen and Wlson, 1993). Therefore, taste of the cheese depends on pasture and composition of botanical forage consumed by animals, whether in the form of pasture or stored forage (Buchin et al.,1999; Verdier-Metz et al., 2000; Chilliard et al., 2001), while the aroma of cheese is influenced by interaction between different components in cheese such as various concentrations, type of milk, rennet properties, bacterial cultures, additives, rippening, packaging and storage (Thomsen et al., 2012). Further, environmental conditions affect the maturation of cheese, having an important role also in the flavor and odor of cheese (Fügen Durlu-Özkaya et al., 2014).

Several studies have shown the large diversity of cheese produced in the world, which make about 500 types cheeses recognized by the International Dairy Federation, over 400 varieties identified by Walter and Hargrove, and more than 1.000 varieties from Sandine and Elliker, which are classified according to: type of milk, texture, maturation time, fat content, moisture content, country or region of origin, etc (Seepr, 1998; Banks, 1998).

The objective of this study was to identify the diversity of the traditional cheeses produced in Kosovo by evaluating the whole technological process along the production line.

Materials and Methods

The study was focused in six regions all over Kosovo, with a total of 53 villages and 480 households (Table 1). The survey was targeting small scale rural households that were randomly selected covering the period from December 2015 to June 2016. The households consisted of farms with as size from 1-3 milking cows and 20-50 sheep or goats.

For the data acquisition on the type of cheese production and the technological processing principles and features, questionnaires were used which consisted of 48 general question such as the number of cheeses produced, raw material quality, quantity of cheese produced and specific question based on the processing technology itself such as questions on the form of production (conventional/industrial), pasteurization of the milk (low, medium, high) use of bacterial culture, use of rennet enzyme for curdling, curdle formation, cutting, pressing, salting (salt percentage in the brine), ripening method, of storage of cheese and finally packaging. Due to lack of recording practice in some farms, incomplete records and obvious outliers were excluded from the analyses.

Statistical analyses. The data were analyzed using JMP-starter packet a business unit of SAS program (Sall et al., 2004).

Table 1
Number of villages/households involved in research

No.	Region	Number of villages	Number of households
1.	Gjilan	8	80
2.	Mitrovice	13	80
3.	Prishtine	8	80
4.	Prizren	8	80
5.	Peje	8	80
6.	Gjakove	8	80
	Total	53	480

Results

This study showed that out of 480 small-scale households involved in the study, 450 resulted to produce cheese as an alternative for family incomes and using the tradicional way of cheese processing inherited over decades. Table 2, shows the types of cheeses produced in Kosovo, according to regional specifics of their production. Based on technological cheese production process, two types of cheeses produced in the traditional way were identified as the most produced cheeses in Kosovo: Soft Cheese (SCH) and Hard Cheese (HCH). In the group of HCH 3 subtypes of cheeses were identified with slight differences in the processing technology.

Table 2
Types of cheeses produced in Kosovo in the traditional way

No.	Region	Number of types	Cheese type*and forms** (%)
1.	Gjilan	2	SCH (70.5), HCH (HCH-W (29.5))
2.	Mitrovice	2	SCH (78.9), HCH (HCH-W (21.1))
3.	Prishtine	2	SCH (69.8), HCH (HCH-W (30.2))
4.	Prizren	2	SCH (50.7), HCH (HCH-S (49.3))
5.	Peje	2	SCH (67.8), HCH (HCH-R (22.2))
6.	Gjakove	1	SCH (100.0)

*Soft Cheese (SCH), Hard Cheese (HCH); **Hard White Cheese (HCH-W), Hard Sharri Cheese (HCH-S), Hard Rugova Cheese (HCH-R)

There was shown that region of Gjilan seem to produce mostly SCH 70.5% followed by HCH with 29.5%, while Mitrovica region produces 78.9% SCH, and 29.5%, HCH; the region of Prishtina 69.8% SCH and 30.2% HCH; the regions of Prizreni and Peja regions produce two types of cheese,

