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Physicochemical parameters of Bulgarian yellow cheese from cow's milk (kashkaval) during the standardized manufacturing

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We analyzed Bulgarian yellow cheese from cow's milk (kashkaval), produced for research purposes in accordance with the technology, described in BDS 14:2010. The batches of kashkaval were stored at manufacturers and delivered for analysis in three stages: immediately after blowing, on the 45-th day and 55-th day from the ripening of the kashkaval. The analyzed parameters were: water content and dry matter, content of fats in total weight, fat in dry matter, proteins, and the ash content. The water-soluble proteins and thus the degree of maturity were determined in 45-th and 55-th day from the beginning of ripening. The energy value was calculated for all samples. The physicochemical parameters of all batches after blowing were very good for the kashkaval, which have not passed the stage of ripening: the amount of dry matter was more than 56% of the total and the fat content in the dry matter was higher than 45.0%. They did not change significantly during the process of ripening. Three of the batches of kashkaval did not meet the requirements of BDS 14:2010 for ripeness (no less than 20.0%) on 45th day. On the 55th day of ripening the degree of maturity of four batches were 20.8 %; 19.4 %; 30.6 % and 16.0 %. Based on the results for physicochemical parameters the important conclusion was: the period of ripening 45 days of kashkaval from cow's milk set out in BDS 14:2010 should be change because they do not guarantee receipt of a mature product.

Keywords: Bulgarian yellow cheese, kashkaval, ripening, proteolysis

INTRODUCTION

Bulgarian yellow cheese, known as "kashkaval", is a type of hard cheese, produced from milk. The technology for producing of kashkaval and all steamed cheeses has been gradually improved over many centuries. The process for manufacturing of the traditional kashkaval includes the following stages: formation of the curd (curdling the milk), initial processing and compressing the curd, cheddaring (proving) the curd, steaming, forming cakes, blowing, salting, ripening, washing and drying [1]. It is important to point at the differences between kashkaval and the yellow cheeses, known in Europe. Those yellow cheeses are manufactured with starters, which can be introduced after curdling the milk.

Essential for the development of the taste and texture of the product is the ripening process. As a biotransformation process, the ripening of the cheese leads to an accumulation of more easily digestible by the human body components. The most significant changes concern protein structure: enzyme assisted proteolysis results in hydrolysis of peptide bonds, leading to the formation of water soluble peptides [2]. It has been found that the proteolysis begins in the first few days of ripening and continues, though sustained, throughout the period of storage [3]. According to Barać et al. [4], proteolysis during cheese ripening can be divided into two stages: First is the basic one, such that there is degradation of the casein in large well formed polypeptides and the second is the proteolytic process, during that process the formation of small polypeptides and free amino acids happens, this part of the process is when the smell and taste are forming. In the process of maturing, the amount of insoluble in water protein gradually reduces, so by monitoring the changes in the amounts of water-soluble protein the degree of ripening in the kashkaval could be detected. According to BDS 14:2010 [5], Bulgarian kashkaval of cow's milk ripens in refrigerated rooms at a temperature of 8°C to 10°C for 45 days and to 60 days for kashkaval of sheep milk.

This paper presents the changes of the quality parameters during the ripening period of kashkaval from cow's milk, produced in accordance with the technology described in BDS 14:2010 and evaluates if 45 days were sufficient time period for the maturing of the product.

EXPERIMENTS

Kashkaval from cow's milk, produced by four leading Bulgarian manufacturers was analyzed. For the research purposes, the batches of kashkaval were produced in accordance with the technology, described in BDS 14:2010 and stored at manufacturers.

Physicochemical parameters were analyzed in three stages: immediately after blowing, on the 45-

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th day [5] and 55-th day from the ripening of the yellow cheese. For each stage the manufacturers have supplied representative samples, which were identical pieces with weight 400 g, according with requirements of sampling method [6].

Preparation of the test sample:

The rind was removed in such a way as to provide a test sample as it is usually consumed. The test sample was grinded by grinder and whole mass was mixed quickly. The test sample was analysed as soon as possible after grinding.

The analyzed parameters were: water content and dry matter, content of fats in total weight, fat in dry matter, proteins, ash content. The water-soluble proteins and thus the degree of maturity were determined in 45-th and 55-th day from the beginning of ripening [5].

The water content and dry matter were defined according to BDS 1109:1989 [7].

