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Research article

QUALITY COMPOSITION OF BRINE CHEESE FROM COWS WITH ADITION OF TURMERIC

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ABSTRACT

The purpose of the study is to determine the influence of biologically active additives from turmeric and black pepper in different concentrations on the organoleptic evaluation, physicochemical and fatty acid composition, antioxidant activity and total polyphenols of brine cheese from cow's milk obtained from highly productive Bulgarian Rhodope cattle. The organoleptic evaluation of the brine cheese with the addition of turmeric and black pepper determines the concentration of 0.1% as the most acceptable in terms of smell, taste, aroma, consistency and colour compared to the control group of white brine cheese. The yield of brine cheese increased significantly (P≥0.001) when applying 0.05% and 0.01% supplement. The protein content decreases reliably, while the fat content increases. The cheeses with different percentages of turmeric were well matured and this was proven by the degree of maturity indicator, which is over 16%. A significant decrease (P≥0.001) in the content of SFA was found when adding the supplement in different concentrations, at the expense of a significant increase (P≥0.001) in PUFA and MUFA.

1.Introduction

In addition to traditional cheeses, new functional types of cheeses were also produced to respond to the new lifestyle, to increase economic income and also for religious reasons (Wei et al., 2020; Gaglio et al., 2021a, 2021b; García-Gómez et al., 2021). In this direction, milk has mainly used for new cheese productions and to date, innovations in its production include the addition of fruit and vegetable by-products to obtain functional cheeses (Lucera, 2018; Barbaccia et al., 2021), natural food colourings for production of more attractive coloured products (Jiao et al., 2021), the inclusion of cereals as prebiotics to support the development of probiotic bacteria in the gut (Plessas et al., 2021). Research on the physicochemical and biochemical changes in white brine cheese with plant additives is scarce and incomplete, which is of interest to science (El-Kholy et al., 2017; Oraon et al., 2017; Basant et al., 2018).

The judicious use of herbs in dairy products can lead to an increase in their nutritional and medicinal parameters and enable the

development of the quality of dairy products. Fortification of milk and milk products with herbs and oils would allow to obtain high quality functional milk products and increase their consumption (Oraon et al., 2017). The antimicrobial and antioxidant properties of aromatic plants allow them to be used as preservatives. Adding them to dairy products can improve a person's health status.

Curcuma longa L. or turmeric (of the *Zingiberaceae* family) was considered a universal panacea in herbal treatment with a wide pharmacological spectrum of action such as antioxidant activity, cardiovascular and antidiabetic effects, inflammatory and edematous disorders, gastrointestinal effects, anticancer effect, antimicrobial activity, hepatoprotective and renoprotective function (Nasri et al., 2014; Verma et al., 2018). Turmeric contains 69.4% carbohydrates, 6.3% protein, 5.1% fat, 2.6% fiber, 3.5% minerals and 13.1% moisture. Curcumin (3–4%) is responsible for the yellow color and contains curcumin I (94%), curcumin II (6%) and curcumin III (0.3%) (Nasri et al., 2014). Another important possible use of turmeric in the food industry is as a substitute for synthetic pigments and it is currently one of the most used natural colorants in the food industry (Fagundes et al., 2018).

Black pepper (*Piper nigrum L.*) is a tropical plant whose fruits were used as a spice and has been designated as the "king of spices". It has high antioxidant, antimicrobial, anticancer, anti-inflammatory, analgesic, antipyretic, hepatoprotective, bioenhancing and enzyme inhibitory activity (Vijayakumar et al., 2004; Nahak and Sahu, 2011; Tasleem et al., 2014; Prashant et al., 2017; Stojanović-Radić et al., 2019; Batubara et al., 2020; Milenković and Stanojević, 2021). The physicochemical composition of black pepper consists mainly of carbohydrates - 37.4%, proteins 25.5%, fibbers of 23.6%, moisture 4.7% and fats of 5.3%, as well as minerals, including 0.66 % potassium (K), 0.20% calcium (Ca), 0.16% phosphorus and 0.16% magnesium (Mg) (Pradeep et al., 1993; Al-Jasass and Al-Jasser, 2012). It has characterized by a high content of polyphenols 1421.95 mg GAE/100 g, flavonoids 983.82 mg CE/100 g and piperine- 2352.19 mg/100 g (Lee et al., 2020).