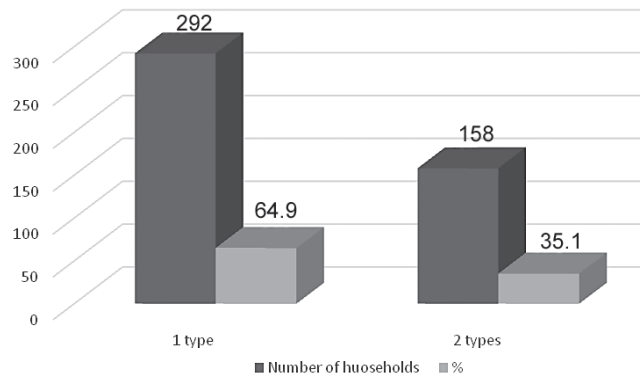

Fig. 1. The diversity of cheeses share among Kosovo small-scale households

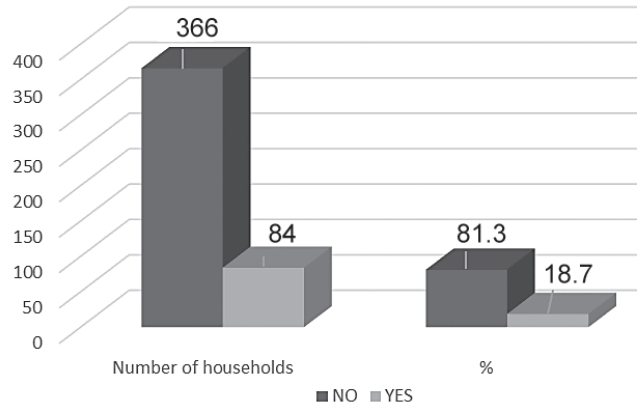

Fig. 2. Pasteurization of milk for cheese production

namely SCH and HCH, with a share of 50.7%, 49.3% and 67.8%, 22.2%, respectively. While, in Gjakova cheese produced in small-scale farms was all SCH type.

Depending from the region, in the group of HCH three types of cheese were identified: Hard White Cheese (HCH-W) 65.7.2%, Hard Sharri Cheese (HCH-S) 23.1%, a characteristic type of cheese only for the region of Prizreni, and Hard Rugova Cheese (HCH-R) 11.2%, which was a characteristic type of cheese only for the region of Peja.

Figure 1 and Figure 2 shows the diversity of cheeses produced among Kosovo small-scale households. As seen from obtained results, even though in Kosovo a total of two types of cheeses were produced in the traditional way, their diversity in our families was small. Most of Kosovo households depending from the region and consumption habits produce only one type of cheese (64.9%), followed by those producing 2 types (35.1%).

Curdling process in the production of the identified cheeses was shown in Table 3. Different practices using, self-fermentation, rennet, yougurt, vinegar, lemon were registered for the curdling process of milk for production of those cheeses. Self-fermentation (which is e method of milk curdling, by putting milk in room temperature for 24 hours (during winter for 48 hours)) and vinegar are used only for production of soft cheese. While, rennet, yougurt and lemon are used for production of both soft and hard cheese. The use of rennet and milk self-fermentation was mainly identified as shown in Table 3.

Table 3
Coagulation of milk for cheese

The way of clot	Number of households	Share (in %)
Self-fermentation	223	49.5
Rennet	294	65.4
Yogurt	67	14.9
Lemon	34	7.5
Vinegar	4	0.9

Figure 3, presents three forms of cheese salting that were applied in Kosovo under small-scale traditional farming. Dry salting was used mostly about 52.0% of cases, followed by mixed salting 42.0% and wet salting only 6.0%, respectively. The results show that usually the produced cheese was used for domestic consumption, but the surpluse was slad, too (Figure 4). As seen over 50% of the small- scale households sell the surplus cheese produced. While it was sold mainly in the retail market 61.4%, private houses 21.1%, green markets 12.0%, restaurants about 2.0% and there are some individual requests 3.5%, too (Figure 5).

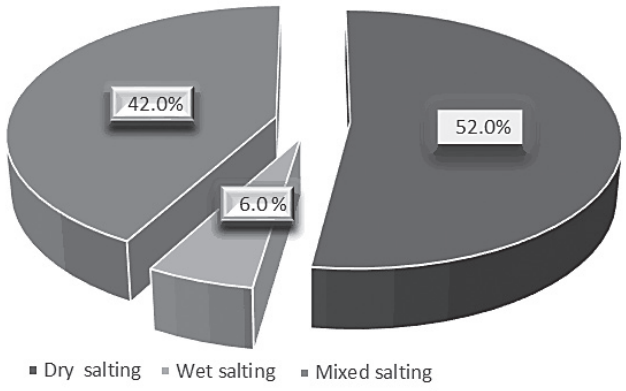

Fig. 3. Salting of cheese

Figure 6, were listed selling prices of the traditionally cheese. It seems to be a large differences on the selling price, which varies between 1.5 €/kg and 7 €/kg, mainly depending on milk and cheese type.

