

Evaluation of Reichert Meissl Values of Butter Produced in Turkey

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Abstract:

Butter is a high-quality dairy product which has nutritious value and special taste. The purpose of this research was to evaluate the Reichert-Meissl values of the butter samples produced in Turkey. 120 butter samples were collected as study material in 2015. The Reichert-Meissl values of the butter samples were determined in accordance with the Turkish Standard (TS1331). The mean Reichert-Meissl values of butter samples were 25.35 ± 6.76 . The highest Reichert-Meissl value was 31.11 and the lowest Reichert-Meissl value was 0.23 in all samples analyzed. When the Reichert-Meissl values of the butter samples were compared with other research results, the average Reichert-Meissl value was in accordance with previous studies. Adequate surveillance programs should be maintained to prevent the impact of food fraud.

Keywords: Reichert-Meissl value, butter, Turkey

1. Introduction

Milk fat has important nutritional properties due to its essential fatty acids. It is an important milk component, especially because it contains vital fatty acids, has high digestibility, contains fat-soluble vitamins and is dissolved at body temperature. These properties of milk fat also increase the nutritional value of butter. Butter has special nutritional, functional and organoleptic properties (Gosewade *et al.*, 2017). In addition to an amount of water present in the composition of the butter, phospholipids, hydrocarbons, sterols and sterol esters, complex glyceride oils, free fatty acids, oil-soluble vitamins, and minerals (Kumar *et al.*, 2016). Since the production process is different from other milk products, butter has its own texture and taste. Butter is a product that can maintain its freshness for one year under ideal storage conditions. The use of butter made from cow's, sheep's and goat's milk in Turkey generally is a common milk product (Atasoy & Türkoğlu, 2010). The most economically valuable dairy product is milk fat. The fact that the raw material is only milk fat in the production of butter causes the adulteration with the addition of different

low-cost oils to reduce the cost of commercial enterprises (Pradhan, 2016). Of milk fat, butter is the most subjected to adulteration by fractional substitution with diverse types of low-value fat, seeds oil or vegetable fat as margarine (Rotar, 2010). Such frauds in the butter can negatively affect both consumer health and the national dairy industry. According to other researches, it has been found that fat-like milk oils such as palm oil, cotton oil, and margarine are used for adulteration (Pradhan, 2016; Gandhi *et al.*, 2014; Sağdıç *et al.*, 2004). Sensorial testing is not consistently pertinent; however fraudulent butter may include a number of compounds seemingly natural provide with the sensory qualities similar to butter, so only the physicochemical analysis is efficient to identify and certify the adulteration (Rotar, 2010). Determination of physicochemical parameters of the butter gain importance in terms of detecting fraudulent products. Many different methods have been used to determine whether different oils are present in butter content. Some of these are attenuated total reflectance (Mid-Infrared Spectroscopy- ATR-MIR), capillary column gas chromatography (Diraman, 2006), differential scanning calorimetry (DSC)

(Aktaş & Kaya, 2001; Koca *et al.*, 2010). While these methods are fast but expensive methods, Reichert-Meissl (RM) value method is still used today as a fast and inexpensive method. RM value is the quantification of short-chain fatty acids soluble in water can be released in overall saponification (Deelstra *et al.*, 2014). The RM value method is based on the detection of volatile fatty acids found only in milk fat, such as butyric acid (C4: 0) and caproic acid (C6: 0) (Pradhan, 2016). The RM value is the amount of 0.1 N alkaline solution needed for the neutralization of volatile fatty acids by saponification, acidification and steam distillation of 5 g fat (Sözbilir & Bayşu, 2008). The value of RM is in the range of 28-35 in the milk fat samples, and it is measured as 7 in the vegetable oils (Kumar *et al.*, 2016). The aim of this study was to determine the value of RM in butter samples produced in Turkey.

2. Materials and Method

120 samples of butter were collected from the local markets and were analyzed to detect milk fat adulteration. Butter samples were brought immediately to the laboratory in a 500 mL glass containers sampling and analyzed on the same day. Butter samples of standard butter prepared from milk provided from the herd of Harran University Agriculture Faculty. Sulphuric acid (H₂SO₄), sodium hydroxide (NaOH), glycerol, phenolphthalein were purchased from Merck, Germany. After dissolving the butter samples, they were filtered to remove from their water and sediment. 5 grams of the filtered samples were weighed into 250 mL distillation flask. 20 g of glycerol and 2 mL of 44% NaOH solution were added. At this stage, the samples were destroyed to saponify, and the liquid returned to the lemon yellow was agitated by heating until clear. The flask was cooled to 90°C. 90 mL of distilled water was added and stirred. Cooling water was opened by placing a flask on the distillation collection section of the distillation device. To facilitate boiling, 0.6-0.7 g of powdered pumice was placed on the soap solution. Then, 50 mL of 1 N H₂SO₄ solution was added and placed in the distillation apparatus and distilled by boiling in such a way that 110 mL of distillate was collected over an average of 20 minutes. The heating was terminated when the distillation approached 110 mL and was completed with the last droplets to 110 mL of the marker line. The mouth of the flask was sealed and placed in a water bath at 20°C, with a 110 mL

