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SENSORY CHARACTERISTICS OF KUČKI CHEESE

SUMMARY

The physical, chemical, microbiological and sensory analysis of the food products is used for the quality evaluation. But in parallel, sensory properties of food are equally important. Sensory analysis is usually used as a tool to improve the sensory quality of products and to achieve their standard quality. The paper presents the results of sensory analysis of the three types of cheese: cheese made of cow's milk; ewe's milk; and mixed milk (cow's+ewe's). The following characteristics: taste, odour, consistency and color, outer appearance, and cut were evaluated. The sensory analysis was performed using the scoring system and the sensory evaluation of cheese quality. The cheeses were graded from 1 to 5 points. The grades were multiplied by appropriate factors to obtain scores for each cheese parameter. The maximum number of points is 20. There are five categories of quality and quality ranges from "unacceptable" to "excellent". The results of sensory analysis showed that all three types of cheese had good quality. The best-rated type of cheeses is ewe's milk cheese, got 18.45 points, out of a maximum of 20, which classified it as cheese with excellent quality category, especially when the tastes and cross-sectional appearance are in consideration. The cheese made from mixed milk obtained 17.63 points, that classified, also, it into the group of excellent quality category cheese while the cow's cheese had 17.08 points, classified as good quality category cheeses.

Keywords: sensory characteristics, cheese, ewe's and cow's milk

INTRODUCTION

Due to their chemical composition and physicochemical characteristics, most foods are very perishable and are easily altered by physical, chemical and biological agents (Martinez *et al.*, 2021). Sensory analysis comprises a variety of powerful and sensitive tools to measure human responses to foods and other products. Sensory quality has been recognized as a crucial aspect of the sale and marketing of cheese (Gulzat *et al.*, 2020), it is now generally accepted that the

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flavour of most cheese results from the combination of a large number of several compounds present in the correct ratios and concentrations, which is known as component balance theory (Fatma *et al.*, 2013). Cheese is a milk product characterized by a wide range of sensory properties that directly influence its consumption. During the ripening of cheese, numerous chemical, biochemical, physical and microbiological changes occur, that directly contribute to its sensory properties. Thus, sensory analysis of cheese as a final product is used for its quality evaluation. Cheeses from cows fed on mountain pastures had a greater variety of tastes (Buchin *et al.*, 1998). According to El-Nimr *et al.* (2010) texture and color are important criteria used to evaluate cheese quality; these two parameters are often the primary consideration of consumers when making purchasing decisions.

White-brine cheeses are one of the most commonly produced cheeses whose production is widespread in the world. Also, they are one of the oldest types of cheeses, and Dozet. (2004) states that the production of these cheeses was recorded in the region of Egypt more than 3200 years BC. Low-fat white cheese has a harder, coarser dough, whereas cheeses with higher milk fat content have a softer, creamier consistency (Živković, 1971).

Cattle husbandry in Montenegro is the most important branch of animal husbandry and agriculture in general. Annual production of cow's milk is about 180 thousand tons. Breed composition of Montenegrin cattle population is quite unfavorable because various crossbreeds dominate, about 50% of the total population. In the last two decades share of high productive breeds Holstein and Simmental has been increased, at the same time Brown Swiss and Grey cattle sharply decreased, while autochthonous Busa breed is in risk of extinction (Marković *et al.*, 2021). Natural grasslands have a special importance in Montenegro, because their share in the total agricultural area is above 90% and they are often the only source of fodder for ruminants (Dubljević *et al.*, 2020). The sheep production is mainly based on rearing autochthonous breeds. Jezeropivska pramenka is one of the most important autochthonous Montenegrin sheep breeds, and made about 20% of its total sheep population (Đokić *et al.*, 2020).