The purpose of the study is to determine the influence of biologically active additives from turmeric and black pepper in different concentrations on the organoleptic evaluation, physicochemical and fatty acid composition, antioxidant activity and total polyphenols of brine cheese from cow's milk obtained from highly productive Bulgarian Rhodope cattle.

2. Materials and methods (TNR 12 Bold, No ident)

2.1. Materials

Bulk tank milk from highly productive Bulgarian Rhodope cattle cows was used, taken every month for one year from the Research Centre of Stockbreeding and Agriculture, Smolyan.

The milk was pasteurized (4 liters), after which the combination of turmeric with black pepper was added in the form of a dry substance in a ratio of 3:1 to the milk with the following concentrations: 0%- control (K), 0.05% (C1), 0.01% (C2), 0.2% (C3) and 0.3% (C4). The technological scheme is presented in figure 1.

The study was carried out with processed milk every month, to establish changes after technological processing caused by the quality of the milk. An organoleptic evaluation of the white brine cheese and the cheese with an additive in different concentrations was carried out to determine the most suitable concentration based on the sensory perceptions of consumers (10 pcs). A colour analysis was performed to determine the differences after treatment with the additive compared to the original white brine cheese. The physicochemical and fatty acid composition, antioxidant activity and polyphenols content of the control and treated cheese were performed at 45 days of ripening.