marking a line in the water and allowed to stand at this temperature for 10 to 15 minutes. If the level dropped at the end of the line, it was completed with 110 mL line with pure water. Distillate was filtered through a filter paper into a 100 mL graduated flask. 100 mL of the filtrate was titrated with phenolphthalein and 0.1 N NaOH. Control was carried out without fat and the control at the end of the experiment was removed from the total consumption (Anonymous, 1995).

Calculation

$$\text{RM Value} = (V_1 - V_0) \times N \times f \times 11$$

V₁: NaOH solution volume spent in the experiment, mL

V₀: The volume of NaOH solution spent in the experiment, mL

N: Normality of NaOH solution used in titration

f: the factor of NaOH solution used in titration

3. Results and Discussion

The RM value of standard butter sample was 26.01. The RM values of the analyzed samples were shown in Table 1. The mean RM value of butter samples was 25.35 ± 6.76. The highest Reichert-Meissl value was 31.11 and the lowest Reichert-Meissl value was 0.23 in all samples analyzed.

Table 1: Descriptive statistics of RM values

Sample	n	Minimum	Maximum	Mean ± SD
Butter	120	0.23	31.11	18.90±7.17

SD: Standard deviation

In a survey conducted with 15 butter samples in 1993, RM values were between 22.65-28.40 and the lowest value was higher than the lowest value in our study and the highest value was close to the highest value in our study (Yalçın *et al.*, 1993). In a research, authors reported that RM value of cow ghee varies between 26-29 and RM value of buffalo and sheep ghee have is higher approximately 32 (Ganguli & Jain, 1973). The average value of the ghee samples is higher than this study's average value because of ghee's fat rate is higher than butter. In India, the study conducted by Pradhan (2016) revealed that the value of RM in the ghee samples from cow's milk ranged from 27.39 to 28.71 and the

average value was 28.01. It was reported by the researcher that the pure palm oil had 0.11-0.22, the pure soybean oil had 0.11-0.33, the canola oil had a 0.11-0.22 RM value. The researcher reported that it was easy and reliable to determine the RM value of vegetable oils added for adulteration purposes by 1.5% or more (Pradhan, 2016). Gandhi et al.'s study (2014) of added palm oil and sheep's internal fat in ghee samples, researchers reported that the value of RM of ghee samples produced from pure cow's milk was 29.50, and the value of RM of ghee samples produced from pure buffalo milk was 33.30 on average. When they added palm oil and 21% sheep internal fat, they reported that the value of RM was 23.87 in the ghee samples produced from cow's milk and 26.51 in the ghee samples produced from buffalo milk (Gandhi *et al.*, 2014). In 2016, the value of RM in a study conducted by ghee samples in Meerut province of India, RM values were in the range of 28.00-40.20 and the average RM value was 34.10 (Kumar et al., 2016). Çelik and Bakırcı (2000) reported that RM values of butter samples obtained from small dairies and family plants changed between 11.62-28.51 and 22.70-29.75 and mean values were 26.86 ± 0.86 and 22.97 ± 0.17 , respectively. The results obtained by researchers were parallel with our results. Peter & Kron (1932) declared that RM values of butter samples obtained from Hungary ranged between 25.0-27.5. Gosewade *et al.* (2017) reported that the RM value of cow and buffalo ghee samples ranged between 29.48-30.25 and 33.22-34.43, with a mean level of 29.95 and 33.91, respectively. In another study from Turkey, RM values varied from 25.57 to 26.68 in butter samples and the highest values had sheep, goat, and cow butter samples, respectively (Kahyaoğlu & Çakmakçı, 2018).

Conclusion

In conclusion, from the results obtained in this research, the mean RM value of butter samples was 25.35 ± 6.76 . When the RM values of the butter samples were compared with other researcher results, the average RM value was in accordance with previous studies. Standard surveillance programmes might be pursued for healthy value requested in the butter. Also when determining adulteration of butter we recommend determination RM value as a fast and reliable method.

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