PRODUCT SPECIFICATION

LIVANJSKI SIR

Indication of geographical origin

Livno, 2019.

CONTENT

1. PRODUCT NAME

„Livanjski sir“

2. PRODUCT DESCRIPTION

"Livanjski sir" is a hard full-fat cheese made from pasteurized, thermalized or raw cow's milk, sheep's milk or their mixtures (hereafter referred to as milk), which is produced in a defined geographical area. The taste and smell of "Livanjski sir" is slightly sweet, reminiscent of walnut kernels, the ripe cheese is slightly picant. It is produced traditionally on family farms from raw milk or in dairies using an industrial method, it is made from pasteurized milk.

2.1. Raw materials for cheese production

"Livanjski sir" is produced from raw or thermically treated milk. Animal rennet or coagulation enzymes of microbiological origin and salt, lactic acid starter cultures, lysozyme and calcium chloride are used in production. Milk used for the production of "Livanjski sir" comes from dairy cows that are grown in the area defined in point 3.1 of these specifications. Milk intended for processing can be non-standardized or standardized. Milk that is not processed within 6 hours after milking is cooled to a temperature below 10°C and processed within 24 hours of milking. Regular control and records of the physico-chemical and hygienic parameters of milk are carried out, as well as control of the presence of inhibitory and illegal substances.

2.2. External appearance and characteristics

The shape of the cheese is cylindrical, with flat bases and a flat or slightly convex mantle. The diameter of the wheel of cheese is from 18 to 28 cm, and the height is from 7 to 10 cm. The cheese weighs from 1,8 to 3,5 kg. "Livanjski sir" is also produced in smaller sizes with a diameter of 9 to 14 cm, a height of 6 to 12 cm, and a weight of 0,6 to 1,2 kg. The rind is smooth and hard, without cracks or signs of damage, golden yellow in color and is formed naturally during the ripening of the cheese, which lasts optimally for 90 days and the shortest for 60 days. The color of the rind during ripening can change from golden yellow to a slightly darker golden yellow.

2.3. Sensory properties

Cheese dough is compact, weakly elastic, easy to cut, with dense texture and without or with a small number of smaller regular holes. If it is produced from raw milk, there are may be more holes which are irregular in shape. It is light yellow color. With ripening, the cheese dough loses its elasticity, and the color takes more darker shade.. The taste is mildly and pleasantly picant and sweet, and the picantnes intensifies with longer maturation.. The smell is conspicuous and typical for mature hard cheeses, and it intensifies with ripening. The aroma is slightly reminiscent of aromatic and spicy herbs from the defined area of milk production. The appearance of "Livanjski sir" is shown in Annex 5.

2.4. Composition of cheese

"Livanjski sir" may go on the market after at least 60 days of ripening and contains at least 60% dry matter and at least 45% fat in dry matter. The concentration of salt in cheese is from 1.8% to 2.2%.

2.5. Special rules for cutting, grating, packing, etc. of product to which the registered name refers

"Livanjski sir" can also be marketed as cut into pieces or grated (cutting and grating is done at the place of production), which are packed in a vacuum or in a modified atmosphere. Cheeses weighing less than 1,2 kilograms may only be placed on the market as a whole wheel. "Livanjski sir" that has ripened for more than 12 months can be put on the market as grated cheese. Cheese is packed in a vacuum or in a modified atmosphere. After cutting the cheese, side surfaces of the obtained pieces are left without natural protection, due to which there is an accelerated loss of cheese quality and a reduction of shelf life for such products. Therefore, pieces of cheese are packed only in the prescribed type of packaging and thus retain the typical sensorial properties of "Livanjski sir" which are prescribed by this specification and which the consumer expects. Process of cutting the cheese also destroys integrity of casein label on which product traceability is based, which is why no physical sign remains on the piece of cheese that would guarantee the authenticity of the product, then such packaging is marked on the declaration with a batch code which is used for product's traceability.

3. GEOGRAPHICAL AREA

The geographical area of production of "Livanjski sir" includes the municipality of Livno and parts of neighboring municipalities located in the western part of Bosnia. The municipality of Livno is located in the southwestern part of Bosnia, along the border with neighboring Croatia, and the city of Livno is located in the northeastern part of the Livno field, the largest karst field. The original production of cheese from only sheep milk was first switched to production from a mixture of sheep and cow milk. The seasonal nature of sheep milk production and insufficient quantities, on the one hand, and the growing needs of the market, exports abroad, and the attitudes and tastes of consumers, on the other hand, conditioned the production of "Livanjski sir" only from cow's milk. As a result of this process, the production of "Livanjski sir" in small family farms started exclusively from cow's milk, especially in the off-season period of sheep's milk. In the 70's in the last century, „Livanjski sir“ began to be produced from cow's milk in a semi-industrial and industrial way in small and medium capacity cheese factories, while maintaining all the principles of the original technology. The increased production of cheese required the expansion of the area of milk production for the production of "Livanjski sir".

3.1. Geographical area of milk production for "Livanjski sir"

Milk production for "Livanjski sir" takes place in the area of HBŽ, i.e. Canton 10 (one of ten Counties, i.e. Cantons of the Federation of Bosnia and Herzegovina) with headquarters in Livno, which includes the territory of the following municipalities: Livno, Tomislavgrad, Kupres, Glamoč, Bosansko Grahovo and Drvar. Specificity of the geographical-morphological, climatic characteristics and vegetation cover of the mentioned area determined the special properties of milk from this area. Municipalities of Livno, Tomislavgrad, Glamoč, Kupres and Bosansko Grahovo are mentioned as areas from which Zagrebačka dairy purchased milk after its opening in 1970. (**Sučić i Erceg, 2002**). The area of milk production is defined in wider limits than the area where cheese is produced, because the pastures where the cows

stay during the summer, as well as the meadows used for storing hay, were also taken into account (Annex 1a).

3.2. Geographical area of production of "Livanjski sir"

The production area of "Livanjski sir" covers a narrower region than the area of milk production and represents the traditional area of production of "Livanjski sir", where it has been produced for decades. "Livanjski sir" is historically connected to this area. Written sources testify that "Livanjski sir" began to be produced in the area of Livno in 1888, and in the areas of Glamoč and Duvno already in the first half of the last century. (**Filjak i Baković, 1974; Zdanovski, 1967; Manđeralo, 1999**). According to oral accounts, "Livanjski sir" was transferred to the areas of Kupres (Malovan) and Tomislavgrad municipalities by the marriage of girls from Livno, who brought the art of making "Livanjski sir" to those regions. Establishment of the industrial production of "Livanjski sir" began with the organized milk collection in 1969, and in the 70s with the modernization and production of cheese based on cow's milk with the preserved basic production process. (**Manđeralo, 1999; Mihaljević, 1982; Krišto, 1998; Kirin i sur., 2003**). Today it is produced in farm and industrial conditions (**Matić 2012**) in all parts of the defined geographical area of "Livanjski sir" production. It encompasses the entire Livanjsko field. In the southwest it extends to the border with Croatia, and in the west to the border with the municipality of Bosansko Grahovo. Border of the area goes further north over the Golija mountain and includes part of the Glamoč field with the villages of Skucani, Staro selo, Vidimlije, Kopić, Dolac and Dragnić. From Glamoč field onwards, border of the production area in the north covers part of Slovinj mountain, Veliki and Mali Cincar and Krug, and descends to Gornji Malovan. On the eastern side, it covers area of Šujica (Borova glava) up to the mountain Ljubuša, descends towards Tomislavgrad (covering villages of Eminovo selo, Stipanići and Prisoje), goes to the shore of Buško Lake and goes along the shore, and then along the border between the municipalities of Livno and Tomislavgrad, all the way to the border with Croatia. Thus, production area includes the entire Livno field, part of the Glamoč field, and only smaller parts of the Kupres and Duvno field. Mentioned area occupies an area of approximately 1,500 km^2 and represents the historically proven limits to which the production of "Livanjski sir" has spread (Annex 1b).