Total solids - BNS 1109: 1989, ISO 9622

Protein - ISO 9622, BNS EN ISO 8968-1: 2002

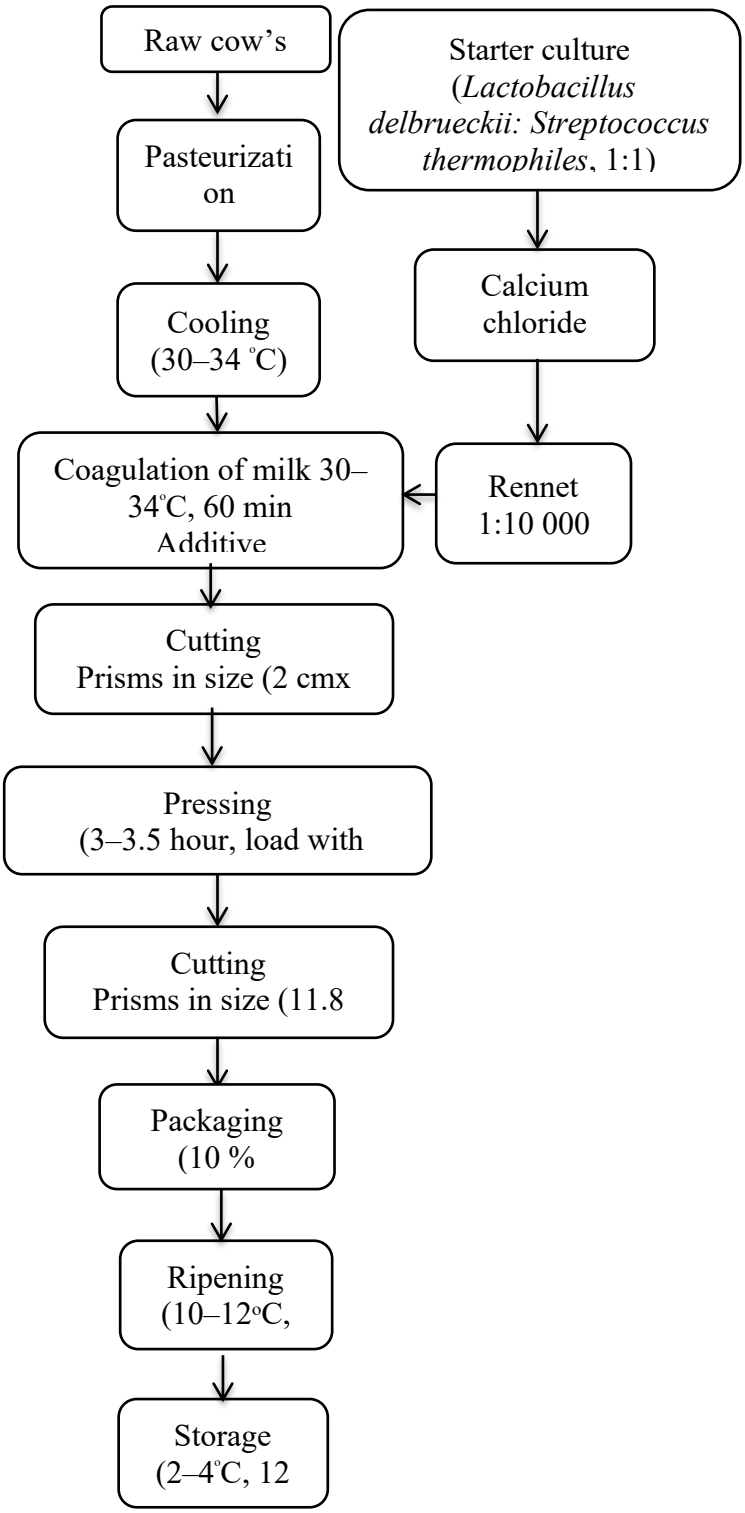

Figure 1. Technological scheme for obtaining cheese with turmeric and black pepper

Fibber by Dosi-Fiber-Selecta automatic fibber extraction system, Spain

Colour with a portable digital colorimeter NR200 (Huanyu, China), where L* corresponds to luminance (0=black, 100=white), a* red-green component value (-a=green, +a=red) and b * value (-b=blue, +b=yellow) represents yellow-blue component. The colour was directly measured on the surface of a standard amount of cheese that filled a petri dish using a white background. Three parallel measurements were made on each sample.

The extraction of total lipids was performed by the method of Roese& Gottlieb и Bligh& Dyer. Fatty acid methyl esters (FAME) were analysed using a Shimadzu-2010 gas chromatograph (Kioto, Japan) equipped with a flame ionization detector and an automatic injection system (AOC-2010i). The analysis was performed on a CP 7420 capillary column (100m x 0.25mm i.d., 0.2μm film, Varian Inc., Palo Alto, CA). Hydrogen was used as the carrier gas, and as a make-up gas - nitrogen. Four-step furnace mode was programmed - the column's initial temperature was 80 ° C / min, maintained for 15 minutes, then increased by 12ºC / min to 170ºC and maintained for 20 minutes, followed by a further increase of 4ºC / min 186ºC for 19 minutes and up to 220ºC with 4ºC / min until the process is complete.

The qualitative assessment of the fat fraction of the resulting samples includes the following: lipid preventive score (LPS), atherogenic (AI) and thrombogenic index (TI) (Ulbricht and Southgate, 1991), the ratio between hyper- and hypocholesterolemic (h/H) fatty acids, trans fatty acids (TFA) and the amount of saturated fatty acids (Regulation (EC) No 1924/2006).

LPS=FAT+2xSFA-MUFA-0.5PUFA,

AI=12:0+4×14:0+16:0/[ΣMUFAs+PUFA n-6+PUFAn-3]

TI=(14:0+16:0+18:0)/[0.5×ΣMUFAs+0.5× PUFAn-6+3×PUFAn-3+PUFAn-3/PUFA n-6]

h/H=(C18:1n-9+C18:1n-7+C18:2n-6+C18:3n-3+C18:3n-6+C20:3n-6+C20:4n-6+C20:5n-3+C22:4n-6+C22:5n-3+C22:6n-3)/(C14:0+C16:0).

Preparation of samples for analysis of total phenol content and antioxidant activity

The samples of cheese were extracted with 95% ethanol at a ratio of sample: extracting – 1:5 (w/v) for 6 h at room temperature and in the dark. All samples after centrifugation (10°C, 4000 rmp, 10 min) and filtration (Whatman No. 4 paper) were stored at (-20)°C for subsequent analyses.

Determination of antioxidant activity by DPPH in cheese

The antioxidant capacity of the samples was evaluated by determining the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging capacity according to the method of Brand-Williams et al. (1995) with a slight modification: 0.6 mL of a 0.2 mM solution of DPPH in methanol was mixed with 0.9 mL of methanol and 0.5 mL of the corresponding sample dilution. Absorbance was measured after standing (60 minutes) at room temperature in the dark with a UV-Vis spectrophotometer (Biochrom Libra S20, UK) at 517 nm against methanol. In the control, the sample solution was replaced by 0.5 mL of 80% methanol. Different concentrations of Trolox were used as standards for calibration, and the results were expressed as milligrams of TE per 100 g of sample.

