SOME PROPERTIES OF FERMENTED MILK PRODUCT WHICH WAS PRODUCED FROM DIFFERENT MILK TYPES BY USING CHICKPEA

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ABSTRACT

In this research, fermented milk products which were similar with yogurt and produced by clotting of cow, goat and sheep milks with chickpea were stored at 4±1°C. The effects of using different milk types on pH, titration acidity, dry matter content, fat content, protein content, ash content, acetaldehyde content, tyrosine content, total volatile fatty acids, water holding capacity, serum separation, viscosity, curd firmness, L, a, b values and sensory properties were investigated.

According to obtained results; the effects of using different milk types were found significant ($p<0.05$) on pH, titration acidity, dry matter content, fat content, protein content, ash content, acetaldehyde content, tyrosine content, total volatile fatty acids, water holding capacity, serum separation, viscosity, curd firmness, L, a, b values, appearance, consistency properties, odor and taste properties.

As a result of sensory analysis; when appearance, consistency (by spoon), consistency (in mouth), odor and taste properties were considered, fermented milk product which was produced by goat milk was the most desired product.

INTRODUCTION

Although the most known milk type is cow milk in Turkey, mainly four types of milks are consumed and these are cow, ewe, goat and water buffalo milks (FAO, 2003; Besler and Unal, 2006). However, the greatest part of milk production and consumption belongs to cow milk in both our country and the world (Terin, 2014). For this reason, cow milk has a great importance for dairy technology. The composition of cow milk changes mainly with race and many other factors. The average composition of cow milk may be expressed as 4% fat, 8.9% non-fat dry matter, 4.6% lactose, 3.3% protein, 2.6% casein, 0.70% mineral components, 87.10% moisture, 31% fat in dry matter, 0.17% organic acids and 0.15% other components (Gursoy, 2017).

Goat milk has high quality protein, essential fatty acids, fat, carbohydrate (lactose), various vitamins and minerals. Beside of these components, goat milk contains many bioactive components such as nucleotides, free amino acids and polyamines further than cow milk (Brandao et al., 2017). According to researches which are about goat milk, it is very precious in terms of its composition, nutritional value and some other properties (Lacin, 2005). It was specified that goat milk had 3.8% fat, 8.9% non-fat dry matter, 4.1% lactose, 3.4% protein, 2.4% casein and 0.8% ash content (Onur, 2015).

Ewe milk is an important income source especially in many Asian and European countries. Because of its high fat and protein contents, production of some ewe cheeses that are worldwide famous was performed in Israel, Italy and France. The ewe milk has high prices in our country (Sahin and Akmaz, 2004). It is widely used in making of yogurt and cheese because of its high dry matter, fat and protein contents (Metin, 2001; Posecion et al., 2005; Ozer, 2006; Ocak et al., 2009). It was stated that ewe milk had 7.9% fat, 12% non-fat dry matter, 4.9% lactose, 6.2% protein, 4.2% casein and 0.9% ash contents (Onur, 2015).

Functional product may be defined as a food or food component which has beneficial properties in terms of human health (Mehenktas and Bayaz, 2004). Today, increasing awareness about human nutrition depending on increase in education level affects the consumer attitude to functional and organic products in a positive way. This situation led to

increase researches about functional products in dairy industry. However further researches about this subject is required. There are three different approaches for functional dairy product production:

- Prebiotic, probiotic and symbiotic dairy product,
- Enriched dairy product,
- Energy-reduced dairy product (Sezen and Koçak, 2006).

At this research which is within enriched milk product, chickpea was used as enrichment agent. Chickpea (*Cicer arietinum*) is a leguminous species of *Cicer* belonging to the *Faboideae* subfamily of the leguminous (*Fabaceae*) family (Singh, 1997). Beside of its rich protein, mineral and vitamin content, its dietary fiber content is also very important (Peksen and Artik, 2005). It is known that chickpea protein isolates are used for enrichment of the products such as cheese, bread and meat products (Sanchez-Vioque et al., 1999).

