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# The effect of tobacco seed supplementation on the physicochemical and fatty acid composition in white brined cheese from buffalo milk

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## Abstract

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The purpose of the study had to conducted an analasys on the physicochemical and fatty acid composition in white brined cheese obtained after technological processing by buffalo milk and addition of tobacco seed in different concentrations.

Technological processing of buffalo milk to white brined cheese with different amounts of tobacco seed leads to technological losses of protein and fat as a result of proteolytic and lipolytic processes during the ripening process, which in turn leads to a decrease in the content of total solids in white brined cheeses with additives relative to the control group. The addition of tobacco seed supplements does not affect the technological process of ripening of white brined cheese, which is established and proven by the indicator of the degree of maturity. The total fat in the studied white brined cheeses increases significantly with the addition of the addition of tobacco seed ($P \leq 0.001$). Fat in the control group of white brine cheeses was 10.8% and increased to 23.85% when the 7.5% supplement was applied. Protein decreased significantly ($P \leq 0.001$) with the application of 7.5% tobacco seed to 9.18% compared to the control group of white brine cheese – 11.3%.

The content of saturated and monounsaturated fatty acids in white brine cheese with the addition of different amounts of tobacco seed decreases, while the concentration of polyunsaturated fatty acids increases with increasing additive content in white brine cheese, which is due to the high levels of unsaturated fatty acids in the additive.

*Keywords:* fat; protein; dry matter; degree of maturity; concentration of the additive
*Abbreviations:* W – water content; DM (dm) – dry matter; F – fat; A – ash; P – protein; SP – soluble protein; TS – total solids; FA – fatty acids; DG – diacylglycerols; TG – triacylglycerols; SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids; CFA – cis fatty acids; TFA – trans fatty acids; CLA – conjugated fatty acids; BFA – branshed fatty acids; At0 – 24h cheese; wb – protein; dm – fat; Bt7 – cheese on day 7

## Introduction

Cheese it was a product with high nutritional value– contains milk fat, protein substances and mineral salts. It was obtained as a result of curdling or crossing the milk, separation of the whey, salting and lactic acid fermentation. Cheese was a product with a long shelf life compared to milk and contains water, lactic acid and salt (Shahab Lavasani, 2014). The production of cheese includes the processes of fermentation and ripening in which important bioactive components were activated. Studies have shown that mature cheese contains peptides with antihypertensive effects, ACE inhibitory peptides, with ACE inhibitory activity increasing during ripening (Meisel et al., 1997). Using a diverse range of lactic acid bacteria as starter different flavors of the cheese were formed. Cheese was a dynamic biochemical product that undergoes changes during the ripening process compared to a number of processed foods. Milk and cheese were an important part of a balanced human diet with a positive role when consumed in moderation. Demand for high-quality and healthy dairy products had increasing as consumers become increasingly aware of the connection between a diet and health.

A number of studies in recent decades have established that milk and dairy products provide a wide range of natural bioactive components. Conventional food provides these bioactive components that function as a food or food supplement (Gobbetti et al., 2007). Many studies have been reported on various beneficial effects of bioactive components in milk and dairy products on health. Interest in bioactive components was greater than ever in modern society.

Tobacco seeds were characterized by high oil content. The main fatty acids in tobacco seed oil were a linoleic, oleic, palmitic and stearic (Ashraf- Khorassani et al., 2015). The seed oil of different types and varieties tobacco were contained certain amounts of fatty acids and a significant level of protein. It was similar to the protein in the seeds from others oleaginous crops. It is similar to the protein in the seeds of other oil-bearing crops. There were studied of tobacco seeds a fed to animals (Rossi et al., 2007). Zdremtan & Zdremtan (2006) found that tobacco seed oil can also had been used as a food supplement.

In general, has been shown that tobacco seed oil yield and its fatty acid profile were influenced by genotype, climatic conditions and other factors such as water and fertilization (Grisan et al., 2016; Mohammad & Tahir, 2014; Rossi et al., 2013). It has been found that application of N- fertilization can affect seed yield, oil content, as well as composition of other crops such as wheat, sunflower and winter mustard (Li et al., 2019; Zheljazkov et al., 2009). Differences in fatty acid composition have been observed under different N- fertilization in walnut kernels (Campiglia et al., 2011; Kuo & Jellum, 2002; Sainju & Singh, 2008).