Determination of the content of total phenols in cheese

For the quantitative determination of the total phenolic content (TPC) the method of Singleton et al. (1999) was used. with modification of Valyova et al. (2012). Briefly, 3.0 ml of distilled water and 0.25 ml of Folin–Ciocalteu reagent were added to 0.5 ml of the sample (with the corresponding dilution). After standing for 2 minutes, 0.75 ml of 20% sodium carbonate solution and 0.5 ml of distilled water were added to the mixture. Absorbance was measured at 765 nm (on a UV-Vis spectrophotometer, Biochrom Libra S20, UK) after standing in the dark at room temperature for 120 minutes. TPC was calculated according to the standard law of gallic acid and expressed as equivalents of gallic acid (GA) in mg/100 g fresh sample.

The reliability of the differences between the examined cheeses was established using the Student's t-test.

3.Results and discussions

The organoleptic research carried out by consumers gives us information about the change of five indicators, the smell being the most acceptable when applying 0.1 and 0.2% additive, the taste, consistency, aroma and colour being the most acceptable at 0.1% additive (Table 1). The obtained results for the colour brightness L* of the cheese with the addition of turmeric in different concentration gives a reliable decrease when applying 0.05% and 0.2% of turmeric with black pepper compared to the control cheese. The red-green component a* increased significantly with the addition of 0.2 and 0.3% of the additive, while the yellow-blue component b* increased significantly and shifted to the yellow component with the addition of turmeric and black pepper at all four concentrations compared to the control cheese (Table 2).

Table 1. Organoleptic evaluation of pickled cheese with the addition of turmeric and black pepper (3:1), n=10

	K		**C1**		**C2**		**C3**		**C4**	
	X	**SD**	**X**	**SD**	**X**	**SD**	**X**	**SD**	**X**	**SD**
Smell	4.0	1.0	3.4	0.9	3.8	0.8	3.8	0.8	3.2	0.4
Taste	4.4	0.5	3.4	0.9	4.2	0.8	4.0	0.7	3.6	0.5
Aroma	4.2	0.8	3.2	1.1	4.0	1.0	3.8	0.8	3.4	0.5
Consistency	4.6	0.5	3.8	0.8	4.2	0.8	4.0	1.2	3.6	1.1
Color	4.4	0.9	4.0	1.0	4.2	0.8	4.2	0.8	4.4	0.5

1-unacceptable; 2-acceptable; 3-I like it; 4- I really like it; 5-I like it very much

Table 2. Colour of brine cheese with additive, n=6

	K		**C1**		**C2**		**C3**		**C4**	
	X	**SD**	**X**	**SD**	**X**	**SD**	**X**	**SD**	**X**	**SD**
L*	91.44 a*,c**	1.13	84.53	2.31	88.67	2.62	82.53	1.48	89.96	0.37
a*	-1.26 c*,d**	0.06	-0.67	0.99	1.57	3.05	2.52	0.91	8.48	1.33
b*	17.35 a,b**,c,d***	0.27	72.47	7.03	65.82	3.83	76.22	0.92	70.95	2.25

L*- lightness**, a*-** red-green component, **b*-** yellow-blue component a- K/C1; b- K/C2; c- K/C3; d- K/C4; *P ≥ 0.05; **P ≥ 0.01; ***P ≥ 0.001

Cheese yield after pressing in the control group was 494 g and increased significantly (P ≥ 0.001) in C1 and C2, while no significant changes were found in C3 and C4 (table 3). the active acidity of the tested cheeses does not change significantly when different concentrations of turmeric and black pepper were added, but it is significantly higher than the control cheese (P ≥ 0.01). The titratable acidity of the analysed cheeses was generally low from 140 to 156 ◦T, with the control cheese being 158 ◦T. The protein content in the control group of cheeses was 16% and reliably decreased when a different concentration of the additive was applied. The lowest value for the amount of protein was reported for C1 and C2. Soluble protein at C1 is lower than K and increases implausibly at C2, C3, and C4. The degree of maturity according to BNS 15:2010 for cow cheese was a minimum of 16%, according to which the control and treated cheeses were well matured and have a degree of maturity from 20.97% (K) to 31.67% (C2). The amount of fat was higher in all variants of adding the additive - 10.29% to 12.81% compared to the cheese control group - 9.86%. The amount of sodium chloride was relatively the same in all cheeses examined and varies from 5.19 to 5.48%. Ash content in the tested cheeses with addition of turmeric and black pepper was significantly

higher ($P \geq 0.001$) compared to the control cheese. The total solids at K was highest and decreases depending on the application of the additive, with the lowest value found at C2 - 34%.