The original technology and specificity of the raw milk are the most important characteristics for traditional cheeses. Golijski cheese must have a mildly salty, sour flavor with a hint of young walnut flavor. This taste is stronger at first; in cross-section, it may just have a few circular holes or none at all. It is a cheese with little pressing, so mechanical cavities are obvious (Ostojić *et al.*, 2010). According to Jovanović *et al.* (2004), a slice of Sjenički cheese has an undamaged regular shape, a distinctive white color, cheese curd of medium hardness that has a modest amount of cavities on the cut. The odour is typical, with nice milky-sour notes and, in certain examples, a stronger saltiness. After 20 days of ripening, Domiati type cheeses grow even harder, saltier, and have a more pronounced taste and fragrance (Tratnik *et al.*, 2000). According to results

obtained by Carvalho *et al.* (2020) more mature ewe's milk cheeses are given higher scores for their characteristic and pungent attributes of flavor. Ewe's milk cheeses made from raw milk, such as those used in this study, are firmer and have a more characteristic odor, taste, and aftertaste than those manufactured with pasteurized milk (Mendia *et al.*, 1999). The original technology and specificity of the raw milk are the most important characteristics for traditional cheeses (Santa *et al.*, 2021), sheep's milk has high values of chemical components, and it is the best raw material for the production of cheese, because it gives twice higher yield than cow's milk (Jandrić and Savić, 2019).

Kučki cheese has a distinctive aroma, taste, and consistency, specific traditional technology, the production area is defined and, as such, meets the requirements for the protection of origin. Production of Kučki cheese is an inseparable part of the heritage of the Kuči region, based on a family tradition, which is passed down from generation to generation and represents an unavoidable part of history and the material treasure of the mentioned area (Jokanović *et al.*, 2021).

The aim of this scientific paper is to collect adequate data for sensory evaluation of Kučki cheese quality made from cow's, ewe's, and mixed milk. Kučki cheese belongs to a valuable group of cheeses in brine, is a part of cultural heritage of this area of Montenegro that should be protected, standardised and better valorised. In recent years, the area of Kuči has increasing number of tourists who come from all over the world not only to enjoy the natural beauty, but to consume the traditional products of this region. In addition to the economic benefit for the population of this area and the preservation of Kučki cheese technology, the protection of origin of this product would also be a significant form of stimulus for traditional agricultural production, which contributes to the preservation of the environment, the protection of biological diversity, and the protection and better valorization of rural areas.

MATERIAL AND METHODS

A total of 15 samples of Kučki cheese from 3 groups made from cow's, ewe's, and mixed milk), 5 samples of each were taken for sensory evaluation. The cheeses were produced in the Kuči area, north of the Montenegrin capital of Podgorica with surrounding mountains that have natural conditions for sheep and cattle production. The most of milk is used for the production of traditional Kučki cheese, that is full-fat, white brine cheese. The ripening in the brine gives cheese specific sensory properties and the possibility to be stored for a longer period, different from other white-brined cheeses produced in Montenegro.

The sensory evaluation of cheese quality was monitored using the scoring system according to Ritz (1991). Each group was evaluated separately, and the groups were classified according to their evaluations and compared. The maximum score that a cheese can get with such appraisal is 20 weighted points.

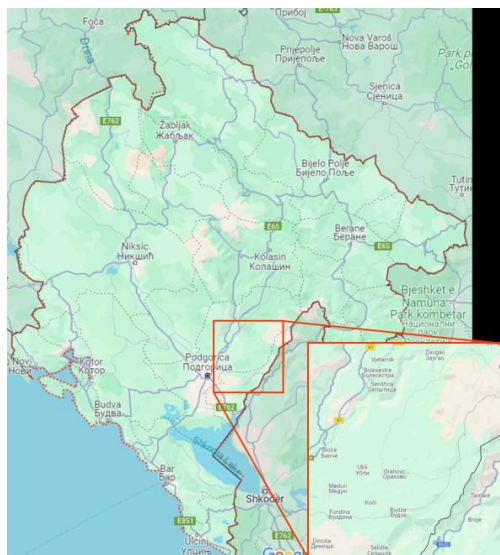


Figure 1. The area of Kučki cheese production

From the table 1, it could be seen that the cheese is graded from 0 to 5 points with the application of significance factors for each individual parameter. The obtained grades multiplied by the significance factor give the corresponding number of weighted points and the following six sensory parameters were appraised as shown in table 1.