Although chickpea is generally used as yeast in dough production, information about yogurt (fermented milk) production by using chickpea present at the media lastly and it becomes more common. Yogurt production which is performed by clotting of milk by chickpea may be applied domestically at homes. At this research, yogurt-like fermented milk product which was produced by clotting of cow, goat and ewe milks by using chickpea was stored at 4±1ºC. The effects of using different milk types on some physical, chemical and sensory properties of fermented milk product were examined.

MATERIAL AND METHOD

MATERIAL

In the production of fermented milk product which was obtained by using chickpea, raw cow, goat and ewe milks that were supplied from Cukurova University Faculty of Agriculture, Research and Application Farm Animal Husbandry Branch were used. Chickpea (Kocbasi) was supplied from the local markets. Milk powder which was used for enhancing dry matter amount was supplied from Pınar A.Ş. Polypropylene boxes of 200 grams were used as packaging materials.

METHOD

This research was performed at Cukurova University Agricultural Faculty Food Engineering Department Dairy Technology Laboratory. Some preliminary experiments were applied for determining the amount of chickpea which would be used in the production of the fermented milk product. For this purpose, 5, 10 and 15 grams of chickpeas were tried for 200 ml of milk and using of 10 grams of chickpea was found proper in terms of curd firmness (penetrometer values), serum separation and appearances of the samples. In another preliminary experiment, chickpeas were added to milk with three different ways; as directly, boiled and ground. The fermented milk product samples which were obtained by boiled and ground chickpeas had dark yellow color and had further serum separation. Therefore using chickpeas directly was found more appropriate.

While fermented milk product production, 3% of milk powder was added to milk and it was heated to 90°C for 5 minutes. At the first step, 10 gram of chickpea was used for 200 ml of milk and chickpea yeast was obtained. Then the same process was performed four times by using this chickpea yeast and fermented milk product was obtained at totally five steps. In the main production, the product which was obtained at the last (5^{th}) step was used for clotting. Milk was cooled to 44± 1°C and 5% of the yeast that was obtained by chickpea was added to it. Milk was poured into the polypropylene boxes and incubated at 44± 1°C until its pH value reached to 4.7. After incubation, it was stored at 4±1°C. The production

was performed in three replications and some physical, chemical and sensory properties of the samples were examined.

Dry matter amounts were determined by gravimetric method (IDF, 1982). Fat contents of ice cream samples were determined by Gerber method (TSE, 2006). Protein contents of samples were determined by Micro Kjeldahl method (IDF, 1993). Ash content was found by burning of the samples at 550℃ and calculating percentage of remaining ash (Kurt et al., 2007). Acidity analyses were performed according to alkali titration method and the results were expressed as lactic acid % (TSE, 2006). pH values were determined by using Testo 230 pH meter (Cemeroglu, 1992). For determining serum separation (%) values, 25 gram of the sample at 4±1ºC was filtered by coarse filter paper for 120 minutes, weighed the filtrate and results multiplied with 4 (Konar, 1980; Tamime et al., 1996). For determining the viscosities of the samples, 15th and 30th seconds viscosity values were measured at +4°C at 100 rpm (Gassem et al., 1991). Penetrometer values were determined by using Sur Berlin Pnr p penetrometer (Alagoz, 1992). Acetaldehyde contents of samples were determined by iodometric method according to Less and Jago (1969). Tyrosine contents were determined by spectrophotometric method according to Hull (1947). Total volatile fatty acid contents were determined according to Kosikowski (1978). Water holding capacities were calculated by centrifuging 5 gram of sample at 4500 rpm at 10°C for 30 minutes, removing supernatant and weighing pellet (Wu et al., 2001). In the color analysis, Hunter Lab Color Flex color meter was used (Kahyaoglu et al., 2005). Sensory analyses of the samples were performed by panelist group that had 7 members. They were performed according to TS 1330 yogurt notification (TSE, 2006). Statistical analyses were performed by using SPSS 21.0 version in terms of Duncan multiple comparison tests (Duzgunes et al., 1987).