Cheese is a dynamic biochemical product that undergoes changes during the ripening process compared to a number of processed foods. Mijačević and Bulajić (2008) found a protein content of 17%, water content of 55% and total solids of 45% in the cheese after ripening for 30 days. Shahab Lavasani et al. (2013) found that the amount of protein decreased in the ripening process from 15.81 to 11.52%, fat from 15.7 to 13.15%, dry matter from 40.15 to 13, 05% by sheep's milk cheeses. Bioactive peptides can be released by enzymes derived from microorganisms or plants (Korhonen and Pihlanto, 2007). Milk and cheese are an important part of a balanced human diet with a positive role when consumed in moderation. Demand for high-quality, healthy dairy products is increasing as consumers become more aware of the link between diet and health (Table 3).

Saturated fatty acids in the control group of cheeses were 66.35 g/100g fat and decreased significantly ($P \geq 0.001$) with the addition of turmeric and black pepper in all variants, with the lowest content found in C2- 58.07 g/ 100g of fat. polyunsaturated and monounsaturated fatty acids in the brine cheeses with the addition of turmeric and black pepper increased, with the highest value for PUFA found at C4-7.35 g/100g fat and for MUFA at C2-32.76 g/100g fat.

The use of an additive of vegetable origin in different concentrations during the technological processing of milk to brine cheese leads to a multiple decrease in the content of short-chain fatty acids from 8.11 g/100g fat in the control group to 0.17 g/100g fat in C1 (47 times). In the case of medium-chain fatty acids, the obtained results were divergent - when an additive of 0.05% was added, an increase in their content compared to the starting curds has found, while at 0.1 and 0.3% it was preserved, and at 0.2% it decreases. The addition of turmeric and black pepper leads to a threefold increase in trans fatty acids in the brine cheese at C1, C2 and C3, while at C4 it has twofold. These changes were probably due to lipolytic processes under the influence of the supplement and the introduction of the whey enzyme during the technological treatment at the expense of the cis isomers of oleic acid, where the lowest values were recorded at 0.05 and 0.1% of the supplement. The content of conjugated linoleic acid during the introduction of the plant additive and ripening of the cheese leads to a 2.5 to 3 times lower content compared to the original control cheeses.

The amount of omega-3 fatty acids decreased slightly, with the lowest value recorded for the cheese with 0.2% addition of turmeric and black pepper (C3). The content of omega-6 fatty acids increased compared to the original cheese and the highest concentration was recorded when adding 0.3% turmeric with black pepper (C3) - 6.29 g/100g fat. This, in turn, predetermines the high ratio between omega-6 and omega-3 fatty acids when adding an additive to the brine cheese in different concentrations.

Branched-chain fatty acids increase in the analysed cheeses by used 0.05% additive and decrease at a concentration of 0.1, 0.2 and 0.3% additive to the concentration of the original cheese. The quantitative content of branched fatty acids in food products is an indicator of microbiological activity, and their reduction as a result of the addition of turmeric and black pepper leads to its suppression (Table 4).

The lipid preventive score in the examined cheeses from the control group was 18.37. The use a combination of turmeric with black pepper gave the lowest value for the lipid preventive score at 0.05% of the supplements 19.95. The combination of turmeric and black pepper gave the lowest value for AI at 0.1% addition - 1.63 and for TI at 0.05% additive - 1.80.

Table 3. Physicochemical composition of white brine cheese and cheese with the addition of turmeric and black pepper in a ratio of 3:1, n=6