4. PROOF OF THE ORIGIN OF "LIVANJSKI SIR"

4.1. Traceability in the production process of "Livanjski sir"

The origin of "Livanjski sir" and its compliance with this specification is proven by means of a documentation system in which all production steps are recorded, as well as data on the receipt and delivery of raw materials and products, from the production of animal feed and rearing of milking cows all to the finished product. All stages of production, ripening and packaging of "Livanjski sir" take place within the defined geographical area of cheese production. There are three basic entities in the production chain of "Livanjski sir": animal feed producers, milk producers and producers of "Livanjski sir".

- In the daily ration of milking cows, voluminous forage must prevail: hay, haylage or pasture with a proportion of at least 75% dry matter. Bulky fodder (hay, haylage, grass) for milking cows can be produced outside the area of milk production for "Livanjski sir" in an amount of up to 40%. Concentrated feeds for nutrition, and complementary feed mixtures and mineral-vitamin supplements, on the other hand, may originate from any area outside of that defined under 3.1. Every producer of voluminous feed must have an established internal traceability system, by means of which it is possible to unequivocally determine the origin and quantity of the food produced.

- Milk from cows that are marked and registered with the competent authority can only be used for the production of "Livanjski sir". Milk producers keep records on the feeding of milking cows, the production and procurement of animal feed, and daily production and sale of milk. In case of producers who process milk into cheese themselves, control and records of milk quality control and all milk storage and processing parameters are mandatory, and milk must be stored and processed separately from milk for other purposes.
- Cheese producers who purchase milk from farmers keep records of the amount of daily purchase for each registered milk producer. Milk intended for the production of "Livanjski sir" is transported and stored in separate and clearly marked containers. For the production of „Livanjski sir“ at least 60% of milk from the area described in point 3.1 must be used. All producers of "Livanjski sir" keep records of the quantities of processed milk and the number of produced "wheels" of cheese per day and for each individual batch (amount of milk and cheese per one batch). If only one batch is produced per day, then the daily and batch quantities are equal. In order to monitor the traceability of the processing of milk into cheese, during the production phase, a casein label is placed on each "wheel" of cheese, which contains the unique serial number of the "wheel" and the common sign "LS", which is also recorded. Casein plates-labels are assigned by the "ASSOCIATION FOR THE PROTECTION OF THE ORIGIN OF LIVANJSKI SIR" to all users of the protected geographical indication "Livanjski sir". Cheese producers keep records of the amount of cheese in maturation rooms, warehouse and the amount of cheese sold. When the cheese is repackaged in a vacuum or in a modified atmosphere, the mark from the casein label is not visible, and such packaging is marked on the product declaration with a batch code, which secure traceability in further documentation.

4.2. Historical evidence of the geographical origin of "Livanjski sir"

There are many irrefutable proofs that "Livanjski sir" has been produced in the Livno region for over 130 years. "Livanjski sir" belongs to the group of hard cheeses. It is traditionally produced from sheep's, cow's and a mixture of sheep's and cow's milk in different proportions. **(Bijeljac i Sarić, 2005)**. The beginning of Livno cheese production took place during the Austro-Hungarian period in the Land Agricultural Station in Livno, which was established in 1888 by the Land Government in Sarajevo. **(Kirin i sur., 2003; Kutle, 1996; Franjić, 1983)**. Already at the beginning of the 20th century, private cheese factories began to be established **(Manđeralo, 1999)** so over 20 cheese makers were recorded in 1933 in Livno and its surroundings **(Balić, 1933)**. In cooperation with the Zagreb dairy, the purchase of milk was organized in the area of Livno and Tomislavgrad. Since 1970, the "Zagreb dairy" cheese plant in Livno has been producing "Livanjski sir" from sheep's milk and mixed cow's and sheep's milk. **(Filjak i Baković, 1974)** but already in the second half of the 70s of the last century, cow's milk prevails in production, especially during winter and autumn months (**Mihaljević**, **1982**). Production of "Livanjski sir" was further modernized, so several medium- and small-capacity plants were opened in the Livno area with the dominant share of cow's milk in cheese production.

5. PRODUCTION PROCEDURE OF "LIVANJSKI SIR"

5.1. Milk for the production of "Livanjski sir"

The technology of "Livanjski sir" in a defined geographical area has changed significantly in recent decades, from small production in family or farm conditions to modern production in dairies. Food safety requirements and the hygienic quality of milk dictated the introduction of

pasteurization in the basic production process of "Livanjski sir". All industrial facilities for the production of "Livanjski sir" comply with all hygiene standards and have implemented HACCP. A detailed description of the technological process for the production of "Livanjski sir" with parameters can be found in Annex 3. The main basis for the production of "Livanjski sir" is high quality milk. Although the breed composition has changed over the years, the largest share of milk for the production of "Livanjski sir" is provided by cattle of several breeds from the indicated geographical area, such as brown (Montafon cattle), green (Oberintal), local Buša cattle or some other breed and their crossbreeds, and the Pramenka sheep as well as some other breeds and their crosses.). In the defined geographical area of milk production, they have been present for more than 50 years, and they are well adapted for greater utilization of mainly voluminous forage, as well as to climatic and geographical conditions. They have good milk yield, and milk has a high milk fat and protein content. Specific climate and vegetation of the geographical area for cheese and milk production also contributes to this. Milk, which is processed into "Livanjski sir", corresponds to the current legal regulations in terms of physical, chemical and hygienic quality. Milk that is not processed within 6 hours after milking is cooled to a temperature below 10°C and processed within 24 hours of milking.
There are several reasons for introducing cow's milkin Livanjski sir production:

- The impossibility of larger dairy capacities to provide larger quantities of sheep's milk
- Cheese production season (sheep's milk production season lasts from April to September)
- Lack of economic effect due to the fact that a large part of consumers simply do not care about the proportion of sheep's milk in cheese
- Consumer preference for products that have a less intensive smell and taste
- Unsuitability of sheep's milk for purchase, longer transport and heat treatment.

5.2. Technological process of production of "Livanjski sir"

- **Preparation of milk for cheese making**

Milk is received in the dairy and mechanically purified. Standardized or non-standardized milk for milk fat content is used. The milk is standardized on centrifugal separators (dairies) or milk from the evening milking is left to stand to separate the layer of milk fat on the surface which is skimmed off, and then this milk is mixed with whole milk from the morning milking (small producers). Mild heat treatment is used for the production of "Livanjski sir". It is made from raw, thermalized (57-68°C) or pasteurized (at least 72°C for min. 15 seconds or at least 63°C for 30 minutes) cow's milk. In an effort to achieve the maturity of the milk and the proper flow of fermentation processes, especially in the case of pasteurized milk, pre-ripening of the milk is carried out. To promote fermentation, it is allowed to use dairy cultures prepared in the facility (ripening a small amount of milk or whey from the previous day at a higher temperature to develop thermophilic microflora until a certain maturity) or selected cultures of lactic acid bacteria for hard cheeses. The milk is adjusted to a temperature of 29-34°C before the cheese is made.