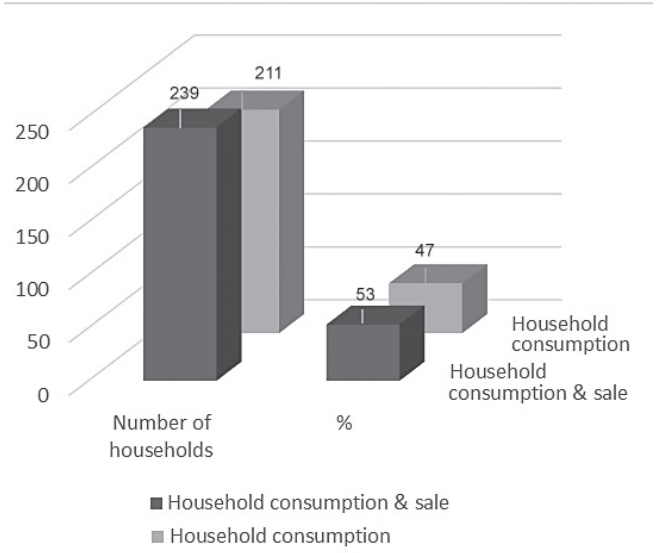

Fig. 4. Use of cheese

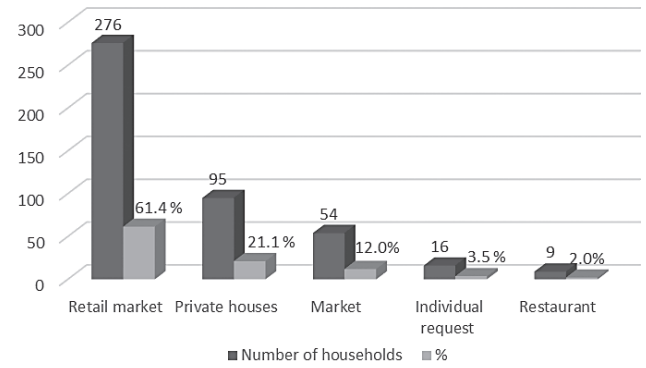

Fig. 5. Places of sale / marketing of cheese

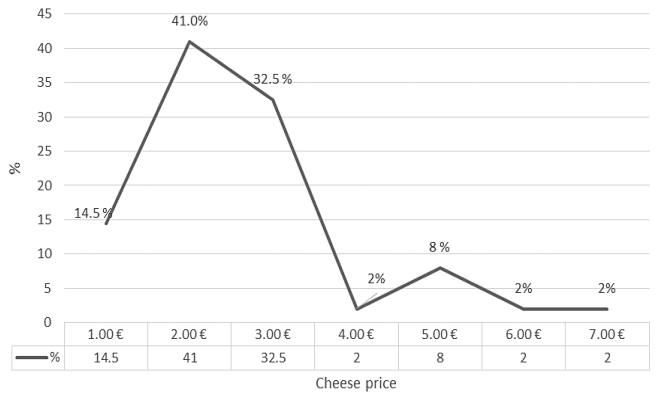

Fig. 6. The selling price of cheese

Soft cheese

Technological process of SCH production was described in the Figure 7 and 8. There was identified a rather unique SCH production process with slight difference, mainly differing by the milk coagulation, using self-fermentation (Figure 7) or other way of milk coagulation (rennet, lemon, vinegar, etc) (Figure 8).