RESULTS AND DISCUSSION

Some physicochemical properties of fermented milk product which was produced by using chickpea were given at Table 1.

Table 1

Some physicochemical properties of fermented milk product

Properties	A	B	C
pH	4.72±0.14^{a}	4.71±0.05^{a}	4.65±0.15^{a}
Titration acidity (L.a%)	0.74 ±0.16^{a}	0.84±0.24^{a}	0.88±0.32^{a}
Dry matter (%)	13.59±0.96^{c}	15.66±0.61^{b}	19.19±0.35^{a}
Fat (%)	3.33±0.20^{b}	4.33±0.15^{b}	5.66±0.90^{a}
Protein (%)	4.94±0.10^{c}	6.18±0.06^{b}	7.75 ±0.03^{a}
Ash (%)	0.90±0.02^{c}	1.10±0.02^{b}	1.26±0.01^{a}
Acetaldehyde (ppm)	13.06±0.10^{c}	17.21±0.48^{b}	19.96±0.07^{a}
Tyrosine(mg/g)	0.10±0.00^{b}	0.11± 0.00^{a}	0.11±0.00^{ab}
Total volatile fatty acid (0.1 N NaOH/100g)	0.41±0.01^{a}	0.40± 0.01^{a}	0.27±0.02^{b}
Water holding capacity (%)	65.60 ± 0.91^{c}	71.63±3.85^{b}	85.66±2.47^{a}
Serum separation (%)	23.85±5.47^{a}	19.77±4.24^{a}	3.04±0.77^{b}
Viscosity at 15th sec. (cP)	903.60±265.08^{b}	1322.00±90.06^{b}	3183.33±331.42^{a}
Viscosity at 30th sec. (cP)	601.30±178.67^{b}	1127.93±157.03^{b}	2914.33±407.44^{a}
Penetrometer (1/10 mm)	209.55± 21.50^{a}	192.55±21.04^{ab}	151.72±23.06^{b}

a, b, c: Values that are shown in the same line with different exponential letters are different in terms of $p<0.05$ level of significance.

The fermented milk product produced by cow milk was expressed as A sample, by goat milk was expressed as B sample and by ewe milk was expressed as C sample.

Using of different milk types in the production of fermented milk product had statistically significant effects on dry matter, fat, protein, ash, acetaldehyde, tyrosine, total volatile fatty acid contents, water holding capacity, serum separation, viscosities at 15th and 30th seconds and penetrometer values ($p<0.05$). However, there was no significant effect on pH and titration acidity values of fermented milk product samples ($p>0.05$). When pH values of the samples were evaluated, the highest value was determined in A sample and B and C samples followed it respectively. As expected, conversely pH values, the highest titration acidity value was determined in C sample and B and A samples followed it respectively. The highest dry matter amount was seen in the sample that was obtained by ewe milk and the samples obtained by goat and cow milks followed it. The dry matter amounts of the samples were proportional with the dry matter amounts of milks that were used as raw materials in the production. Similarly, fat, protein and ash contents of samples were proportional with the milks and the highest values were recorded in C, B and A samples respectively. The amount of acetaldehyde is about flavor properties of yogurts. According to the obtained results, C sample has the highest amount of characteristic flavor and B and A samples followed it respectively. It is known that tyrosine amount is used for determining the total amino acid content which is released by proteolysis. According to the obtained results, C and B samples had the similar tyrosine content, but A sample had lower values. When the total volatile fatty acid contents of the samples were evaluated, the highest values were recorded in A, B and C samples respectively. The highest water holding capacity was seen in the sample obtained by ewe milk and the samples obtained by goat and cow milks followed it respectively. Serum separation amounts were found inversely proportional with water holding capacities of the samples as expected and the least amount of serum separation was seen in C sample. In parallel with these results, the sample obtained by ewe milk had the highest consistency and viscosity values and the samples obtained by goat and cow milks followed it respectively. According to the penetrometer analysis, the hardest sample was found as C sample. The color properties of fermented milk products were shown at Table 2.