- **Curdling and curd/coagulum processing**

For curdling milk in the production of "Livanjski sir", rennets suitable for hard cheeses are used. Curdling process lasts 30-45 minutes at a temperature of 29°C to 34°C. Curd processing enhance syneresis (extraction of water) and the appropriate size of the cheese grains is reached. In the first stage, the curd is cut into larger cubes, then into cubes approx. 15 cm in size. Shredding of cheese grain is done up to the size of a grain of wheat. Time of cutting and shredding depends on the degree of acidification of the whey. Appropriate maturity and firmness of cheese grain is achieved by additional heating and drying with development of acidity. Cheese grain is heated to a temperature of 46°C to 48°C and finally, with constant mixing, it is dried to the appropriate quality and maturity of cheese grain.

- **• Shaping, separating cheese grain from whey and pressing**

Depending on the technical equipment of the cheese factory, shaping of cheese, i.e. formation of cheese mass and separation of cheese grain from the whey can be done in molds using a cheese scarf or with a pre-press. Process of cheese pressing, during which most of the lactic-acid fermentation takes place, is intended for separation of free water, unification of the cheese mass, formation of the crust and it's final shape. Depending on the type of press, duration of cheese pressing is from 1.5 to 2.5 hours (pneumatic press) or up to 24 hours (mechanical press), in an adequately heated space (room temperature). Turning the cheese during pressing is intended for faster separation of water, i.e. whey, proper distribution of water in a cheese and a more regular shape of the cheese.

- **Salting and ripening of cheese**

"Livanjski sir" is salted in salt water (brine) for 24 to 48 hours, but not less than 12 hours. Length of salting depends on the size of cheese wheel and concentration of the brine, which is 18-22%. After salting, cheese is drained. Purpose of ripening is, first of all, formation of significant sensory properties. Extent of changes during cheese ripening and speed of these events are also determined by external conditions during ripening. Care of cheese during ripening process (turning, wiping, cleaning, grating) is very important. In order to achieve full maturity and quality, "Livanjski sir" must be ripened in a defined geographical area for at least 60 days, ripening takes place on wooden shelves under controlled conditions of temperature (13-16°C) and relative humidity (80-90%).

5.3. Placing on the market

- „Livanjski sir" is placed on the market as a whole product, in wheels, it can be coated with a protective coating before sale. Recently, however, demand for repackaged pieces of cheese has been increasing, especially from supermarkets, so "Livanjski sir" is also put on the market cut into pieces which are packed in a vacuum or in a modified atmosphere. Cheeses weighing less than 1,2 kilograms may only be placed on the market as whole wheels. "Livanjski sir" that has ripened for more than 12 months can also be put on the market as grated cheese. Packaging is done in a vacuum or in a modified atmosphere. After cutting the cheese, side surfaces of obtained pieces are left without natural protection, due to which there is an accelerated loss of cheese quality and a reduction of the shelf life. Therefore, pieces of cheese are packed only in the prescribed type of packaging in order to retain typical sensorial properties of "Livanjski sir" which are defined in this specification and which consumer expects. Process of cutting the cheese also destroys integrity of the casein label on which product traceability is based, which is why no physical sign remains on the piece of cheese that would guarantee authenticity of the product, which is why such packagings are marked on the declaration with a batch code which is used for monitor product's traceability.

6. CONNECTION WITH THE GEOGRAPHICAL AREA OF PRODUCTION

6.1. Specificity of the geographical area

Area of western Bosnia, especially municipalities of Livno, Tomislavgrad, Glamoč and Kupres, is extremely rural, predominantly hilly and mountainous with a significant share of karst fields. Population is constantly decreasing (even in local towns), and the aging index is among the highest in Bosnia and Herzegovina. Significant problem of this region is constant emigration of educated people. This area is dominated by limestone mountains, most famous

of which is Dinara as part of the Dinaridi mountain range. Natural and geographical characteristics of this area are diverse, from fertile, spacious fields and endless pastures, rivers and lakes to century-old deciduous and evergreen forests, which provide abundant opportunities for life and economic development based on agricultural production, livestock, and wood industry. Ecologically clean and untouched nature, moderate to hilly mountain climate, proximity and good traffic connection with the neighboring Republic of Croatia, and especially central Dalmatia, a highly developed tourist region to which it gravitates economically and traditionally, are important factors for the economic prosperity of this region. The relief is very diversed and incised. Water slowly dissolves the limestone, thus widening the cracks, which eventually results in the formation of depressions and scratches on the surface, and caves and pits underground. Caves and pits are very characteristic of this area. Large karst fields were formed in these areas: Livanjsko, Glamočko, Duvanjsko and Kupreško fields. The lowest points of these fields are at 1117 meters above sea level at Kupreško field, 882 meters above sea level at Glamočko field, 859 meters above sea level at Duvanjsko field, and 699 meters above sea level at Livanjsko field. Field with largest area is Livanjsko, which has an area of 405 km2, followed by Glamočko 130 km2, Duvanjsko 128 km2, and Kupreško with 96 km2. It is important to point out that according to the Ramsar convention, Livanjsko field is the largest wetland area (10,000 ha area) in the country, and with a length of 64 km and a maximum width of 12 km, it is also the largest karst field in the world. (**Strategy of Herceg-Bosnia County, 2007).** According to the UNESCO definition, Livanjsko Field meets all the criteria to be placed on the UNESCO World Heritage List as a "continuous cultivated landscape" and "an important part of the "cultural heritage" of Bosnia and Herzegovina (**Bernardoni i sur., 2008**). Benefits for cultivating the land and agriculture are enormous, but utilization of these benefits is very small. Namely, in winter, some parts of these fields are flooded due to the cyclone, frequent rainfall and melted snow. Due to its structure, as mentioned, water often flows into cracks in the limestone rocks, and therefore this region is poor in rivers and lakes. In this area there are a couple of rivers, length of which exceeds 10 km, and there are also 11 lakes, of which 8 are artificial, and other 3 are natural.

- Continental to mountainous climate prevails in the defined geographical area, which main features are cold and harsh winters and moderate and warm summers. Decisive factors that determine climate of this area are: geographical location, geomorphological characteristics of the area and proximity to the Adriatic Sea. Rainfall is characteristic for this area. Main maximum in the amount of precipitation is in November, while the second maximum is from February to April. Main characteristic of this area is that it is karst, and because of this there is a rapid draining of precipitation, which is why there are frequent droughts in the summer months. Also, this area is characterized by precipitation in November, which is followed by a snow blanket during winter months. Result of all this is an excessive amount of water, which causes the flooding of certain parts of this area. Livanjsko field is very rich in water, and excess water during the winter period is drained by a network of canals to Buško Lake. Permanent rivers in Livanjsko field are Sturba, Žabljak and Bistrica, which main feature is that the field is also a collector of water from the Cetinje basin from higher horizons. These areas are characterized by continental winds, with Bura prevailing. Bura is a sharp, cold and dry wind that reaches its full strength and capacity in the winter months. What characterizes Bura is clear weather, but lower air temperatures than usual. Another characteristic wind for this area is Jugo (south wind). In these areas, it is more frequent in winter than in summer. Its main function is that it enables faster snow removal. This area is also characterized by a period without wind, which causes frequent temperature inversions.