Table 1. The scoring system for cheese sensory evaluation

Parameter	Points (a)	Factor (b)	Maximum points (a x b)
Appearance	0-5	0.4	2.0
Color	0-5	0.2	1.0
Consistency	0-5	0.4	2.0
Cut	0-5	0.6	3.0
Odour	0-5	0.4	2.0
Taste	0-5	2.0	10.0
TOTAL POINTS:			20.00

There are five categories of quality category: excellent (17.6-20); good (15.2-17.5); mediocre (13.2-15.1); still acceptable (11.2-13.1) and not acceptable (<11.2) points. The commission for sensory evaluation of cheese was a trained panel - staff of the Dairy Laboratory. The data were processed using the computer program STATISTICA 12. An analysis of variance was performed using One-way ANOVA for the effect of cheese type on external appearance (shape, crust), color, dough, cross-section, odour and taste parameters. Mean comparison was done by Duncan test (Duncan Multiple Range Test) where statistical significance was shown at the $P < 0.05$ probability level.

RESULTS AND DISCUSSION

The result showed that, in general for all types of cheese from the research, taste is typical, unevenly salty with mild milky aromas, and some examples revealing notes of bitterness. Consistency was soft, brittle, consistent with a medium hardness and the color ranged from white to pale yellow. When discussing form, the common shapes were rectangles or triangles and the smell is slightly sour and milky.

The best-rated type of cheeses is ewe's milk cheese, which got 18.45 points of a maximum of 20, as shown in Table 3. It is classified as cheese with excellent sensory properties, especially when it comes to tastes and cross-sectional appearance. The cheese made from mixed milk obtained 17.63 points, that, also, classified it to the group of excellent quality cheese, and scored an average taste rating of 8.88 indicates its excellent quality (table 2). The obtained points show that cow cheese is classified as good quality cheese. Cow's milk cheese received the lowest rating because of its poorer cut and consistency scores, but the listed flaws of the cheese are such that they are still acceptable, meaning that the samples had only minor structural flaws. Statistical analysis revealed that differences in all obtained parameters were not statistically significant.

Table 2. The results of the sensory evaluation of the quality of the Kučki cheese

Type of cheese	External appearance	Color	Consistency	Cross section	Odour	Taste
Cow	2	1.9	1.6	1.6	1.5	8
	1.9	1.9	2	1.6	1.8	9
	2	2	1	1.5	1.7	8
	2	2	1.6	1.7	1.5	8.5
$\bar{X} \pm SD$	1.98±0.05	1.95±0.06	1.55±0.41	1.60±0.08	1.63±0.15	8.38±0.48
Mixed	1.5	1.9	1.9	2	1.6	9
	1.6	1.9	1.5	1.6	1.7	8.5
	2	2	1	1.7	2	9
	2	1.9	1.5	1.7	2	9
$\bar{X} \pm SD$	1.78±0.026	1.93±0.05	1.48±0.37	1.75±0.17	1.83±0.21	8.88±0.25
Ewe	1.9	2	2	1.9	2	10
	2	1.6	1.5	2	2	8
	2	2	1	1.4	1.7	9
	2	2	2	2	1.8	10
$\bar{X} \pm SD$	1.98±0.05	1.90±0.20	1.63±0.48	1.83±0.29	1.88±0.15	9.25±0.96

The slice of cheese is similar in shape, firmness, and color to the Sjenički cheese results referred by Jovanović *et al.* (2004). In contrast, the saltiness of the Kučki cheese samples was quite uneven compared to the Feta type cheeses Tratnik *et al.* (2000), which had a lower salinity concentration.