Tobacco has an oilseed crop with an oil yield from 30% to 40% in the dry seed weight, which is higher than some other crops, such as corn (3-5%), cotton (16%), soybean (18 %) and olives (18% to 25%) and close to that of mustard (from 37% to 39%), canola (from 37% to 41%), sunflower (from 25% to 47%) and saffron (from 38% to 48 %) (El-badawy et al., 2016; Giannelos et al., 2002; Methamem et al., 2015; Popova et al., 2018; Zheljazkov et al., 2011, 2012, 2013). This highlights the potential of tobacco seeds as a source of industrial and edible oils (Giannelos et al., 2002; Usta, 2005).

Vegetable oils have been used to improve the fatty acid profile of dairy products (Marand et al., 2020; Bakry et al., 2019; Goyal et al., 2016; Ganesan et al., 2014). Enrichment of dairy products with omega-6 fatty acids has mostly done by including a seed oil in the ruminant's diet (Goiri et al., 2019; Nguyen et al., 2019).

Another possibility has to replace milk fat in dairy products partially or completely, by oils rich in polyunsaturated fatty acids (Dal Bello et al., 2017; Soliman et al., 2019).

Compared to other vegetable oils, canola oil had been characterized by the lowest content of saturated fatty acids (less than 10 g/100 g) following by walnut and linseed oil. It has an excellent source of mono- and polyunsaturated fatty acids with an optimal ratio of omega-6/omega-3 (Daun et al., 2011). Rapeseed oil has a valuable composition of fatty acids (Ghazani & Marangoni, 2016).

Belynskaia et al. (2010) determined the fatty acid composition of the vegetable oils mixture by calculating the percentage of each in them (soybean oil – 72%, sesame oil – 13.5–15.5%, amaranth oil – 26.4–25.88%. Amaranth and sesame oils were low in ω-3 (respectively 0.34% and 1.3%), while soybean oil has a higher percentage of ω-3 (respectively 7.34%) thanks to the specific its taste and favour and has not included in the 72% mixture, which is further used in dairy technology.

As one of the four main types of nuts in the World has the walnut (*Juglans regia* L.). The walnuts content from 52 to 70% oil. Walnut oil has an excellent source of essential fatty acids with high nutritional content that can be used for cooking and as an ingredient in paint and cosmetics (Zambón et al., 2000). The main constituents of walnut oil were triacylglycerols (TG) and diacylglycerols (DG). TG and DG represent a good source of essential fatty acids, the most common of which were linoleic and linolenic acids (Bouabdallah et al., 2014). The ratio of n-3 and n-6 unsaturated fatty acids in walnut oil was 4~6:1, which was in line with healthy dietary standards for humans (Croitoru et al., 2019). Triglycerides were found in walnut, sesame, water chestnut, hazelnut and beech oils. Walnut oil was mainly composed from highly unsaturated triglycerides (54:6-8) (Bail et al., 2009). The lipid molecule of walnut oil contains 21 types of saturated fatty acids and 27 types of unsaturated fatty acids, including a low content of rare once ultra-long chain unsaturated fatty acids. The quality of walnut oil was due to the fact that it contains a large amount of unsaturated fatty acids, which can effectively reduced cholesterol levels, prevented atherosclerosis and cardiovascular diseases (Ibáñez et al., 2017). Oxidized linoleic acid produces a n-butyraldehyde and other volatile components that determined the flavor and taste of the walnut (Zhou et al., 2017). Walnut has a high nutritional value, but its unsaturated fatty acids were easily oxidized, resulting in reduced shelf life of nuts and oil (Emilio & Mataix 2006).

Phipps et al. (1993) have studied and found that a daily intake per 10 g of flaxseed coud reduced the risk of breast cancer. The healthy qualities of flaxseed were mainly due to the presence of linoleic acid – 57% (omega-3 fatty acids). It contains a high amount from dietary fibber (both soluble and insoluble), protein and antioxidants such as lignan.

The purpose of the study had to conducted an analasys on the physicochemical and fatty acid composition in white brined cheese obtained after technological processing by buffalo milk and addition of tobacco seed in different concentrations.

## Material and Methods

The physicochemical and fatty acid composition of white brine, obtained after technological processing according to BNS 12:2015 from bulktank milk whith addition of tobacco seed with a concentration from 1%, 2.5%, 5% to 7.5%, was investigated (Figure 1).