- The fact that the geographical area of milk and cheese production is located at the geographical transition from Herzegovina in the south and Bosnia in the north, where the influences of the warm Mediterranean from the south and the cold mountain

climate from the north collide, has caused, over time, the creation of special ecological conditions. They are characterized by pronounced temperature and hygroscopic extremes, as well as a high amount and specific distribution of precipitation. Ecosystems developed under these conditions are simultaneously inhabited by thermophilic (warm-loving) and frigophilic (adapted to low temperatures), i.e. mountain plant and animal species. Most of the species that make up these communities are of endemic Dinaric and Balkan character. One of the important facts is that this area has huge areas of natural grasslands (pastures) in relation to the total agricultural areas (over 80% of the total areas under grasslands). Special characteristics of the pastures are given by the types of grasses, sedge, meadow fescue, red fescue, small gentians, euphrasia, chelinšćica, saffron, daisies, field queen, lion's tooth, goat's beard and others. In addition to the more widespread species, these communities also include numerous endemic species such as black root (Scorzonera vilosa), spotted hawkweed (Hypochoeris maculata), spike (Dantonia sp.), pannonian clover, various orchids such as purple cacti, common cacti, ofris, udders, endemic carnation, Balkan widow, and a significant number of grasses (oats, celery, fescue, sedges). Specific natural conditions primarily favor the growth of flora typical of Mediterranean pastures, so on most pastures we find a high proportion of aromatic and medicinal herbs such as yarrow (Achillea millefolium L.), wormwood (Arthemisia absinthium L.), and even some immortelle (Helichrysium italicum Roth G . Don), St. John's wort (Hypericum officinalis L.), mint (Mentha sp.), yarrow (Ruta graveolens L.), thyme (Thymus vulgaris L.) and meadow sage (Salvia officinalis L.). Mnoge vrste iz njihovog sastava predstavljaju krmne biljke visokih nutricionih vrijednosti, što čini osnovu razvoja održivog ovčarstva i govedarstva na ovom prostoru.

- Agriculture was the most important activity in the past. In the second half of the last century, it lost its importance. This also stimulated natural processes, because many agricultural areas were neglected and abandoned and began to grow into thickets, maquis or forest. Natural conditions for the development of agricultural production in the geographical area are quite unfavorable and often prevent the use of modern mechanization. In addition, the large fragmentation of agricultural land represents an additional obstacle for sustainable agricultural activity. Animal husbandry and agriculture are generally extensive and sustainable, and partly more intensive. This is reflected in different farming methods, from the preparation of corn and grass for feeding ruminants, to the traditional way of preparing dry fodder (baling hay, making haylage and baling it, drying hay in haylofts). Brown and gray breeds of cattle, which are best adapted, are mainly represented in cattle breeding. In sheep breeding, the Pramenka breed and certain crossbreeds of Pramenka with other sheep are most represented. Agricultural areas range from 700 m above sea level. up to 1,200 m above sea level. Productivity is quite low and mostly meets needs of the local population. Most grass areas are mowed once (rarely twice). approx. 10% of agricultural households use artificial fertilizer and in very small quantities.

6.2. Historical overview

"Livanjski sir" has a long and rich tradition of production in a defined geographical area. Beginnings of cheese production in this area go back to the distant past, and are associated with the beginning of grazing and livestock keeping in the districts in the mountains, which is understandable, because at that time cheesemaking was the only way to preserve milk in hilly-

mountainous conditions.. In the Livno area, many dairy products were made - Sour milk, Kajmak, Butter and "Trveni cheese" or "Trvenjak" (from skimmed milk), "Tvornjak" (cheese made from boiled milk formed in cheese press) and „Belava“ **(Manđeralo, 1999)**. The turning point and the beginning of the production of "Livanjski sir" took place during the Austro-Hungarian Empire. In 1888, the State Government in Sarajevo founded the State Agricultural Station (Stock or Economic Station) in Livno **(Kirin i sur., 2003; Kutle, 1996; Franjić, 1983)**. Cheese masters from Switzerland introduced the production of hard cheese made of sheep milk. They used French (Swiss) hard cheese Gruyère as a model. This is why this cheese is called "Swiss cheese". It was soon accepted by many consumers, so many shepherds of the region decided to produce it. Swiss cheesemakers then also held courses for the production of this cheese, which helped spread the technology **(Filjak i Baković, 1974)**. In the agricultural school, which was established as part of the experimental station, local population was taught how to make cheese. Famous cheesemakers of that time from France, Switzerland and the Czech Republic gave lectures and produced cheese here (Karlo Oksner, Felix Lacombe, Rikard Berger). **(Manđeralo, 1999)**. However, most significant role was played by a Frenchman, Cyprian Jaillet, who arrived in Livno at the very end of the 19th century and who soon became a prominent citizen of Livno. Under his supervision, production of Roquefort and Vollkäse cheese begins, and later Feta, Liptauer, Camembert, etc. Roquefort type cheese was stored in a natural cave in the Crvenica massif above Duman because temperature was suitable for the development of mold. How high-quality produced cheese was is shown by the fact that at the exhibition in Budapest in 1896 it was crowned with the "Grossenmilleniums medalle" as a product equal to the original **(Kirin i sur., 2003; Zdanovski, 1967)**. Over time, production of Roquefort cheese was abandoned, and since 1905, mainly "Livanjski sir" also called Vollkäse (full fat) has been produced, which was particularly popular in the market of the monarchy **(Manđeralo, 1996)**. In addition to Livanjski sir, only production of Trappist cheese at the Kruzi mountain station lasted longer of all types of other cheese **(Manđeralo, 1996; Marijan, 2005)**. All activities on production and training in cheese production took place in the cheese factory, which was part of the Land agricultural station where mainly sheep's milk produced in the surrounding villages and on the Kruzi mountain estate below the Cincar mountain was processed. **(Kirin i sur., 2003)**. As part of the dairy (cheese factory) there were rooms for salting and a cellar for ripening cheese **(Zdanovski, 1967)**. As he states **Manđeralo (1999):** "in Livno cheese dairies (both one at the station in the city and the one at Begovača under Cincar) production of cheeses that are sought after by a large market throughout the Empire started (Roquefort, Vollkäse, Feta, Liptovec or Liptauer, Camembert, Trappist, Herve...)". Expert cheese makers from abroad trained a number of local young men in all skills of cheese production, and since those times Livestock station has had the required number of professionally trained master cheese makers in its cheese factories.