The content of fats in total weight was analyzed according to ISO 3433:2008 (IDF 222:2008) [8] and the calculation for fat in the dry matter was by following equation (Eq. 1):

Equation 1:

fat in the dry matter, % = (content of fats in total weight /dry matter) x 100

The total protein was determined according to BDS EN ISO 8968-1:2014 [9]. Kjeldahl digestion unit "GERHARD", type EBL was used for the incineration (acidic hydrolysis) of the sample of kashkaval. The distillation of nitrogen content was performed by distillation unit "VELP", type UDK 129.

The ash content was determined in accordance to BDS 6154:1974 [10]. The incineration of the samples was carried out in the oven at 550 °C.

The water-soluble proteins were analyzed as follows: 5.000 g homogenized sample was transferred in a volumetric flask (500 ml) with preheated (40 – 45) °C distilled water. The flask was shaken periodically for 1 hour and then allowed to cool to 20 °C. The solution was filtered through paper filter and 50 ml of the filtrate developed a procedure for determining the total protein in accordance with requirements of BDS EN ISO 8968-1:2014 [9].

The degree of maturity of the kashkaval was calculated by the following equation (Eq.2):

Equation 2:

Degree of maturity, % = (water-soluble protein/total protein) x 100

Energy value was determined by calculations described in Regulation 23/2001 of Ministry of Health art.10, p.3 and p.4 [11]. We used the following formula:

Energy value, kcal/100g = (4 x total proteins, %) + (9 x fat in total weight, %)

RESULTS AND DISCUSSION

The results of the analyzed physicochemical parameters of the kashkaval after blowing are presented in Table 1.

Table 1. Physicochemical parameters of the kashkaval after blowing

Parameters	Water content *x±Sx* %	Dry matter *x±Sx* %	Content of fats in total weight *x±Sx*, %	Fat in dry matter *x±Sx* %	Ash content *x±Sx* %	Proteins *x±Sx* %	Energy value *x±Sx* kcal/100 g
Batch 1	42.65±0.08	57.35±0.11	28.0±0.5	48.82±0.88	4.09±0.06	24.36±0.34	349±9
Batch 2	38.43±0.08	61.57±0.12	30.5±0.5	49.54±0.89	3.78±0.05	24.77±0.35	374±10
Batch 3	42.14±0.08	57.86±0.12	25.5±0.4	44.07±0.79	4.72±0.07	25.50±0.36	332±9
Batch 4	38.97±0.08	61.03±0.12	29.0±0.5	47.52±0.86	3.72±0.05	26.23±0.37	366±10

The values of all physicochemical parameters of kashkaval samples, produced by four companies were very close. That means that the milk, used for production is standardized - fat content and protein content have been similar. The amount of dry matter in the studied samples conformed to the requirements of BDS 14:2010 for kashkaval from cow's milk (not less than 56.0 %), [5]. The fat content in the dry matter of the all batches of kashkaval was higher than 45.0 % [5]. The physicochemical parameters of the samples were very good for the kashkaval, which have not passed the stage of ripening.

The water content was increased by 0.64 % to 4.07 %, due to the ongoing process of proteolysis on 45th day of ripening of the kashkaval (Table 2).

The amounts of water-soluble protein in the four batches were different and accordingly the degree of ripeness of the kashkaval was different. Only batch 3 met the requirements of BDS 14:2010 for ripeness (no less than 20.0 %) [5].

On the 55th day of ripening of the kashkaval (Table 3) the water content was increased in batch1 and 2, but it was reduced in batch 3 and 4, if compared with 45th day. The decrease of water content can be explained by the delayed process of proteolysis and moisture loss during storage.

Table 2. Physicochemical parameters of the kashkaval on 45th day of ripening

Para-meters	Water content *x±Sx* %	Dry matter *x±Sx* %	Content of fats in total weight *x±Sx* %	Fat in dry matter *x±Sx* %	Ash content *x±Sx* %	Proteins *x±Sx* %	Energy value *x±Sx* kcal/100 g	Water-soluble protein *x±Sx* %	Degree of maturity *x±Sx* %
Batch 1	43.88 ±0.09	56.12 ±0.11	27.5±0.5	49.00 ±0.88	3.92±0.05	23.59±0.33	342±9	4.48±0.06	19.0±0.4
Batch 2	39.07±0.08	60.93±0.12	30.0±0.5	49.24 ±0.89	3.64±0.05	24.48±0.34	368±10	4.42±0.06	18.1±0.4
Batch 3	44.84 ±0.09	55.16±0.11	26.0±0.5	47.14 ±0.85	4.40±0.06	24.06±0.34	330±9	6.56±0.09	27.3±0.6
Batch 4	43.04±0.09	56.96 ±0.11	27.5±0.5	48.28 ±0.87	3.45±0.05	24.51±0.34	346±9	3.44±0.05	14.0±0.3