Table 2

Color properties of fermented milk product

Properties	A	B	C
L	92.78±0.50^{b}	94.05±0.58^{a}	93.50±0.37^{ab}
a	-4.10±0.34^{a}	-4.40±0.41^{a}	-5.78±0.29^{b}
b	10.57±1.04^{b}	10.81±0.61^{b}	17.50±1.54^{a}

a, b: Values that are shown in the same line with different exponential letters are different in terms of $p<0.05$ level of significance.

When the color properties of fermented milk products were evaluated, it was determined that using different milk types had statistically significant effects on these properties ($p<0.05$). The highest L value, brightness, was seen at the sample which was obtained by goat milk and samples which were obtained by ewe and cow milks followed it respectively. Low a value is expressed as high amount of green color in the sample. In this situation, the lowest a value was determined in the sample which was obtained by ewe milk and the samples which were obtained by goat and cow milks followed it respectively. High b value is expressed as high amount of yellow color in the sample. The highest b value was determined in the sample which was obtained by ewe milk and the lowest value was recorded in the sample which was obtained by cow milk.

The sensory properties of fermented milk products which were produced by using chickpea were given at Table 3. Appearance (5 points), consistency by spoon (5 points),

consistency by mouth (5 points), odor (5 points) and taste (5 points) properties were scored by the panelists.

Table 3

Sensory properties of fermented milk product

Properties	A	B	C
Appearance	3.92±0.32^{b}	4.60±0.37^{a}	4.30±0.10^{ab}
Consistency (by spoon)	3.95±0.29^{b}	4.39±0.25^{ab}	4.71±0.14^{a}
Consistency (by mouth)	4.09±0.33^{a}	4.10±0.20^{a}	4.38±0.10^{a}
Odor	4.66±0.35^{a}	4.49±0.38^{a}	4.04±0.47^{a}
Taste	4.40±0.25^{a}	3.97±0.35^{ab}	3.61 ± 0.17^{b}
Total	**21.02**	**21.55**	**21.04**

a, b: Values that are shown in the same line with different exponential letters are different in terms of $p<0.05$ level of significance.

When the sensory properties of fermented milk product were evaluated, the effects of using different milk types on appearance, consistency (by spoon) and taste properties were found significant ($p<0.05$). However, it had no significant effect on consistency (by mouth) and odor properties. The most liked fermented milk product in terms of appearance was chosen as the sample obtained by goat milk and the sample obtained by cow milk had the lowest points. The highest points in terms of consistency properties belonged to the sample obtained by ewe milk and the sample obtained by cow milk had the lowest points again. It is determined that the most liked fermented milk product in terms of odor and taste properties was the sample obtained by cow milk and the least liked sample was obtained by ewe milk. When they were generally evaluated, the most desired sample was obtained by goat milk and the samples obtained by ewe and cow milks followed it respectively.

CONCLUSION

When the general properties of fermented milk product were evaluated, the highest nutritional value was determined in the sample which was obtained by ewe milk and fermented milk products obtained by goat and cow milks followed it respectively. When the physical properties of the samples were compared, it was determined that the sample obtained by ewe milk has the highest viscosity and the samples obtained by goat and cow milks followed it respectively. In terms of color and appearance, when L, a and b values were considered, samples obtained by goat and cow milks were more desired than sample obtained by ewe milk because of its yellowish-greenish color. The sample obtained by cow milk was preferred by the panelists in terms of odor and taste properties. It was determined that the sample obtained by goat milk was the most liked sample in terms of general sensory properties. It can be advised that preferential goat milk, cow milk and ewe milk may be used for production of fermented milk product that is obtained by using chickpea.

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