On the basis of these literature data, it can be assumed that data refer to two cheese factories: cheese factory in Livno and the cheese factory on Begovača, located between the Krug and Cincar mountains, and that cheese production was focused on master cheesemakers of the Land agricultural station for about 15 years. Already at the beginning of the 20th century, following example of cheese makers from Livestock station, enterprenour people started with establishing private cheese factories. First one was founded by the famous Livno baker Anto Tadić in 1903. Since he was the first, Land Government initially gave him basic equipment and a free cheesemaker for the first year. Five years after that, he founded his cheese factory with his own equipment and his own master cheese maker, where he produced about 3 tons of cheese, which was sought after at the markets of Dalmatia, Rijeka, Trieste, Sarajevo, Mostar and other cities. **(Manđeralo, 1999)**. After World War I, many people in the Livno region focused on producing cheese for the market **(Manđeralo, 1999)**. More than 20 cheese factories were recorded in 1933 in Livno and its surroundings, of which cheese factory of the Banovina Livestock (formerly Land) station in Livno and on Cincar mountain, were cheese production

started, stood out. Station also made other types of cheese, but preference was "Livanjski sir", especially made from sheep's milk. Station continued to educate local population and organize courses in cheese production **(Balić, 1933)**. A few returnees from America and Western European countries decided to invest in cheese production **(Manđeralo, 1999)**. According to some estimates, production of "Livanjski sir" in that period amounted to 20-30 wagons per year in the entire area of production, while it is assumed that in the narrow area of Livno production was at the level of about 5 wagons per year **(Balić, 1933; Zdanovski, 1947; Filjak i Baković, 1974; Nikolić, 1943)**. In the period between the two world wars, cheese was mostly sold in Split, and it began to be exported to Belgium, France, Israel and South America **(Filjak i Baković, 1974)**.

After World War II, the station was rebuilt, some private cheese factories were taken over and the Agricultural State Property "Ante Zoro Kelava" was created, which then produced about 1 wagon of „Livanjski sir“ per year. Private cheese factories continued to play a significant role so the total annual production was from 4 to 5 wagons of cheese **(Filjak i Baković, 1974)**. According to other data, in this period the Agricultural State Property produced up to 3 wagons of sheep's cheese per year **(Manđeralo, 1999)**. Since 1953, production of "Livanjski sir" has been in decline, which was contributed to by a partial reorientation to the production of white cheese (Feta), but this was abandoned in the period 1955-1956 **(Filjak i Baković, 1974)**. Hard "Livanjski sir" made from sheep's milk was then exported to Egypt, England and America **(Manđeralo, 1999)**. **Zdanovski (1956)** states that in that year about 10 wagons of "Livanjski sir" were exported to areas outside of Livno. Number of sheep on agricultural property gradually decreased, thus production of cheese in the public sector was extinguished. Last year of production was 1968. **(Krišto, 1998)**. In 1969, Agricultural estate Livno stopped working in sheep farming **(Franjić, 1983)**. In the same year, in cooperation with the Zagreb dairy, collection of milk from local farmers was organized in the area of Livno and Tomislavgrad.

Since 1970, the Zagreb dairy plant in Livno produces 10-15 wagons of cheese annually. **(Filjak i Baković, 1974)**. The initial milk collected amounted to about 700 liters per day, and in 1976 it reached 17,000 liters per day. **(Krišto, 1998)**. This dairy initially produced cheese from mixed milk, with fact that the ratio was usually 50:50, but sometimes amount of sheep's milk was even less. **(Filjak i Baković, 1974)**. The biggest change was transition from sheep's milk to cow's milk, i.e. to a mixture of them, and later to the almost exclusive curdling of cow's milk. Another important change was introduction of modern cheese-making facilities and procedures (e.g. pasteurization of milk for cheese-making), use of pure dairy starter cultures, and other modern aids. **(Marijan, 2005)**. It has been recorded that already in the 70s, cow's milk was predominantly used in the then Dairy for the production of "Livanjski sir" (**Matić, 2012.**), and to a lesser extent sheep's milk mixed with cow's milk (**Mihaljević, 1982**). The industrial production of "Livanjski sir" in the 90s was mainly based on cow's milk, and only sporadically on sheep's milk. **(Kutle, 1996)**. Survey of consumers showed that they know "Livanjski sir" which is present on the market of Bosnia and Herzegovina, that they accept it very well, and that they consume it quite often.

6.3. Specific characteristics of "Livanjski sir"

"Livanjski sir" is a hard cheese that is characterized by a pleasant spicy taste and a compact closed texture. It can be recognized by its regular, low cylindrical shape. Cheese dough is light yellow to dark yellow in color, and the crust is natural, hard and smooth. Depending on its maturity, texture and taste of "Livanjski sir" may differ. "Livanjski sir" aged 2 months is

weakly elastic, easy to cut, and on cross-section it may be without or have a smaller number of sparsely distributed round small eyes (with "Livanjski sir" obtained from raw milk, there may be a considerable number of eyes on cross-section). Its taste is slightly sweet, moderately salty and pleasantly picant. It has a pronounced persistent aroma characteristic of the area of production, reminiscent of aromatic and spicy herbs. During ripening, "Livanjski sir" gradually becomes more picant, intensity of taste, aroma, smell and color increases, and cheese dough becomes firmer. Fully matured "Livanjski sir", matured for 3 or more months, has a fine structure, and aged for 6 or more months, breaks irregularly when cut. Its taste is picant harmoniously full, it melts in the mouth, and fine "crystals" are felt under the tongue, and such cheese is of Premium quality.

6.4. Reputation of "Livanjski sir"

Although it is produced in the area of the municipality of Livno and parts of the neighboring municipality, "Livanjski sir" has built a high reputation with its history and quality and has become a recognizable symbol, trademark and ambassador of Bosnia and Herzegovina in the world. Cheese's specificity, long tradition of production, standard quality, but also the sale and popularity of cheese abroad, primarily in Croatia (Dalmatia) but also on the BiH market, had a dominant influence on the popularization of cheese. In particular, it should be emphasized that the sale and marketing of "Livanjski sir", especially made from pasteurized cow's milk, helped popularize "Livanjski sir", which significantly contributed to the development of the economy and the economic progress of the inhabitants of Bosnia and Herzegovina. This is evidenced by the data that show that sale (and therefore also production, which took place in the area of Livno and its surroundings, annex 1b) of "Livanjski sir" in the 1970s and 1980s was mostly from 700 to 900 tons per year, of which on the territory of Croatia (especially Dalmatia) was about 90 %, and approx. 10% in BiH and some other countries. Of the total amount, about 50% was from industrial production, and the rest of 50% from rural households. In the 2000s, sales maintained a high level and varied from 500 to 800 tons per year, of which more than 80% went to Croatia, and 20% to BiH and some other countries (about 70% was from industrial production, and the rest of 30% from rural households). This ratio was quite conditioned by unsettled situation and barriers to the export of small producers, but it clearly indicates that Dalmatian market accepts "Livanjski sir", regardless of whether it is produced industrially or by small producers. With accession of Republic of Croatia to the EU, there was a tremendous drop in the production and sale of "Livanjski sir", but after two dairies received a license to export cheese to the EU, the situation improved.

6.5. Causal link between geographical area and product characteristics

Characteristics and uniqueness of "Livanjski sir" stem from the special characteristics of milk from which it is produced. Geographical area of milk production and processing into "Livanjski sir" is special and unique in many respects. It provides ideal conditions for raising livestock. Specific collision of Mediterranean and continental climates, combination of pastures on the mountains and unique complex of karst fields provide vegetation composed of valuable plants that cannot be found anywhere else, nor the geographical environment. Botanical composition of natural grasslands used for the production of "Livanjski sir" indicates that this area is home to a large number of aromatic plants, some of which are valuable and unique only to these areas. Cattle grazing in such an environment where there is a large presence of various aromatic plants significantly affects increase in nutritional value of milk, and thus on the cheese produced from such milk. In addition, cheese obtained in this way has a special taste and smell that is characteristic and closely related to the vegetation of this region. Main livestock grazing takes place on mountainous and hilly areas with most valuable plants.