Table 3. Physicochemical parameters of the kashkaval on 55th day of ripening

Para-meters	Water content *x±Sx* %	Dry matter *x±Sx* %	Content of fats in total weight *x±Sx* %	Fat in dry matter *x±Sx* %	Ash content *x±Sx* %	Proteins *x±Sx* %	Energy value *x±Sx* kcal/100 g	Water-soluble protein *x±Sx* %	Degree of maturity *x±Sx* %
Batch 1	44.92±0.09	55.08±0.11	27.5±0.5	49.93 ±0.90	4.02±0.06	22.24±0.31	337±9	4.63±0.06	20.8±0.4
Batch 2	41.12±0.08	58.88±0.12	29.5±0.5	50.10±0.90	3.66±0.05	23.94±0.34	361±10	4.64±0.06	19.4±0.4
Batch 3	43.94±0.09	56.06±0.11	25.5±0.4	45.49±0.82	4.72±0.07	24.15±0.34	326±9	7.38±0.10	30.6±0.6
Batch 4	42.80±0.08	57.20±0.11	27.5±0.5	48.08±0.86	3.58±0.05	25.01±0.35	348±9	4.01±0.06	16.0±0.3

The amounts of water-soluble protein were increased at the four batches, which leaded to an increase in the degree of maturity at all batches (Fig.1).

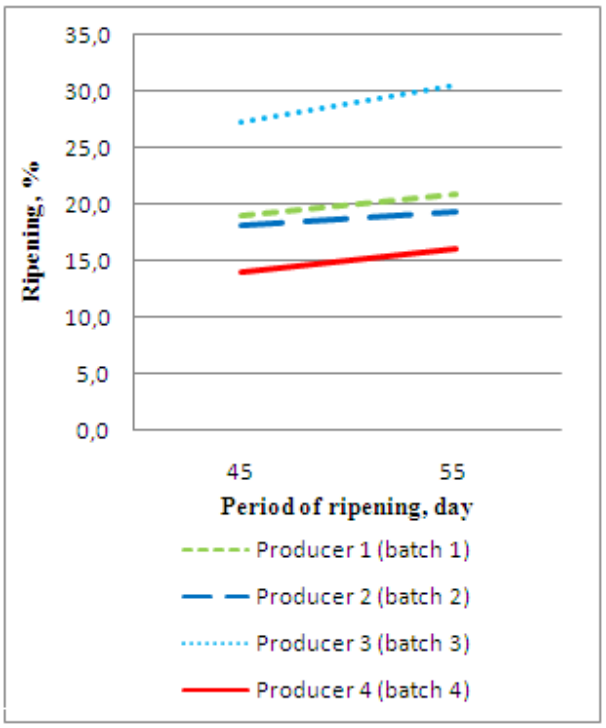

Fig.1. Changes in degree of maturity (%) of four batches kashkaval on 45th and 55th days

Only batch 4 did not meet the requirement of BDS 14:2010 [5] for ripeness. The different degrees of maturity of the studied kashkaval have shown, that the conditions for ripening the product were different in the four manufacturers.

The energy value of the four batches of kashkaval met the requirement of BDS 14:2010 [5]. There was a slight tendency to decrease throughout the period of study.

CONCLUSION

Based on the results for physicochemical parameters of four batches Bulgarian yellow cheese, produced in accordance the requirements of BDS 14:2010, we concluded the following:

1. The cow milk used as raw material for production of kashkaval, was standardized. Its quality was suitable for production of kashkaval, according to BDS 14:2010.

2. The physicochemical parameters of the four batches of kashkaval: dry matter (%), fat in dry matter (%) and energy value (kcal/100 g product) met the requirements of BDS 14:2010 early in the ripening process.

3. The period of ripening 45 days for kashkaval from cow's milk, set out in BDS 14:2010 [5] should be changed, since it does not guarantee the maturity of the product and its high nutritional value.

The following recommendation is acceptable for the future:

Based on the results, we will suggest to the relevant public authority to change 45 days period of ripening of kashkaval from cow's milk, set out in BDS 14:2010 and to extend it to 55 days, to ensure the completely conducted ripening process.

As a general conclusion: the quality of the produced in Bulgaria milk is good and allows manufacturing of the quality milk products.

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