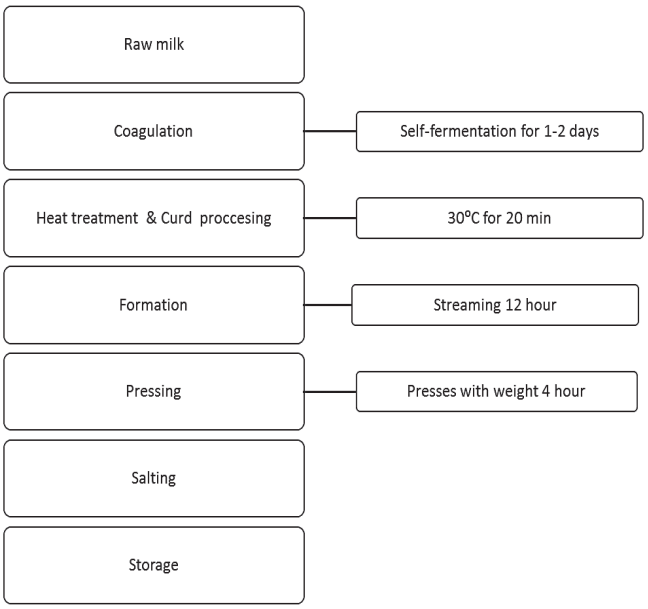

Fig. 7. Technological process of SCH production by self-formation

The technologic SCH production process includes several steps: If cheese was produced by self-fermentation (Figure 7), fresh milk was placed in containers (dishes) and it was left to self-ferment for 1-2 days at room temperature. After the milk was coagulated, comes curd processing.

During self-fermentation except the curd was won the cream too, which during cheese making it was removed (used for other product e.g. butter production) and the curd was treated with low temperature (about 30°C) for 20 minutes and it was cut so the whey comes out. Next, it was drained for 12 hours and pressed for 3-4 hours.

After cheese was produced it was cut in different shapes, salted for 24 hours and it was put in brine. If others ways of curdling are used (Figure 8) the fresh milk thermally treated 30-90°C (depending of what was used for fermentation rennet 30°C, yogurt 80°C, lemon 80°C and vinegar 90°C) and coagulation process. After, the process of cutting the curd with the intention of removing the whey takes place.