This way of grazing and feeding livestock has been present in these regions since ancient times. Tradition of herders in this region is to make maximum use of pasture when feeding dairy cattle. Milking cows are fed on pasture for about 6 months, and remaining part of the year cows are fed with hay or silage obtained from pastures or arable land from the production area. This means that the milking cow's feed is min. 60% originating from a single geographical area.

In such an environment, milk and whey (if it is used for plant culture) has a rich and diverse microflora that is transferred to the cheese and gives it special characteristics. Production plants are also home to a rich microflora that comes from environment surrounding dairies and that inhabits cheese during production and ripening phases.
Also, specific method of production of "Livanjski sir" has been preserved for decades, being passed down from generation to generation, where skill of the master cheesemaker came to the fore. Namely, cheese is made according to the original recipe that began in the Land agricultural station, on whose foundations Mljekara Livno d.o.o. is today located. All of the above gives "Livanjski sir" high quality and special textural properties, with a characteristic smell and taste. Naturally formed rind gives a seal to the appearance of cheese and makes it different from the others.
"Livanjski sir" has been produced from raw milk for decades, and with the application of pasteurization for over 40 years, so it can rightly be said that it has become traditional and recognizable both in Bosnia and Herzegovina and in Croatia and the world. It is valued and sought after by the general population, so it is an important export item and is found in sales centers throughout Bosnia and Herzegovina. It is important for tourism through exports to Dalmatia, but also as a traditional specialty in the tourist-gastronomic offer of Bosnia and Herzegovina. "Livanjski sir" has a reputation as a high-quality hard full-fat cheese that has been built up over the years and occupies a prominent place in the category of these cheeses in the region and beyond ("Livanjski sir" is also described in the Cheese Encyclopedia by: **Kamerlener J., 1989 god, Labkäse- tehnologgi III str.759,** where it is noted, among other things, that it is made from both sheep's and cow's milk).
Tradition, geographical environment and specific technology in combination with high hygienic milk quality and quality assurance system in production provide cheese with characteristic, high and guaranteed standardized quality. As such, "Livanjski sir" is a synonym and a trademark and the best promoter of Bosnia and Herzegovina.

7. NAME AND ADDRESS OF THE COMPETENT AUTHORITY

Agencija za sigurnost hrane BiH/Food Safety Agency of B&H
Kneza Višeslava b.b.
88000 Mostar

8. LABELING RULES

Cheeses that meet all the requirements of this specification are marked with the name of the producer, the name "Livanjski sir" and the sign of the protected label. The label must also state whether cheese is made from raw, pasteurized or thermalized milk, and type and proportion of milk must be specified by type of animal from which milk originates. If cheese was ripened longer than prescribed 2 months, and not shorter than 6 months, producers can additionally indicate maturity of cheese and then such "Livanjski sir" can carry also PREMIUM label. Finished product that is placed on the market is marked with the name "Livanjski sir", which must be more clearly highlighted than any other inscription by the size, type and color of the letters.
In addition to the mentioned name, product also has a common casein label (it is placed before pressing, and it is integrated into the cheese rind during pressing). Common mark is

colorless (Figure 1), and consists of a rectangle in which serial number of the casein brand is printed in the upper part, and the "LS" symbol is in the lower part of the rectangle.

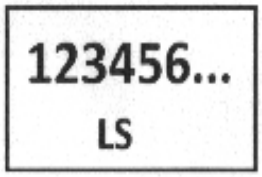


Figure 1. Casein label

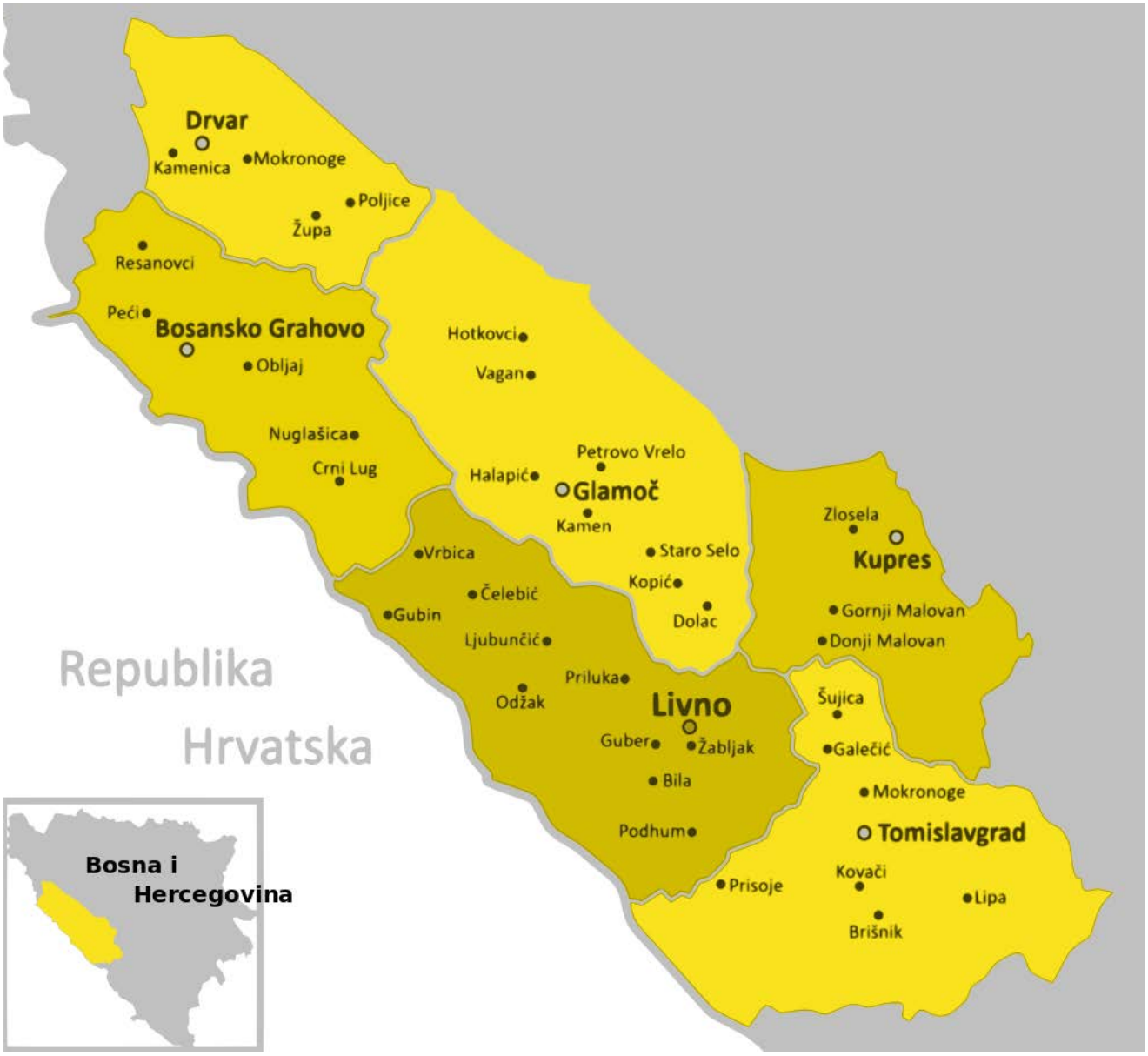
Right to use casein labels and the common name "Livanjski sir", under equal conditions, has all users of protected designations of geographical origin who produce ″Livanjski sir″ in accordance with the product specification. Provisions of this specification are in accordance with the Ordinance on providing information to consumers about food ("Official Gazette of BiH", number 68/13) and the Ordinance on milk products and starter cultures ("Official Gazette of BiH", number 21/11, 25/12 and 17/19).