		К	С1	С2	С3	С4
Yield, g	X	494.40 a,b****	602.61	694.60	552.18	588.88
	SD	31.58	29.55	20.72	79.29	97.77
pH	X	5.19 b**, a,c,d***	5.51	5.46	5.46	5.51
	SD	0.12	0.11	0.12	0.11	0.06
A, ◦T	X	158.60	140.60	145.60	153.80	156.20
	SD	10.55	9.56	8.62	15.83	9.04
P, %	X	16.37 a,b,c,d**	8.73	9.69	10.97	12.28
	SD	0.72	0.94	2.26	1.12	1.09
SP, %	X	2.53	2.46	3.40	2.96	3.78
	SD	0.59	0.81	1.43	1.13	1.17
DM, %	X	20.97 b**,d*	20.91	31.67	22.11	26.53
	SD	4.04	3.62	2.75	4.12	2.99
F,%	X	9.86 d*	10.29	11.27	12.07	12.81
	SD	1.88	5.21	1.67	1.33	1.52
NaCL,%	X	5.19	5.01	5.37	5.47	5.48
	SD	0.22	0.22	0.45	0.44	0.50
A, %	X	3.97 a,b,c,d***	5.89	5.57	5.70	6.10
	SD	0.41	0.34	0.47	0.33	0.31
TS, %	X	44.53 b,c**,d*	40.92	34.00	36.14	39.69
	SD	3.73	2.58	3.01	2.13	2.66

A- titratable acidity according to Turner; P- protein; SP- soluble protein; DM- degree of maturity; F- fat; A- ash; TS-dry matter; a- К/С1; b- К/С2; c- К/С3; d- К/С4; *P ≥ 0.05; **P ≥ 0.01; ***P ≥ 0.001

Table 4. Fatty acid groups in brine cheese with the addition of turmeric and black pepper in different concentrations, g/100g fat, n=6

	К		С1		С2		С3		С4	
	X	SD	X	SD	X	SD	X	SD	X	SD
SFA	66.35 a,b,c,d***	0.08	59.23	0.23	58.07	1.09	58.18	0.11	56.90	0.67
MUFA	27.87 a,b,d***,c**	0.03	32.04	0.12	32.76	0.62	34.65	0.08	31.74	0.37
PUFA	4.09a,b,c***	0.00	5.28	0.02	5.27	0.10	4.50	0.01	7.35	0.09
Σ C-18:1 TFA	4.22	0.01	14.17	0.05	13.77	0.26	12.09	0.02	9.92	0.12
Σ CLA	0.68	0.00	0.45	0.00	0.56	0.01	0.43	0.00	0.71	0.01
C-16:0/C-18:1cis9	1.45	0.00	2.05	0.00	1.82	0.00	1.50	0.00	1.51	0.00
C-16:0/C-18:1 ges.	1.14	0.00	0.99	0.00	0.92	0.00	0.88	0.00	0.94	0.00
Σn-3	0.76 a,b,c,d***	0.00	0.60	0.00	0.64	0.01	0.53	0.00	0.65	0.01
Σ n-6	3.00	0.00	4.44	0.02	4.32	0.08	3.88	0.01	6.29	0.07
ΣMCFA	15.66	0.02	16.99	0.06	15.87	0.30	13.92	0.03	15.79	0.19

(C-10>C-14)										
ΣSCFA (C-4>C-8)	8.11	0.01	0.17	0.00	0.33	0.01	0.22	0.00	0.44	0.01
CLA 9c,11t	0.53	0.00	0.21	0.00	0.27	0.01	0.18	0.00	0.15	0.00
Σn-6/Σn-3	3.96	0.00	7.36	0.00	6.71	0.00	7.38	0.00	9.72	0.00
S C-18:1CFA	20.86	0.03	15.01	0.06	16.37	0.31	19.99	0.05	19.08	0.22
BFA	3.18	0.00	3.23	0.01	2.88	0.05	2.81	0.01	3.09	0.04

a- K/C1; b- K/C2; c- K/C3; d- K/C4; *P ≥ 0.05; **P ≥ 0.01; ***P ≥ 0.001

Table 5. Qualitative characteristics of brine cheese fat with the addition of turmeric and black pepper in different concentration, n=6

	K	C1	C2	C3	C4
LPS	18.37a ***	19.95	22.24	25.37	27.58
AI	2.19a,b,c,d ***	1.65	1.63	1.81	1.70
TI	2.28 a,b,c,d ***	1.80	1.92	1.94	1.89
h/H	0.60	0.74	0.72	0.76	0.74
TFA (g/ 100g product)	0.38	0.95	1.24	0.88	1.03
SFA+TFA (g/ 100g product)	6.39a***	7.33	8.45	9.09	8.29