The changes in the sensory properties are in agreement with those reported by Tratnik *et al.* (2000) for Domiati cheese, where as ripening progresses, the taste and smell intensify, which is similar to Kučki cheese. Kučki cheese has a sharper taste, in contrast to Golijski cheese, where Ostojić (2010) states that the taste resembles a young walnut. The consistency appears as an uneven triangle or rectangle and is soft, easily breakable, but not brittle. The cross section is closed or has cavities, and the color is white or yellow/white. Those characteristics of slices of Kučki cheese are similar with results of scientific paper whose topic was Pljevaljski cheese (Mirecki and Konatar, 2014). Stronger salting in Kučki cheese is also characteristic of Sozinski cheese, which is described, by Dozet *et al.*, (1996), as a round shape with firm structure, while it breaks a little when cut, preferably white to white-yellow. Travnički cheese produced from cow's milk also has a whitish-yellow color and a specific pleasant lactic acid taste (Dozet, 2004). Homoljski sheep's cheese, unlike Kučki, does not have a cavity on the cut, and also has a spicy and salty taste (Popović-Vranješ, 2015).

Table 3. Total results of the sensory evaluation of Kučki cheese

Cheese type	Evaluator 1.	Evaluator 2.	Evaluator 3.	Evaluator 4.	Results
Ewe	19.8	17.1	17.1	19.8	18.45
Mixed	17.9	16.8	17.7	18.1	17.63
Cow	16.6	18.2	16.2	17.3	17.08

The alterations in the sensory characteristics are consistent with those noted by Tratnik *et al.* (2000) for Domiati cheese, which is comparable to Kučki cheese in that as ripening advances, the flavor and odour intensify. Compared to Golijski cheese, which Ostojić *et al.* (2010) says tastes like a young walnut, Kučki cheese has a harsher flavor. The results of sensory analysis in table 3. showed that ewe's and mixed types of cheeses had excellent and cow's cheese had good quality.

Characteristics of slices of Kučki cheese are following: height: 2.0-4.0 cm; length: 10-15 cm; width: 5-10 cm. The consistency is soft, easily breakable, but not brittle with appearance of irregular triangle or rectangle.

Table 4. Quality categories of food products (Ritz *et al.*, 1991)

Quality Category	Points scale	Cheese type		
		Cow	Mixed	Ewe
Excellent	17.6-20.0	-	17.63	18.45
Good	15.2-17.5	17.08	-	-
Mediocre	13.2-15.1	-	-	-
Still acceptable	11.2-13.1	-	-	-
Unacceptable	<11.2	-	-	-

CONCLUSIONS

Montenegro is known for a wide range of traditional dairy products, especially cheese. One of them is Kučki cheese, which belongs to the group of white brined full-fat cheeses. Production is organized in villages and on katuns. Although it is a nutritionally valuable product, in the last 30 years there has been no significant research on the Kučki cheese, which is an unavoidable segment in the history and culture of Kuči region. Indigenous dairy products have always had their consumers, today's requirements relate to quality with a safe geographical origin. According to the obtained results, ewe's milk cheese had the highest total points of all type of analyzed cheeses, scoring 18.45 out of a possible 20, which classified it as a excellent quality cheese with exceptional sensory qualities, particularly in terms of taste and cross-sectional appearance. Characteristics of slices of Kučki cheese are following: height: 2.0-4.0 cm; length: 10-15 cm; width: 5-10 cm. The consistency is soft, easily breakable, but not brittle with appearance of irregular triangle or rectangle. The color is white, yellow/white and the cross section is closed or with cavities.

Kučki cheese has a specific stronger, a little bitter taste, but typical for this traditional–autochthonous cheese type. In conclusion, Kučki cheese is a part of the cultural heritage of this area of Montenegro that should be protected, standardised and better valorised.

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