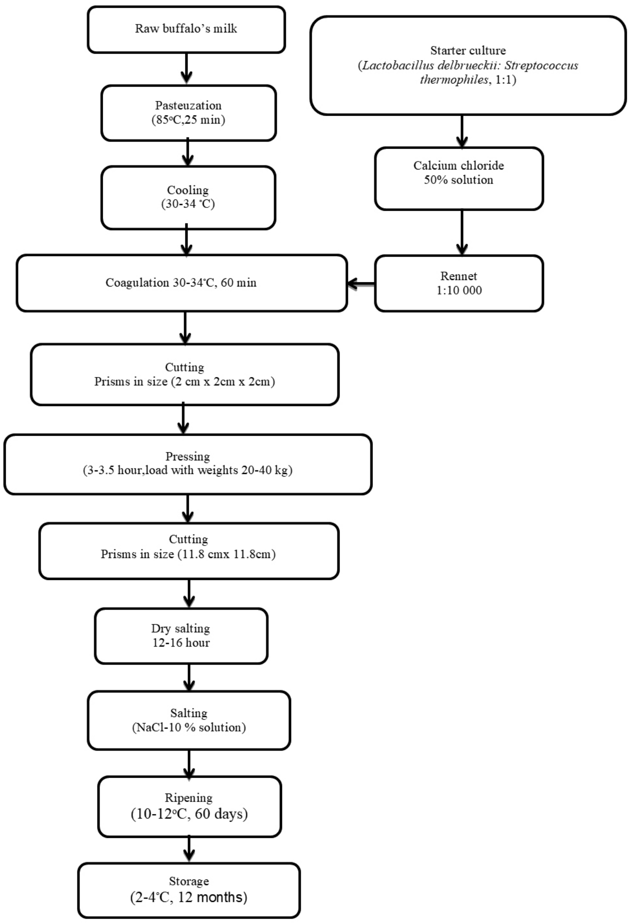


**Fig. 1. Technological scheme for obtaining of white brined cheese**

Methods of analysis:
– Water content – BNS 1109: 1989, ISO 9622
– Total solids – BNS 1109: 1989, ISO 9622
– Protein – ISO 9622, BNS EN ISO 8968-1: 2002
– Fats – BNS EN ISO 1211: 2002, ISO 9622

Fatty acid composition – extraction of total lipids was performed by the Roese-Gottlieb method, using diethyl and petroleum ether and subsequent methylation by sodium methylate ($CH_3ONa$, Mersk, Darmstadt) and drying with $NaHSO_4xH_2O$. The fatty acids methyl esters /FAME/ were analyzed using a gas chromatograph Shimadzu-2010 (Kioto, Japan) equipped with a flame-ionization detector and an automatic injection system (AOC-2010i). Analysis was performed on a CP 7420 capillary column (100 m × 0.25 mm i.d., 0.2 μm film, Varian Inc., Palo Alto, CA). Hydrogen was used as carrier gas, and nitrogen as make-up gas. A four-step furnace mode was programmed – starting column temperature – 80ºC/min, which was maintained for 15 min, then increased by 12°C/min to 170°C and maintained for 20 min, followed by a further increase of 4°C/min to 186°C for 19 min and up to 220°C at 4ºC/min until the process is complete.

The data were processed according to the methods of variation statistics using the statistical package of the computer program EXCEL 2016. The reliability of the differences between the examined cheeses was established using the Student's t-test.

## Results and Discussion

In addition to traditional cheeses, new functional types of cheeses were also being produced to meet the demands of modern lifestyles, which supports religious societies and economic income (Wei & Yano, 2020; Gaglio et al., 2021; García–Gómez et al., 2021). In this regard, milk was mainly used for new productions of cow's milk cheese. To date, innovations in cheese production include the addition of fruit and vegetable by-products to obtain functional cheeses (Lucera et al., 2018; Barbaccia et al., 2022), such as natural food colorings to produce more attractively colored products (Jiao et al., 2021). A new approach was to included grains as prebiotics to enhance the growth of probiotic bacteria in the intestine (Plessas et al., 2021).

