

Yield and calo of the “Marija Zvijezda” Trappist cheese during ripening

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Abstract

This paper presents the results of research on yield and calo during ripening of the Trappist cheese. The cheese has been produced for more than 140 years by the monks of the Marija Zvijezda Monastery (Mariastern Abbey) in Banja Luka. In 2008 cheese production has been restored and the cheese has been presented to the market in cooperation with the “Livač” Cooperative. The Trappist cheese is made in the form of a wheel weighing 1.6-2.0 kg and it has a natural rind that is yellowish, thin, and smooth. The conditions and the way in which it ripens are specific and give a special flavour to the cheese. The duration of the ripening is a minimum of 90 days and it happens under specific conditions of humidity and temperature. The cheese ripens on wooden boards and it is rotated and cleaned manually. Its consistency is soft, elastic, mild, and it is easily cut. The cut is smooth without or with very little holes. It is characterized by a clean scent of milk, slightly salty, and it melts easily. The cheese yield calculated for the Trappist cheese is 12.81 %. The actual cheese yield obtained after 90 days of cheese ripening is 10.74 %. Cheese weight changes with ripening time and weight loss at the end of the production cycle is 0.322 kg or 15.85 %. The amount of whole milk needed for one kilogram of the final cheese product is about 9.35 kg.

Key words: Trappist cheese, yield, calo, Marija Zvijezda monastery.

Introduction

The processing of milk is finalized into a new product, which enables a higher profit for those who are engaged in this activity. Nowadays, cheese

production is gaining importance, especially on smaller family farms, and enables them to ensure their livelihood. As a basic ingredient, milk plays a big role in the cheese making process, primarily by the content of the milk components, such as casein and milk fat.

Cheese yield can be defined as the amount of cheese (kg) produced from 100 kg of milk. Another definition says that cheese yield means the amount of milk (kg) needed or consumed to produce one kg of cheese (Gregurek, 2015). Cheese yield is also sometimes expressed as the volume of milk in litres required to manufacture one tonne of cheese; in Cheddar production this is approximately 10 000 litres (Gregurek, 2015).

The loss of cheese weight during ripening, known as calo, is one of the factors in the utilization of the basic raw material - milk (Kammerlehner, 1986). This weight loss in cheese occurs under the influence of mechanical processes during care and ripening, and primarily as a result of continuous processes that take place between the cheese and the environment in which it ripens. Calo itself represents a weight loss under various influences, both internal and external (Stanišić, 1971). Cheese yield is influenced by several factors and is the result of very complex processes, some of which interact, due to the often primitive or insufficiently modern technical equipment in the cheese factory, uneven and insufficient professional qualifications, lack of standards, etc. The harmonization of these factors is not an easy problem in our country. Due to all the above, achieving high and constant cheese yields is significantly more difficult (Gregurek, 2015).

Various authors have addressed the problem of the influence of the amount of milk fat and the size of fat globules on cheese yield. According to Inihov (1971), the size of a fat globule affects the amount of fat and its transition into cheese and whey. Odenwald (1953) did not find fat globules larger than 6 μm in Simmental cows. Stanišić et al. (1972) found that in black cows in BiH, the size of fat globules in milk was 2-3 μm (63.57%), and the largest measured diameter was 12 μm .

Cheese yield is an important element for monitoring and controlling the cheese production process, but it is also important for the economic basis of the sustainability of cheese production (Dozet et al., 1966). Cheese yield arises as an interaction between the cheese and the ripening environment. In these relationships, a special role is played by the cheese crust, which is a protective layer and contact surface. The formation of passive rind is conditioned by the cessation of all active forms of synthesis in cheese, and its thickness is determined by the intensity of drying, i.e., surface dehydration caused by evaporation and salt (del Prato, 1998). In the past, in traditional cheese-making, different methods have been used to increase the yield of cheese (washing, turning, oiling, smoking, etc.), because in this way the drying of the cheese is reduced. Today, in modern cheese-making, procedures and materials have been introduced that reduce or completely eliminate this artificially, while also

protecting cheese. The most widely used methods are protective coating and maturation of cheese in plastic bags (Kirin, 2002).