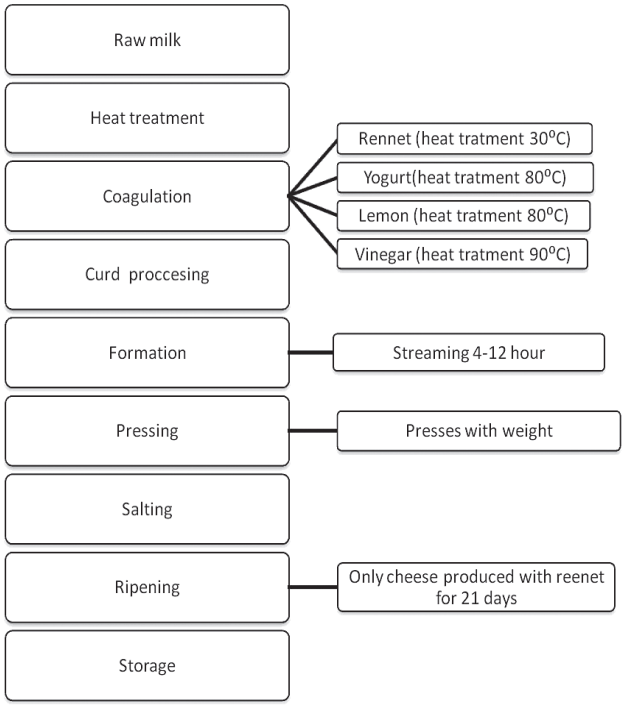

Fig. 8. Technological process of SCH production

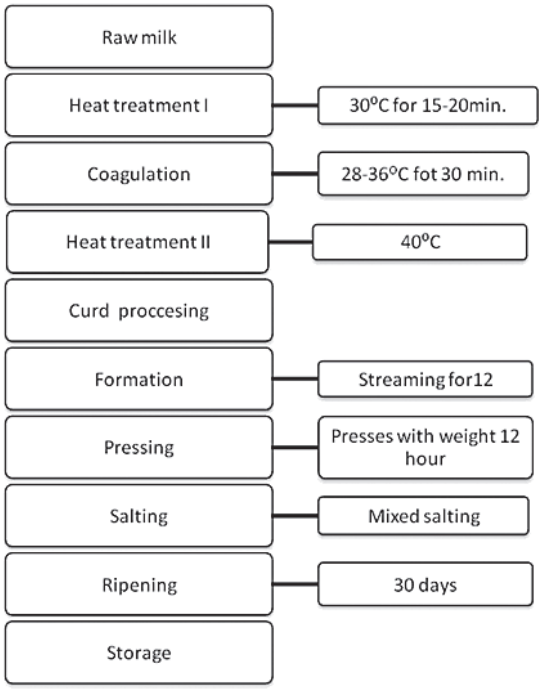

Fig. 9. Technological process of HCH-W production

The cheese was drained for 4-12 hours and the pressing process lasts for 3-4 hours (pressing was performed after curdle cutting). Next processes that take place among the cheese producers was cheese cutting in different shapes, salting process takes place for 24 hour, and placement of cheese in brine. If the SCH was produce with rennet it goes in maturation for 21 days, if other milk coagulation forms used, it was consumed like fresh cheese.

Hard cheese types

The results described in the Figure 9, 10 and 11, show HCH was represented by three different forms of technological process: HCH-W, HCH-S and HCH-R, respectively.

HCH-W*:* This type of cheese seems to be spread in many regions of Kosovo (Figure 9). Technological process of HCH-W production consists of: After the fresh milk was thermally treated till temperature 30°C the coagulated process using rennet lasts for 30 minute. In the following, the second heat treatment with the intention of removing the whey takes place followed by cutting process of the curd and drained for 12 hours. The cheese pressing (presses with weights) for 12 hours, the cheese cutting in different shapes, salting and placement in the brine were next processes. The maturation time of this type of cheese lasts for 30 days before the consumption.

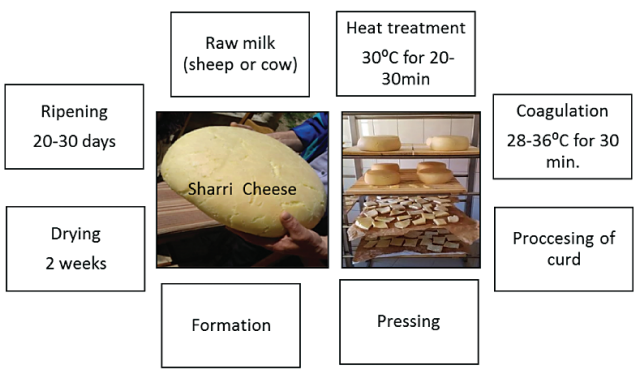

Fig. 10. Technological procces of HCH-S production

HCH-S*:* Sharri cheese was a traditional hard cheese produced in the region of Prizren (Figure 10). Technological process of Sharri cheese production consists of: After the fresh milk was thermally treated till temperature 30°C the coagulated process using rennet lasts for 30 minute. The warm water was added and it was stirred for 10-20 minutes and it was left until the cheese fall down (precipitation). In the following, the cheese was drained for 12 hours, was giv-

en the shape and salting. Further, the cheese was placed on shelves or hangs to dry for 2 weeks, broken into small pieces by hands and the cheese was placed on the brine, were next processes. The maturation time of this type of cheese lasts for 20-30 days before the consumption.

***HCH-R**:* It is a hard cheese, too. It is produced in the traditional way only in Peja region (Figure 11). The technological process of producing Rugova cheese consists of: After the fresh milk was thermally treated till temperature 30^{o}C the coagulated process using rennet lasts for 30 minute. In the following, cutting process of the curd takes place followed by cheese draining for 12 hours. The cheese pressing (presses with weights) for 1 hour, the cheese cutting in different shapes, salting in this cheese type firstly was applied dry salting for 24 hour and after it was placement in the brine. The maturation time of this type of cheese lasts for 15 days before the consumption.