a- K/C1; b- K/C2; c- K/C3; d- K/C4; *P ≥ 0.05; **P ≥ 0.01; ***P ≥ 0.001

The atherogenic index gives the correlation between the sum of the main saturated fatty acids and the unsaturated fatty acids, the former being considered proatherogenic (favoring the adhesion of lipids in the cells of the immune and circulatory system) and the second are anti-atherogenic (inhibit plaque aggregation and decrease levels of esterified fatty acids, cholesterol and phospholipids, thus preventing the occurrence of micro- and macro-coronary diseases).The thrombogenic index has the tendency to clot formation in blood vessels and is defined as the ratio between prothrombogenic (saturates) and antithrombogenic (monounsaturated and polyunsaturated omega-3 and omega-6 fatty acids) fatty acids (Ghaeni et al., 2013). The thrombogenic and atherogenic index as indicators, should not exceed 1.00 while the cholesterol index is above 1.00 (Ivanova and Hadzhinikolova, 2015). The hypo-hyperulistic index of the white brine cheese was 0.60 and increased slightly with the addition of turmeric and black pepper. Cholesterolemic index was low (below 1.0) in all concentrations of turmeric. Trans fatty acids have the lowest concentration with 0.3% addition- 0.88 g/ 100g product, while saturated fatty acids with 0.05% turmeric – 7.33 g/ 100g product. The use of turmeric and black pepper in different concentration leads to improvement of the fatty acid profile and quality indicators of the brine cheese compared to the control untreated white brine cheese (Table 5).

Antioxidants can delay or inhibit oxidative damage to proteins, nucleic acids and lipids caused by free radicals that cause oxidative stress (Baardseth, 1989; Zheng and Wang, 2001; Norshazila et al., 2010) by autoxidation. Lipid oxidation leads to undesirable changes in the taste, texture and nutritional value of foods (Wang et al., 2006). Milk proteins were characterized by their ability to scavenge reactive oxygen species or free radicals (Lindmark-Månsson and Åkesson, 2000; Suetsuna et al., 2000; Karakaya et al., 2001; Hambraeus and Lönnerdal, 2003; Wang et al., 2006) and were used as natural antioxidants in the food industry due to the fact that they have

no taste and smell, but are nutritious. Phenolic compounds are widely present in dairy products, but literature data regarding their study in milk and dairy foods is scarce. Ertan et al. (2017) were found an increase in antioxidant activity and polyphenol content in milk with increasing fat content in UHT-milk. According to Calligaris et al. (2003) the application of different temperature regimes for pasteurization of milk increased the antioxidant activity. Fardet and Rock (2017) found that the antioxidant activity in cheese was determined by the production process depending on the technological losses and the cheese ripening time during which proteolysis and microbiological activity processes take place.

Table 6. Antioxidant activity and total polyphenols in brine cheese with additives, n=6

	DPPH, TE mg/100 g product	**TPC, GAE mg/100g product**
K	4.16±0.67 a***	44.83±1.25a***,b**
C1	4.22±1.77	43.33±4.04
C2	6.05±1.64	49.74±0.21
C3	9.34±0.12	75.50±3.50
C4	20.93±0.58	93.63±1.09

a- K/C1; b- K/C2; c- K/C3; d- K/C4; *P ≥ 0.05; **P ≥ 0.01; ***P ≥ 0.001

The antioxidant activity in the investigated white brine cheeses was 4.16 TE mg/100 g product. The use of a combination of turmeric with black pepper at 0.05% supplementation did not change the antioxidant activity in the brine cheese, but at 0.1% it increased to 6.05 TE mg/100 g product, at 0.2% it increased twice, and at 0.3% fivefold. Total polyphenols in the investigated white brine cheese were 44.83 GAE mg/100g product. The use of low concentrations of turmeric and black pepper additive preserves the polyphenol content compared to the original brine cheese. The addition of 0.2 and 0.3% of the supplement increased the content of total polyphenols to 75.50 and 93.63 GAE mg/100g product (Table 6).

4. Conclusions

The technological processing of collective cow's milk to brine cheese with the addition of different concentrations of turmeric and black pepper leads to technological losses of protein as a result of proteolytic processes during the ripening process, which in turn leads to a decrease in the content of total solids in the brined cheeses with additives compared to the control cheese group. Adding an additive in a different concentration does not affect the technological process of ripening the brine cheese, which is established and proved by the degree of maturity indicator. The content of saturated fat is reliably reduced as a result of the addition of turmeric and black pepper in different concentrations, which improves the quality of the product and makes it a healthier product**.**

5. References

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