In general, the yield of cheese depends on a number of different factors, primarily on the differences with regard to their belonging to a certain basic group of cheeses, whether it is hard cheese, sliced cheese or soft cheese. Within each group or type of cheese, the yield determines the composition of the cheese, which is the result of many elements that were intentionally or accidentally expressed in the production of a type or subtype of cheese (Sabadoš, 1996). Protective coatings are usually copolymers to which a fungicide is added or has already been added. In that way, the growth of surface microflora is prevented, the drying of cheese is reduced, the turning of the cheese needs less human labour, etc. (Kirin, 2001). Although they are popular because they retain their traditional features and appearance, protective coatings still do not provide complete protection for the cheese. Thus obtained cheese comes with inedible rind, which represents a certain, albeit reduced, loss for both the cheesemaker and the consumer (Kirin, 2001).

The Trappist cheese has been produced for more than 140 years by the monks of the Marija Zvizžda Monastery in Banja Luka. Due to specific production, the cheese is produced only by the monks inside their community who have passed the vows, and up to now there was no opportunity to highlight some of the indicators and specifics of its production. Written evidence about this cheese did not exist and there was no opportunity to perform some analysis of the final product. The production in Bosnia and Herzegovina began in 1882 and it lasted till 1945 when the confiscation of the properties of religious communities happened. Afterwards, the cheese production was done in the monastery solely for the purposes of the Trappist community or it was produced at the request of the local population for their feasts (Budimir and Stipić Bagarić, 2015).

The Trappist cheese belongs to a group of semi-hard cheeses and it is easy to cut. It differs from other products present on the market under the same name which are either too soft or too hard to cut. Unfortunately, given that in the past there were no restrictions in using this original cheese name, different variants of the Trappist cheese can be found on the market (Budimir, 2012).

The softness and easy cutting are a result of the special preparation method and special conditions under which it ripens. It is important to highlight here that the original Trappist cheese ripens under specific conditions, where everyday procedures of turning it around and wiping it are being applied. In Bosnia and Herzegovina, the technological production of the Trappist cheese takes place in facilities where the cheese is “dried” for fifteen days and is then delivered to stores. For the original Trappist cheese to mature it takes between 75 and 90 days, which ensures its special consistency and taste (Budimir and Stipić Bagarić, 2015). It is in a shape of a wheel, with 19 cm diameter and the size of 7-9 cm (Budimir, 2012).

Material and methods

The analysis and sampling of the Trappist cheese were carried out at the farm within the “Livač” Cooperative, located in Aleksandrovac, the municipality of Laktaši, Bosnia and Herzegovina. This agricultural cooperative is engaged in raw milk production. Since 2008, the Maria Zvijezda Trappist cheese has been produced in cooperation with the Trappist monks in the newly built cheese-making plant, according to the recipe owned by the Maria Zvijezda monastery. Currently, about 2.5 tonnes of the Trappist cheese is being produced on a monthly basis. The cheese factory has HACCP and ISO 9001:2015 certificates and is a subject to regular veterinary inspection control. The cheese factory has an export license for the European Union, and as such it abides by all applicable hygiene and health regulations.

The cheese is produced exclusively in the form of a wheel, with 19 cm in diameter and 7-9 cm size

The characteristic of the Trappist cheese is the wheel shape weighing 1.6-2.0 kg and it has a natural rind which is yellowish, thin, and smooth. Its consistency is soft, elastic, mild, and can be easily cut. The cut is smooth with or without very little holes, and the colour is pale yellowish. Its aroma is clean, milk-specific, and it is moderately saline and melts easily. According to Gerber, the fat content is about 32%, the water content is about 41% while the dry matter is 56% (Budimir, 2014).

The sampling was performed in 2012, where 5 cheese samples were taken from different production batches. The weight measurement of the series was performed using a digital scale Digi Seiko Japan, which was calibrated by an authorized repairer and has a valid certificate. The first weighing was done after the end of the cheese production process. The second weighing was done after 90 days of cheese ripening and its transfer to the storage chamber.

Cheese yield (Rs) was defined as the amount of cheese (kg) produced from 100 kg of cheese milk. We did the calculation according to the formula:

$$R_s = \frac{\text{kg cheese} \times 100}{\text{the amount of milk}}$$

This yield applies to conclusions on the success of milk utilization or to the planning of the quantity of milk required for the production of an introduced type of cheese, the yield of which is well known from the practice of the plant concerned.

The same formula to calculate the actual cheese yield was used, but the amount of cheese was weighed after 90 days spent in the ripening chamber. The amount of cheese obtained after the end of cheese production and after ripening represents calo (weight loss) during the process.

Results and discussion

Table 1. shows the results obtained by weighing five production batches of cheese. For each batch, 950 litres of fresh, whole milk were taken, which meets all the criteria in accordance with the regulations on the quality of raw milk (Law on agriculture, 2011, 2015).