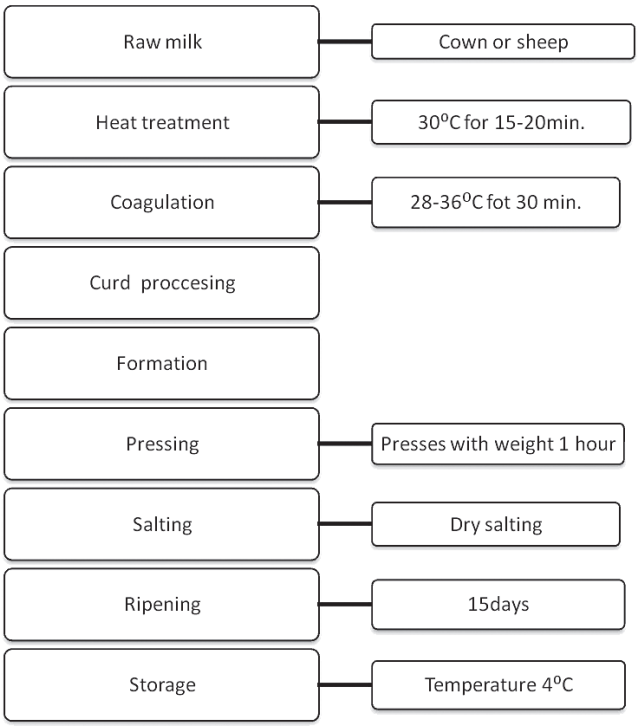

Fig. 11. Technological process of RHCH production

Discussion

The study shows that small scale farmers in Kosovo produce two types of cheeses only (SCH and HCH). This lack of cheeses production diversity can be explained by the fact that Kosovo is a small country and cheese production habits were almost similar, lack of knowledge about the cheese production, self cheese consumption, mainly. Changes that have been identified in cheese production between regions consisted of differences in milk coagulation process.

The cheese that was produced the most in Kosovo and it was spread all over the country appears to be a SCH (about 73.0% of total small-scale cheese production). Usually, it was produced as fresh cheese, no maturation period and was consumed all year round covering needs for consumption in small-scale households.

HCH production tends to be less used by Kosovo small-scale farmers and mainly it relates to specific regions. Since HCH-W was produced in other three regions (Mitrovica, Gjilani and Prishtina), covering about 27.0% of total production in the country, HCH-S and HCH-R were solely produced and consumed in their regions of origin, with share of about 49.3% of total cheese production in Prizren and about 22.2% in Peja, respectively.

Knowing the fact that pasteurization was important process in the cheese production, which eliminates the pathogenic bacteria, reducing micro-flora of milk without changing the physico-chemical characteristics, and enabling the prolongation of the storage period it was seen that show that the majority of cheeses (81.3%) produced in the traditional way, in Kosovo were usually produced without heat treatment of milk or it was treated on low temperatures 30-40^{o}C (results not shown). Application of pasteurization at such low level in cheese production could potentially be a problem on food safety, in particular when knowing the fact that there was reported a few cases animal diseases presence of pathogenic bacteria (Staphylococcus aureus, Listeria monocytogenes, Brucella spp., etc.). The cheese pressing was mainly done with weights presses 99%, just few of them applied self-pressing (results not shown).

Traditionally, small-scale farms in Kosovo used to produce cheese from raw milk of cows, sheep and goat, and in small quantities from the buffalo. Actually, equipments and storage facilities used in the cheese production process are very simple. It was noticed also lack of the product standardization which makes not unique the chemical composition of the same type of cheese. Following, strict standardization process among the same type of cheese would increase the product quality and better marketing.

There was shown also a big cheese price difference between, depended on cheese type, milk and marketing place. Mostly, SCH produced with self-fermentation was of lower price, while cheese produced from sheep milk cost more (HCH-S cheese 5-7 €/kg). As the lactation was very much seasonal and appears to start in spring, Kosovo small-scale farms tend to sell the cheese surplus during the summer time.

Recently, a few projects are taking place in Kosovo with the aim to introduce new cheese production types (i.e., yellow cheese, etc). However, due to the eating habits, small-scale farms not organized in groups, it makes difficult spreading and use these cheese products in the country.

Conclusions

By all means, traditional cheese production in Kosovo plays an important dietary, economic, social and historical role among the small-scale households. Therefore, preservation of traditional cheese production, followed by upgraded technological and storage process, standardization, without changing cheese type uniformity, will present great food diversity in the country and broader.

There was an evidence of small cheese diversity among the small-scale farming in Kosovo, leaving a space for many other imported cheese products. Introduction of new types of cheese, consisting of different chemical content and marketing (packaging, storage, etc) would have important food and economic rural development impact. In order to clarify this concept more, further studies should take place analyzing the chemical, microbiological and nutritional aspects of these cheese types.