Total fat in the investigated white brine cheeses increased reliably with the addition of tobacco seed (Tables 1 and 2). Fat in the control group of white brine cheeses was 10.8% and increased to 23.85% when the 7.5% aditive was applied. Protein decreased reliably with supplementation from 11.3% in the white brine control group to 9.18% with 7.5% tobacco seed supplementation. The degree of ripeness was highest in the control cheese with the addition of 1% tobacco seed, while the lowest values were found in the white brine cheese with 7.5% addition – 17.9%. The total solids have the highest value – 49.25% with 5% additive and the lowest with 1% additive – 42.21%. The control cheese has 42.76% total solids.

Hirigoyena et al. (2018) was investigated the physicochemical parameters of Colonia cheese during the two different seasons – spring and summer. The following values were found in the cheeses analyzed: pH – 5.34, moisture – 41.4%, protein – 24.93%, fat – 30.28% for the summer season and pH – 5.36, moisture – 41.54%, protein – 24.64% and fat – 29.32% respectively for spring. They found no significant differences in the physicochemical parameters.

Filipczak–Fiutak et al. (2021) were established the following physicochemical results for smoked cheeses from cow's, goat's and sheep's milk – cheese produced from raw goat's milk ripening without brine: W% – 51.57, F% – 19.77, TS% – 40.80, P% – 22.73, A% – 4.16; Salt% – 1.8, pH – 5.52; cheese made from raw sheep's milk, maturing in brine – W% – 39.03, F% – 27.59, TS% – 43.53, P% – 28.37, A% – 4.06, Salt% – 1.70 , pH – 5.18; cheese made from pasteurized goat's milk, maturing in brine – W% – 43.30, F% – 15.50, TS% – 27.37, P% – 32.97, A% – 6.86, Salt% – 2.57 and pH – 6.12; raw cow's milk cheese, maturing in brine – W% – 44.90, F% – 23.00, TS% – 41.70, P% – 29.43, A% – 3.68, Salt% – 1.37, pH – 5.06.

Faccia et al. (2021) were produced mozzarella from pasteurized milk under two different low-temperature continuous treatments (67°C or 63°C × 30 min) with pre-acidification. The analyzed cheeses were showen differences in physicochemical composition, texture, proteolysis and lipolysis. At0 (cheese at 24h), pH 5.30, moisture 61.1%, fat (wb) – 15.4%, fat (dm) – 39.6%, protein (wb) – 15.4%, protein (dm) – 44.7%, lactose – 0.3%, yield – 16.9%; Bt0 (24h cheese) pH – 5.33, moisture – 58.5%, fat (wb) – 17.2, fat (dm) – 41.4%, protein (wb) – 19.6%, protein (dm) – 47.2%, lactose – 0.4%, yield – 14.3%; At7 (7 day cheese) pH – 5.20, moisture – 65.3%, fat (wb) – 13.8%, fat (dm) – 39.8%, protein (wb) – 15.0%, protein (dm) – 43.2%. Bt7 (7-day cheese) pH – 5.23, moisture – 59.1%, fat (wb) – 17.1%, fat (dm) – 41.8%, protein (wb) – 18.9%, protein (dm) – 46.2%. Bioactive peptides couden been released by enzymes derived from microorganisms or plants (Tamime & Robinson, 2007).

Marino et al. (2021) were found the following physicochemical composition of the control sheep's milk cheese (g/kg dry matter): moisture – 40.1%, dry matter – 61.2%, fat – 26.5%, ash – 3.76%, protein – 25.3% and, respectively, for cheese produced from milk obtained from ruminants fed a diet with hazelnut bark for moisture – 38.9%, dry matter – 64.2%, fat – 31.9%, ash – 3.29% and protein – 24.3%.

Mohammad &Tahir (2014) were investigated the phys-

**Table 1. Physicochemical composition of white brined cheese with tobbaco seeds, %**

| | Protein | | Soluble protein | | Degree of maturity | | Fat | | Humidity | | Total solids | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SX | SD | SX | SD | SX | SD | SX | SD | SX | SD | SX | SD |
| I | 11.30 | 0.31 | 3.40 | 0.33 | 30.66 | 0.28 | 10.80 | 0.53 | 57.57 | 1.17 | 42.76 | 0.56 |
| II | 11.66 | 0.39 | 3.56 | 0.45 | 30.54 | 0.12 | 17.56 | 0.33 | 57.71 | 1.25 | 42.21 | 0.41 |
| III | 10.08 | 0.26 | 2.45 | 0.31 | 24.25 | 0.24 | 27.25 | 0.23 | 51.15 | 1.48 | 48.60 | 0.42 |
| IV | 9.41 | 0.17 | 1.80 | 0.18 | 19.14 | 0.28 | 19.26 | 0.54 | 51.13 | 1.13 | 49.25 | 0.38 |
| V | 9.18 | 0.16 | 1.63 | 0.12 | 17.90 | 0.29 | 23.85 | 0.29 | 56.21 | 0.44 | 43.86 | 0.21 |

