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Research Article

Determination of Mineral Content of Butter Milk

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Abstract

Objective :
The composition and food value of buttermilk are essentially the same as those of skim milk. The fat content is higher in case of buttermilk. It supplies protein, riboflavin and calcium in the highest amount. It contains a large proportion of the protein mixture slouched from the fat globule- milk serum interface by churning. Churning 1 kilogram of cream will typically yield 0.5 kilogram of butter and 0.5 kilogram of buttermilk. Liquid buttermilk is prone to oxidation, so this product is concentrated by evaporation and then sprays dried in order to extend the shelf life. Currently, dried buttermilk is mainly used for animal feeding (swine, bovine), but also used in the food industry for its emulsion properties and its positive impacts on the texture and taste of products.

Conclusion :
In this study, it was aimed to determine the content of minerals buttermilk that uses the traditional method in the dairy plants. Calcium, potassium, phosphorus, sodium and magnesium quantities were determined by simultaneous inductively coupled plasma optical emission spectrometry (ICP-OES). In the butter milk, the concentration of Ca was 8476,94 mg/L; Mg, 526 7 mg/L; K, 1920 mg/L; Na, 6095,309 mg/L; and P, 7170,496 ± 23 mg/L.

Key Words: Dairy-waste, butter, buttermilk, mineral contents

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Buttermilk is an industrial waste with a high organic load of all the components found in milk solids. This byproduct from the production of butter is directly released into the sewer system and is never evaluated or tested for its components. Buttermilk is a dairy ingredient widely used in the food industry because of its emulsifying capacity and its positive impact on flavor. Buttermilk contains milk proteins (caseins and whey proteins), lactose, vitamins, and minerals in the same proportion as skimmed milk, meanwhile its amount of phospholipids is about nine times higher (MacGibbon & Taylor 2006).

The overall production of liquid buttermilk is 4.1 million tons worldwide and 0.6 million tons in the United States, based on the annual production of butter from 40% cream. In the United States, the commercial use of buttermilk is mainly for the baking industry (39%), prepared dry mixes (33%), and for the dairy industry (23%). (Sodini et al., 2006) In the baking industry, buttermilk is used to improve flavor and texture of bakery products (Vetter 1984). Other industrial uses of buttermilk are to prepare functional mixes for various foods, such as sauces, chips, and chocolate products (Chandan, 1997). In the dairy industry, buttermilk is used in cheese making (Joshi et al., 1994), in formulation of ice cream (Chandan, 1997) or yogurt (Trachoo and Mistry, 1998), or in the manufacture of recombined milks (Singh and Tokley, 1990). Cheese whey and buttermilk constituents have interesting biologic, nutritional properties, and health-benefits. Many applications have been developed to use whey in food formulation, such as in cheese, bakery, pastry, and delicatessen productions. Unfortunately, buttermilk has not found as many industrial applications as whey yet. Buttermilk is often used in baking because of its special properties (for instance, sourness, enzymes, and microflora present in this by-product). It can enhance the flavor of various preparations, that is, cips and cakes. Further, buttermilk can be used as a battering agent for frying of chops of pork and chicken (Sharma et al. 1998; Raval and Mistry 1999; Shukla et al. 2004; Patel and Gupta 2008). Various studies have also shown the thera-peutic importance of the consumption of buttermilk (Larsson et al. 2008; Conway et al. 2013a, 2013b; Fuller et al. 2013; Fu et al. 2014).

Recently, Vanderghem et al. (2010) summarized ten potential applications for buttermilk or buttermilk constituents that have been tested in research labs over the last 20 years (Table 1).

In this study, it was aimed to determine the content of minerals buttermilk that uses the traditional method in the dairy plants.

2. Materıals and Methods

Nine buttermilk samples from three different butter production plants in Burdur and Isparta, Turkey, were sent to the laboratory under cold chain (+ 4°C).

Minerals Analysis

Ash content was quantitated by dryashing the samples in a muffle furnace at 550 ◦C for 24 h. Before samples were placed in the muffle furnace, they were dried in an oven at 105 ◦C. (IDF, 1992). Calcium, potassium, phosphorus, sodium and magnesium quantities were determined by simultaneous inductively coupled plasma optical emission spectrometry (ICP-OES) (Perkin Elmer Optima 8000, ABD). Two g of cheese on ash + 8 mL of 65 % HNO3 added to 2 mL of 30 % H2 O2 were burned in the microwave Milestone at 200 °C for 15 minutes. This process was complemented with 50 ml of ultrapure water and the sample was removed from the container. For the mineral analysis, all the reagents were of an analytical grade. All the reagents and samples were prepared in double distilled water. The determinations were carried out at 315.8, 214.9, 279.0, 214.9, 589.7, 766.4, nm for Ca, P, Mg, Na, Mn and K, respectively. All the analyses were performed in duplicate.