Tab. 1. Yield calculation for the Marija Zvijezda Trappist cheese after production (day 0)

Series	Obtained value	
	kg	cheese yield %
1	121.81	12.82
2	119.89	12.62
3	122.59	12.90
4	120.96	12.73
5	123.35	12.98
Average	121.72	12.81

The cheese yield calculated of the Trappist cheese is 12.81% (Table 1.).

After completion of this process, the cheese is left to rest for some time and afterwards goes into brine which consists of water and salt concentration.

Once this phase is finished, the cheese is left on a shelf to drip and afterwards it is put into a pre-chamber. The first phase of cheese ripening has been done in this pre-chamber under adequate moisture and temperature conditions. After 40 to 50 days, the cheese is moved into another chamber with altered ripening conditions: lower temperature and slightly higher humidity. The ripening process ends with the optimal 75 to 90 days.

During the ripening process, the cheese is covered by the coating and it is rotated and cleaned in the chambers daily. The cheese is cleaned and coated regularly, as well as the wooden holders and shelves on which the cheese ripens. Hygiene has a great influence on the ripening and the quality of the Trappist cheese. Its production requires a lot of human manual work.

Tab. 2. Yield calculation for the Marija Zvijezda Trappist cheese after 90 days of ripening process

Series	Obtained value	
	kg	cheese yield %
1	102.49	10.79
2	100.58	10.58
3	103.09	10.85
4	101.04	10.64
5	103.15	10.86
Average	102.168	10.74

By monitoring the production process (Table 2.), the cheese weight changes during ripening time and at the end of the production cycle, which lasts ninety days, it amounts to 102.168 kg for daily production of sixty pieces. The actual cheese yield obtained after 90 days of ripening is 10.74 %.

Calculated per individual pieces of weight loss or abatement is 0.322 kg or 15.85%.

The amount of whole milk needed for one kilogram of finished cheese is 9.35 kg.

Conclusion

It was the 150th anniversary of the Trappists' arrival to Banja Luka in 2019. With their arrival they contributed to the improvement of both economic and cultural development of this region, but, unfortunately, very little is known about this. What the Cooperative is trying to achieve is to bring the activities of the monks, or at least a part of their craft history, closer to the public. Just like their community was striving to retain the population in this area and provide them with the employment opportunities, we are trying to achieve the same in the present time. We hope that we will manage to employ an additional number of people and pursue the production of the Maria Zvijezda Trappist cheese, as well as the manufacturing of other products nourishing the tradition of the monks' community.

The original Trappist cheese belongs to a group of semi-hard, full-fat cheese with high energy value, and it can be consumed on a daily basis, either as a side dish or an ingredient in the meal preparation. The cheese yield calculated for the Trappist cheese is 12.81%. The actual cheese yield obtained after ninety days of cheese ripening is 10.74 %. By monitoring the production process, the cheese weight changes during ripening time and at the end of the production cycle, which lasts ninety days, it amounts to 0.322 kg or 15.85%. The amount of whole milk needed for one kilogram of the final product is about 9.35 kg.

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Рандман и кало сира Траписта “Марија Звијезда” током зрења

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Сажетак

У овоме раду ћемо приказати резултате истраживања за рандман и кало сира Траписта током зрења. Сир производе више од 140 година, редовници Траписти, самостана Марија Звијезда из Бања Луке. У току 2008 године обновљена је производња сира и сир се појавио на тржишту у сарадњи са задругом “Ливач”. Карактеристика сира Трапист, је да се ради у облику колута тежине 1,6-2,0 kg, са својом природном кором, која је жућкаста, танка и глатка. Услови и начин у којима дозријева су специфични и они сиру дају посебну арому. Вријеме трајања дозријевања је минимално 90 дана, у специфичним условима влажности ваздуха и температуре. Сир дозријева на даскама, уз ручно окретање и брисање. Конзистенција тијеста је мекана, еластична, њежна и лако резива. Пререз је гладак без или са јако мало окаца, свијетложућкасте боје тијеста. Одликује се чистим мирисом по млијеку, умјерено сланкаст и лако топив. Рандман сира израчунат за Трапист је 12,81 %. Стварни принос сира након 90 дана зрења сира је 10,74 %. Праћењем процеса производње, кало сира се мијења са временом зрења и на крају производног циклуса, који траје деведесет дана, износи 0,322 kg или 15,85 %. Количина пуномасног млијека потребног за један килограм готовог сира износи око 9,35 kg.

Кључне ријечи: Трапист сир, рандман, кало, самостан Марија Звијезда

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Received: Mart 10, 2022

Accepted: November 24, 2022