*Note:* I – control, II – 1%additive, III – 2.5% additive, IV – 5% additive, V – 7.5% additive

**Table 2. Statistical reliability of the results obtained for the physicochemical composition of white brined cheese with tobacco seeds**

| | Protein | Soluble protein | Degree of maturity | Fat | Humidity | Total solids |
|---|---|---|---|---|---|---|
| I/II | | | | *** | | |
| I/III | ** | * | *** | *** | *** | *** |
| I/IV | *** | *** | *** | *** | *** | *** |
| I/V | *** | ** | *** | *** | | |
| II/III | ** | * | *** | *** | *** | *** |
| II/IV | *** | ** | *** | ** | *** | *** |
| II/V | *** | ** | *** | *** | | ** |
| III/IV | * | * | *** | *** | | |
| III/V | ** | * | *** | *** | * | *** |
| IV/V | | | ** | *** | ** | *** |

*Note:* *P ≤ 0.05; **P ≤ 0.01; ***P ≤ 0.001

icochemical composition of 10 tobacco genotypes. Protein, ash, fiber and oil contents ranged from 20.861 to 23.872%, from 2.067 to 3.467%, from 13.66 to 19.33% and from 24.56 to 41.933%, respectively.

Lazova-Borisova et al. (2020) was made a study and found that the protein content in organic whole grain rye flour was 10.30%, and in organic tobacco flour it was 23.90%. It also found that the fat in organic rye flour was 2.29% and in organic tobacco flour it was 35.97%; and that the amount of fiber in organic rye flour was 8.00%, while in organic tobacco seed flour they were 22.10%.

The content of saturated fatty acids in the control white brine cheese was 62.15 g/100 g fat and when tobacco seed was added they decreased by 6% at 1% additive, 8% at 2.5, 5 and 7.5% suppliment, 9% at 7.5% additive, 16% at 10% supplement and 12% at 12.5% additive. A slight decrease in the content of monounsaturated fatty acids was found by 1% at 5% addition, by 2% at 7.5% suppliment, by 3% at 10, 12.5 and 15% addition compared to the original cheese and did not suffer a change during the addition of 1 and 2.5% additive. Polyunsaturated fatty acids increased by 1, 3, 5, 9, 14, 16% compared to the control cheese when adding 1, 2.5, 5, 7.5, 10, 12.5 and 15% of the tobacco seed supplement, which was due to the content of omega-6 fatty acids.

Trans fatty acid content increased slightly from 4.84 g/100 g fat to 5.58 g/100 g fat at 12.5% supplementation. The cis isomers of oleic acid increased by 4% at 12.5% input additive in the white brine cheese compared to the baseline. The trend of increasing in omega-6 fatty acids by the white brine cheese, which was found in the PUFAs content was maintained. Omega-3 fatty acids in the white brine cheese increased from 1.07 g/100 g fat at the control cheese to 3.24 g/100 g fat when adding 12.5% tobacco seed. The ratio of omega-6 to omega-3 fatty acids increased as a result of the addition of tobacco seed from 1.89 in the control cheese to 7.52 at 7.5% suppliment. The total content of conjugated linoleic acid varies with the different amount of added tobacco seed and reaches the highest concentration at 7.5% (Table 3).