Evidence-annexes to this specification are:

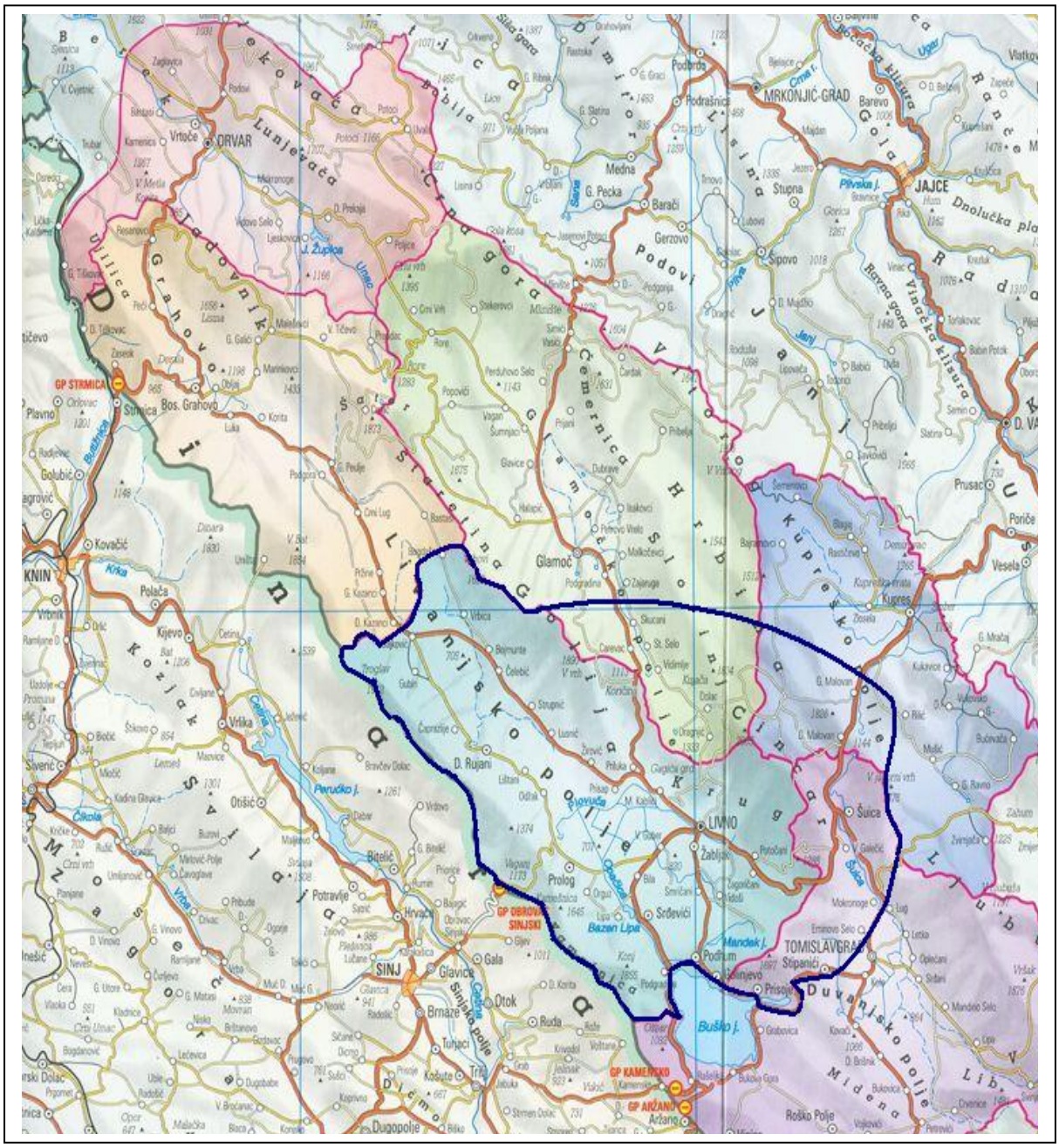
ANNEX 1a. Map of the geographical area of milk production for the production of "Livanjski sir"
ANNEX 1b. Map of the geographical area of "Livanjski sir" production (area marked with a blue line)
ANNEX 2. Measures to ensure compliance with the specification
ANNEX 3. "Livanjski sir" production scheme
ANNEX 4. Literature list
ANNEX 5. Appearance of "Livanjski sir"
ANNEX 6. One of the trademarks of "Livanjski Sir" from 1900.
ANNEX 7. Cincar label "Livanjski sir" from the 50s of the 20th century
ANNEX 8. Copies of the mentioned literature in the historical overview

9. ANNEXES

ANNEX 1a. Map of the geographical area of milk production for the production of "Livanjski sir"



ANNEX 1b. Map of the geographical area of "Livanjski sir" production (area marked with a blue line)