Statistical analysis

All of the statistical calculations were performed using SPSS Statistical Software and the obtained values were presented as the mean ±SE. (Duzgunes and Akman, 1991; Draper and Smith, 1998).

Results

The mean values of the the mean values of the mineral contents are shown in Table 2. In the buttermilk, the concentration of Ca was 8476,94±751,216 mg/L; Mg, 969 ± 25526,31±107,274 mg/L; K, 19202±507,898 mg/L; Na, 6095,390±237,604 mg/L; and P, 7170,496 ±256,804 mg/L.

Discussion

Macro minerals such as calcium, magnesium, potassium and sodıum are an important group of milk nutrients required by the human body in amount greater than 100 mg per day for optimal function (Kırdar et al., 2013).

Calcium plays a major regulatory role in numerous biochemical and chemical physiological processes and it must be ingested with the daily diet (Kırdar et al., 2013). The level of calcium in the buttermilk was higher than yogurt whey and cheese whey (Kırdar et al., 2017). Buttermilk is recommended for an adequate calcium intake in a daily diet. Buttermilk provides calcium and nutritional supplements without the added calories. Getting the required calcium in your meal plan helps slow bone loss as one grows older. It provides sustenance for new bone development and keeps off osteoporosis. As a result of all these

qualities, including buttermilk into one's daily diet is a sound choice for the health-aware consumer (Vandana and Akash, 2016).

Magnesium is important for nucleic acid and protein metabolism, communication between neurons and muscles and especially the muscle system and it has also been reported that magnesium, together with calcium (Kırdar et al., 2015). The level of magnesium in the butermilk is higher than the others dairy-waste (Kırdar et el., 2017).

Phosphorus, an abundant element in nature, is also widely present in food. The majority of phosphorus in the human body is present in bones and blood and its quantity varies between 600-900 g, while the daily intake requirement is between 0.8-1.2 g (Kırdar et al., 2015).

Goyal and Gandhi (2009) recorded the values for sodium, potassium, calcium and magnesium for cheese whey 35, 130, 48, 5.9 mg/100g. Wit (2001) noticed the amount of sodium, potassium, calcium, magnesium and chloride in cheese whey by 50, 150, 60, 10 and 110 mg/100g, respectively.

Kırdar et al., 2017 reported that in the yogurt serum, the concentration of Ca was 934 ± 130 mg/L; Mg, 969 ± 257 mg/L; K, 1257 ± 159 mg/L; Na, 940 ± 104 mg/L; and P, 157 ± 23 mg/L.

In this study, the high amounts of sodium, potassium, calcium, magnesium and phosporus detected in Buttermilk. According to obtained results, the sodium, potassium, calcium, magnesium and phosporus content of buttermilk was detected to be higher than the values of dairy-waste (yogurt whey and cheese whey).

Conclusion

The tendency and potential that buttermilk components can positively influence human health and its contribution to a balanced daily diet is without doubt (although its per capita consumption is still quite low in many European countries). In the future, much more research is necessary in order to investigate the full bioactive potential of buttermilk components on the one hand and buttermilk as a whole food on the other hand.

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Table 1 Proposed applications for the use of buttermilk in food formulation (Vanderghem et al., 2010).

Sources	Desired Properties	Applications	Effects
Fresh buttermilk	Agent for the heat stability	Recombined evaporated milk	Stability increased
Ultrafiltered sweet buttermilk	Viscosity agent	Cheddar cheese	Cheddar cheese
Condensed sweet cream buttermilk	Agent for the yield, texture, meltability, and coagulation Moisture retention	Pizza cheese	Higher cheese yield, moisture content. Decreased chewy, Reduced meltability and gel strength
Buttermilk	Moisture retention Agent for the dough and sensory properties	Bread	Higher water absorption, Increased resistance to extension, Better sensory score

Tablo.2 Mineral content of yogurt serum (mg / L)

Minerals	Mean values
Ca	8476.94±751.216
Mg	526.31±107.274
K	1920.2±507.898
Na	6095.390±237.604
P	7170.496±256.804