Kirkova et al. (2016) was studied the fatty acid composition of Virginia tobacco seed and found that the percentage ratio between fatty acid groups was relatively constant, namely: saturated, monounsaturated, polyunsaturated fatty acids was 30%: 60%:10%. Palmitic fatty acid from the SFA group, oleic fatty acid from the MUFA group and linoleic fatty acid from the PUFA group stand out with the highest content. Kirkova et al. (2015, 2017) in their research prove that the seeds of the three common types of tobacco in our country were rich in polyunsaturated fatty acids and fiber. They also found that poppy and sesame seeds had a high content of polyunsaturated fatty acids, fiber and carbohy-

**Table 3. Fatty acid profile of white brined cheese with addition of tobacco seeds, g/100 g fat**

| | Control | | 1% | | 2.50% | | 5% | | 7.5% | | 10% | | 12.5% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SX | SD | SX | SD | SX | SD | SX | SD | SX | SD | SX | SD | SX | SD |
| SFA | 62.15 | 2.79 | 61.38 | 1.93 | 60.76 | 1.50 | 54.90 | 2.35 | 49.25 | 4.47 | 47.54 | 1.68 | 49.22 | 2.37 |
| MUFA | 27.94 | 2.85 | 30.64 | 1.60 | 30.56 | 1.43 | 30.92 | 0.60 | 30.83 | 0.64 | 29.12 | 0.59 | 29.06 | 1.94 |
| PUFA | 3.67 | 0.55 | 5.34 | 0.53 | 7.94 | 0.53 | 11.43 | 1.38 | 18.66 | 3.14 | 23.05 | 3.55 | 22.53 | 2.40 |
| ΣTFA | 4.84 | 1.08 | 4.08 | 0.60 | 5.10 | 0.55 | 5.76 | 1.08 | 5.52 | 0.64 | 5.15 | 0.42 | 5.58 | 0.46 |
| ΣCLA | 0.60 | 0.36 | 0.59 | 0.03 | 0.47 | 0.06 | 0.62 | 0.09 | 0.64 | 0.14 | 0.86 | 0.27 | 0.57 | 0.09 |
| C-16:0/C-18:1cis9 | 1.43 | 0.19 | 1.39 | 1.46 | 1.35 | 1.00 | 1.17 | 1.38 | 1.04 | 1.23 | 1.04 | 1.39 | 0.96 | 0.74 |
| C-16:0/C-18:1 ges. | 1.07 | 0.06 | 1.14 | 0.07 | 1.05 | 0.02 | 0.89 | 0.08 | 0.79 | 0.15 | 0.79 | 0.14 | 0.83 | 0.16 |
| Σn-3 | 1.07 | 0.10 | 1.20 | 0.10 | 1.29 | 0.23 | 1.49 | 0.32 | 2.12 | 0.64 | 3.56 | 1.50 | 3.24 | 1.28 |
| Σn-6 | 2.02 | 0.28 | 3.55 | 0.61 | 6.18 | 0.25 | 9.36 | 1.24 | 15.92 | 2.40 | 18.86 | 2.29 | 18.72 | 1.98 |
| ΣMCT(C-10>C-14) | 14.78 | 1.06 | 13.91 | 1.06 | 14.00 | 0.95 | 11.61 | 1.30 | 9.20 | 2.46 | 8.81 | 2.65 | 9.56 | 1.59 |
| ΣSCT(C-4>C-8) | 4.36 | 2.62 | 0.21 | 0.10 | 1.32 | 0.72 | 0.03 | 0.02 | 0.11 | 0.05 | 0.56 | 0.29 | 1.89 | 1.05 |
| CLA 9c,11t | 0.40 | 0.28 | 0.35 | 0.10 | 0.16 | 0.01 | 0.22 | 0.04 | 0.20 | 0.05 | 0.27 | 0.10 | 0.12 | 0.03 |
| Σn-6/Σn-3 | 1.89 | 0.42 | 2.97 | 0.78 | 4.81 | 1.04 | 6.29 | 0.57 | 7.52 | 2.59 | 5.30 | 2.21 | 5.78 | 2.41 |
| ΣCFA | 19.38 | 2.34 | 23.27 | 3.66 | 22.08 | 2.70 | 22.19 | 2.49 | 22.63 | 7.43 | 21.30 | 7.00 | 23.65 | 6.20 |
| BFA | 2.31 | 0.45 | 1.93 | 0.82 | 1.76 | 0.79 | 1.48 | 1.13 | 1.31 | 0.81 | 0.91 | 0.83 | 1.38 | 0.63 |

drates, inferior to them in terms of fat content. They were superior to poppy seeds in terms of calories and inferior to sesame seeds.