References

Alichanidis, E. and A. Polychroniadou, 2008. Characteristics of major traditional regional cheese varieties of EastMediterranean countries: A review. *Dairy Science and Technology,* **88**: 495-510.

Banks, J. M., 1998. Cheese. In: R. Early (Ed.) The Technology of Dairy Products. 2nd ed., *Thomson Science*, London, pp. 80-122.

Boyazogly, J. and P. Morand-Fehr, 2001. Mediterranean dairy sheep and goat products and their quality a critical review. *Small Ruminant Research*, **40** (1): 1-11.

Buchin, S., B. Martin, D. Dupont, A. Bornard and C. Achilleos, 1999. Influence of composition of Alpine highland pasture on the chemical, rheological and sensory properties of cheese. *Journal of Dairy Research*, **66**: 579-588.

Bugaud, C., S. Buchin, J. B. Coulon, A. Hauwuy and D. Dupont, 2001. Influence of the nature of alpine pastures on plasmin activity, fatty acid and volatile compound composition of milk. *Lait*, **81**: 401-414.

Chilliard, Y., A. Ferlay and M. Doreau, 2001. Effect of differetn types of forages, animal fat or marineoils in cow's dieteon milk fat secretionand composition, especially conjugatedlinolric acid (CLA) and polyunsaturated fatty acids. *Livestock Products Science,* **70**: 31-48.

Dozet, N., O. Maćej and S. Jovanović, 2004. Autochthonous milk products basis for specific, original milk products development in modern conditions. *Biotechnology in Animal Husbandry*, **20**: 31-4

Fügen, D. and Ö. İ. Gün, 2014. Aroma compounds of some traditional Turkish cheeses and their importance for Turkish cuisine. *Food and Nutrition Sciences*, **5**: 425-434.

Keen, A. R. and R. D. Wilson, 1993. Pasture feeding. A contribution of additional flavour nuances to milkfat and meat flavour. In: Milkfat Flavor Forum, Summary Proceedings*, New Zealand Dairy Research Institute*, Palmerston North, New Zealand, pp. 24-31.

Ministry of Agriculture, Forestry and Rural Development, 2015. Milk Market Analysis, pp. 15-16.

Monnet, J. C., F. Berodier and P. M. Badot, 2000. Characterization and localization of a cheese georegion using edaphic criteria (Jura Mouintains, France). *Journal of Dairy Science*, **83**: 692-702.

Sall, J., A. Lehman and L. Creighoton, 2004. JMP Start Statistics. A Guide to statistics and Data Analysis Using JMP and JMP IN Software, 3rd ed., *SAS Institute,* USA, 491 p.

Sandine, W. E. and P. R. Elliker, 1970. Microbiolically induced flavors and fermented foods: flavor n fermented dairy products. *Jurnal Agriculture, Food Chemistry*, pp. 557-562.

Speker, E., 1998. Milk and Dairy Product Technology (A. Mixa, Trans.). *NY: Marcel Dekker, Inc*., New York.

Stimac, M., S. Kalit, J. Lukac-Havranek, M. Brajan and Z. Prpic, 2003. The technology of production and protection of indigenous cheeses in the area of Primorje-Gorski. Fifth counseling breeders of sheep and goats in the Republic of Croatia and the fourth exhibition of Croatian sheep and goat cheeses. Proceedings of the Conference, Opatija, October 9-10, (Peto savetovanje uzgajivaca ovaca i koza u republici Hrvatskoj i Cetvrta izlozba Hrvatskih ovcijih i kozjih sireva. Zbornik predavanja), pp. 48-63 (Cr).

Thomsen, M., C. Martin, F. Mercier, P. Tournayre, J. L. Berdagué, T. Thomas-Danguin and E. Guichard, 2012. Investigating semihard cheese aroma: Relationship between sensory profiles and gas chromatography-olfactometry data. *International Dairy Journal*, **26**: 41-49.

Verdier-Metz, I., J. B. Coulon, P. Pradel, C. Viallon, H. Albouy and J. L. Berdagué, 2000. Effect of the botanical composition of hay and casein genetic variants on the chemical and sensory characteristics of ripened Saint-Nectaire type cheeses, *Lait,* **80**: 361-370.

Walter, H. E. and R. C. Hargove, 1972. Cheese of the World. *Drover publication*, *Inc.*, New York.

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