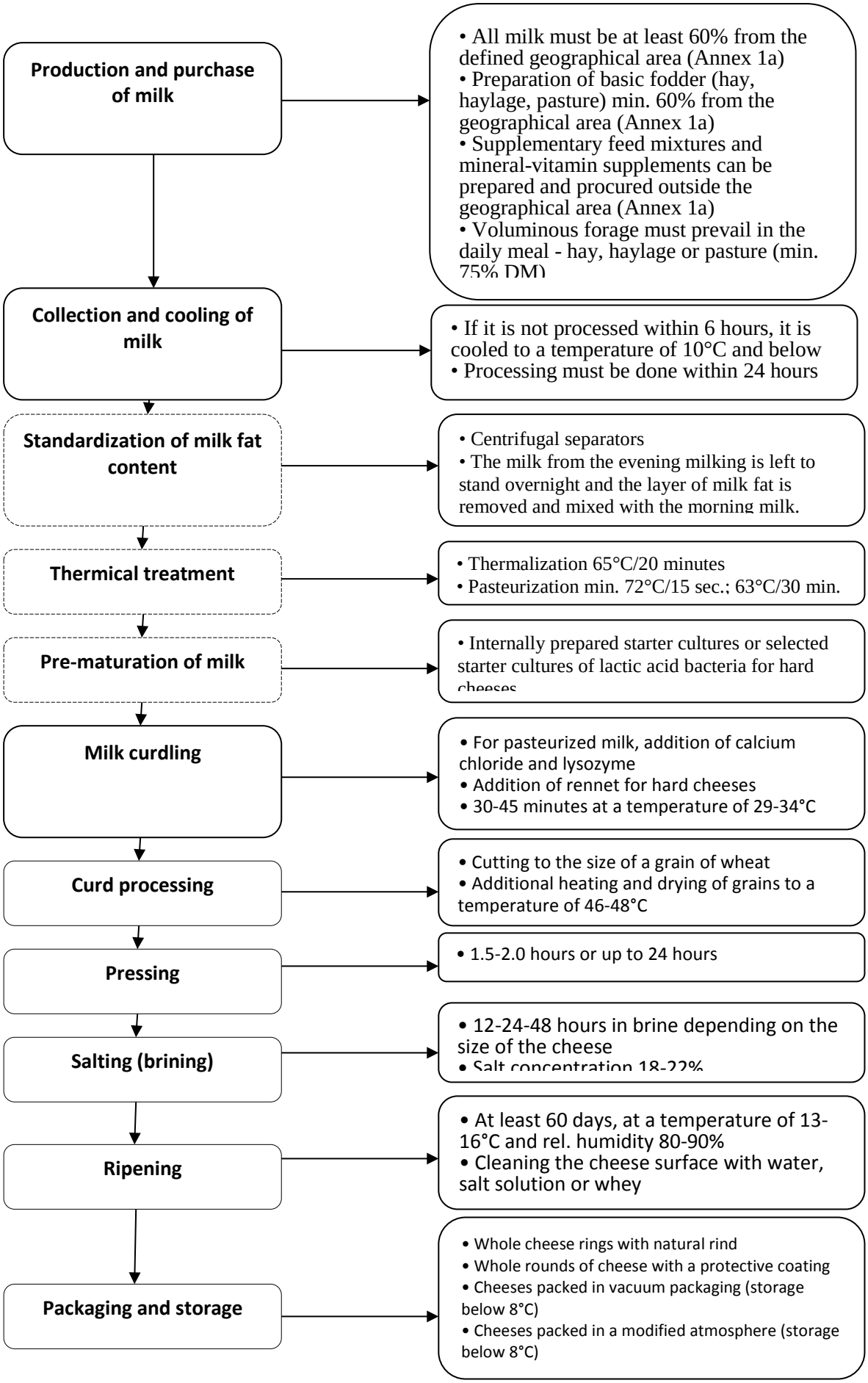

MRKONJIĆ-GRAD
JAJCE
ORVAR
Vrtoče
Medna
G. Pecka
Barači
Gerzovo
Stupna
Šipovo
Podorda
Podrašnica
Barevo
Lunjevača
Ledovnik
Grahovo
Bos. Grahovo
Stirmica
GP STRMICA
Cerna gora
Cemernica
Glamočko polje
Livanjsko polje
Livanjski kraj
Kupreško polje
Kupres
Prusac
Vesela
Poriče
KNIN
Kovačić
Polača
Kijevo
Vrbnik
Kozjak
Svilaja
Vrlika
Otišić
Sivenić
Čikola
Cetina
Glamoč
Vrbica
Bajmurte
Čelebić
Strupnić
D. Rujani
Prološko blato
Prološko polje
LIVNO
Šuica
Žabljak
Srđevići
Prisoje
TOMISLAVGRAD
Duvanjsko polje
Buško j.
Bazen Lipa
Mandek j.
Potravlje
Hrvace
Bitelić
Prološac
GP OBROVAC SINJSKI
SINJ
Glavice
Gala
Otok
Brnaze
Tijarica
Sinjsko polje
Cetina
Dicmo
Dugopolje
Košute
Ruda
GP KAMENSKO
GP ARŽANO
Aržano
Roško Polje
Perućko j.
Peruća
Vrlika
Čikola
Vrba
Cetina
Krka
Kosovčica
Ričica
Ričina
Šuica
Plavno
Golubić
Radučevo
Bistrica
Zasiok
Dabra
Unac
Ričina
Janj
Vinačka klisura
Rovna gora
Dnolučka pla
Ravni
Lisina
Podovi
Vitorog
Hrbi
Kupreško
Cinčarsko polje
Lib
Midena
Lisina
Ljubuš
Ljubuš
Ljubuš

ANNEX 2. Measures to ensure compliance with the specification

Specification	Failure to comply with specification	Record
MILK PRODUCTION (Annex 1a)		
Production of basic fodder in the geographical area min 60% (Annex 1a)	Purchase or preparation of basic fodder outside the geographical area (Annex 1a)	1. List of agricultural land used in the current year 2. Accompanying lists on the temporary movement of animals
Milk for "Livanjski sir" must be min. 60% of milking cows from a certain geographical area (Annex 1a)	Obtaining milk from milking cows that are not from the geographical area (Annex 1a)	Up-to-date stable records
In the daily meal must prevail voluminous forage (at least 75 % DM)	Share of voluminous forage in meal less than 75% DM	1. Stored receipts for supplementary feed mixtures and mineral-vitamin supplements, 2. Records of fodder rations for milking cows during lactation
Milk production in the geographical area (Annex 1a)	Production or purchase of milk outside the geographical area (Annex 1a)	List of all farms that produce milk for "Livanjski sir"
Quality of milk corresponds to the current legal regulations	Quality of milk does not meet the current legal regulations	Results of chemical and microbiological analyses
CHEESE PRODUCTION (Annex 1b)		
Preparation of milk for curdling	1. Addition of illegal additives 2. Inadequate thermalization or pasteurization temperatures 3. Improper pre-ripening of milk	1. Records on the type and quantity of added additives 2. Records on thermalization or pasteurization of milk 3. Records of the time and temperature of pre-ripening of milk
Curding of milk	Use of illegal rennet	Records of the type of rennet added (keeping receipts, packaging)
Cutting to the size of a grain of wheat	1. Inadequate curd compactness 2. Inappropriate size of cheese grains	Sensory rating without records
Drying of cheese grain until suitable strength (T=46-48°C)	1. Inadequate firmness of the cheese grain 2. Wrong reheating temperature	1. Sensory evaluation of firmness without records 2. Measurement of reheating temperature (cheese diary)
Cheese pressing takes approx. 1.5 to 2.5 hours or up to 24 hours (depending on the type of press)	Inadequate pressing time	Records on the length and time of pressing (cheese diary)
Salting in brine - from 12 - 24 to 48 hours	Inadequate salting time	Records on length-time of salting (cheese diary)
Ripening optimally for at least 60 days, appropriate temp. and rel. moisture	Shorter ripening time Inappropriate temp. and relative humidity	Records on length-time of ripening, temp. and rel. humidity (cheese diary)

1. External parameters (appearance, shape, weight, dimensions) 2. Sensory evaluation of the product, at least once a year 3. Chemical analyzes of products (at least once a year)	1. Inappropriate parameters 2. Bad sensorial properties of cheese 3. Inappropriate chemical composition of cheese	1. Records on the dimensions, weight and appearance of the cheese 2. Record of sensory evaluation of cheese 3. Results of chemical analyzes of cheese
Labeling and product identification	Misuse of logos and quality symbols or marks for "Livanjski sir"	1. A system of internal control and sanctions in case of violation of the Specification has been developed 2. Records on quantities of milk and cheese

ANNEX 3. "Livanjski sir" production scheme --------



ANNEX 4. Literature list

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ANNEX 5. Appearance of "Livanjski sir"

ANNEX 6. One of the trademarks of "Livanjski Sir" from 1900.

ANNEX 7. Cincar label "Livanjski sir" from the 50s of the 20th century