Mohammad & Tahir (2014) were investigated the fatty acid composition of 10 tobacco genotypes. The content of phospholipids, sterols and tocopherols in the oils was 0.453-1.167%, 0.2-0.373% and 0.005-0.007%, respectively. They were found a significant difference between genotypes for all saturated and unsaturated fatty acids. Palmitic (21.33 to 25.667%) and oleic fatty acids (17.00 to 26.667%) predominate in the oils.

Lazova-Borisova et al. (2020) was researched and established the fatty acid composition of tobacco flour as follows: saturated – 5.54%, monounsaturated – 12.42% and polyunsaturated – 71.81% fatty acids. It also establishes the content of biologically active substances in the oils and seeds of tobacco (variety Oriental) – fatty acids – saturated – 15.54%, unsaturated – 84.16%, Σω-3-0.64%, Σω-6- 71, 11%, ω-6/ω-3 – 111.1.

Scientists had worked on improving the fatty acid profile of milk and dairy products by adding unsaturated fatty acids through feed and fortifying dairy products with high content of PUFAs oils (Abou- Zeid, 2016). Peanuts contain a high level of unsaturated fatty acids acids and have attracted the attention of manufacturers to be used as an ingredient in various foods because they were cheap and nutritious (Sanders, 2001). They were rich in protein, fat and fibber and were present in their most useful forms (Suchoszek-Lukaniuk et al., 2011). All these components were present in their most useful forms. The fatty acid profile of peanut fat contains 50% monounsaturated (MUFAs), 33% polyunsaturated (PUFAs) and 14% saturated fatty acids, therefore their combination was beneficial for the heart (Feldman, 1999). Peanut consumption induces several biological effects such as weight loss (Alper & Mattes, 2002), prevention of cardiovascular disease by lowering blood pressure and blood cholesterol levels (Lopes et al., 2011), anti-inflammatory effects (Higgs, 2003) and inhibiting cancer (Awad et al., 2000).

The use of peanut milk in the preparation of yogurt (Isanga & Zhang, 2009) and cheese spread (Rafiq & Ghosh, 2017) has been reported. They were investigated and found an increased content of unsaturated fatty acids in the melted cheese by adding peanuts with a concentration of 5%, 10% and 15% by reduced content of saturated (SFA from 64.19 to 57.37%) and increased level of polyunsaturated (PUFA from 5.64% to 10.71%). The fatty acid profile has been improved by adding peanuts up to 10% without affecting the qualities of the product and to improve its functional value. The addition of peanuts to the processed cheese leads to an increase in the moisture content with the addition of 10% – 42.29% and respectively 15% – 42.50%, compared to the control – 40.95%, increasing the fat levels respectively 31.35% at 5%, 31.82% at 10% and 32.21% – 15% supplement compared to the control 30.26%. They also found a decrease in the protein content- 19.79% at 5%, 19.46 – 10% and 8.89 – 15% compared to the control 21.82%, corresponding pH 3.78 – 5%, 3.74 – 10% 3.87 – 15% compared to the control 4.03.

Ivanova et al. (2020) were investigated the influence of rapeseed oil and basil extract on the chemical and sensory properties of fresh cheese spread. An important feature of the final product was its biological and functional value. The health benefits of cheese with partial replacement of milk fat with rapeseed oil was characterized by a reduced content of saturated fatty acids, which have a negative effect on human health 35.02 g.100 $g^{-1}$ compared to 68.33 g.100 $g^{-1}$. The product contains a large proportion of short-chain fatty acids, characteristic of milk fat, which determines the functionality of the final product (Besten et al., 2013; Niccolai et al., 2019).

## Conclusion

The technological processing of bulktank buffalo milk to white brine cheese with the addition of large amounts of tobacco seed leads to a technological loss of protein and fat as a result of proteolytic and lipolytic processes during the ripening process, which in turn leads to a decrease in the content of total solids in the white brined cheeses with additives compared to the control group. The addition of tobacco seed does not affect the actual ripening process of the white brine cheese, which is established and proven by the degree of maturity indicator.

The content of saturated fatty acids in the white brine cheese with the addition of different amounts of tobacco seeds decreases, monounsaturated fatty acids slightly decrease. While the content of polyunsaturated fatty acids increases with increasing concentration of the additive in the white brine cheese, which is determined by the high levels of unsaturated fatty acids in the suppliment.

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