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Research Article

Study on Quality Characteristics of Sweet and Sour Cream Butter

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Abstract: A study was conducted to assess the quality characteristics of market sweet and sour cream butter. Five experimental trials were conducted to prepare the butter from market sweet and sour cream. Parallel to that butter was also manufactured from Laboratory sweet and ripened cream for comparison purposes. Market sour cream butter, laboratory sweet cream butter, and laboratory ripened cream butter showed no considerable ($P > 0.05$) difference for refractive index. The iodine value of market sour cream butter (45.67 ± 1.60) was comparatively higher than laboratory ripened cream butter (37.49±2.96), market sweet cream butter (34.56 ± 2.03), and laboratory sweet cream butter (32.48 ± 3.44). Peroxide value of market sweet cream butter (1.56±0.17meq O2 per kg fat) was considerably ($P < 0.05$) higher than market sour cream butter (1.00±0.08meq O2/kg fat), laboratory ripened cream butter (1.00±0.10meq O2 per kg fat), and laboratory sweet cream butter (1.04±0.11meq O2 per kg fat). Saponification value of market sour cream butter (253.57±5.98mg KOH per gram fat) was significantly different ($P < 0.05$) from laboratory ripened cream butter (231.13+ 4.12mg KOH per gram fat) and laboratory sweet cream butter (228.89±5.72mg KOH per gram fat). The acid degree value of market sour cream butter (1.79±0.07mg KOH per gram fat) was comparatively different ($P < 0.05$) from laboratory sweet cream butter (1.43±0.11mg KOH per gram fat). In conclusion, saponification, iodine and acid degree values of market sour cream butter remain higher compared to other kinds of butter.

Keywords: Quality characteristics, Saponification, Sour cream, Sweet cream.

1. INTRODUCTION

Globally the butter is considered an important nutritional source for humans. It is a traditional dairy product that is consumed in all parts of the world. Butter is a rich source of most essential nutrients such as fat, fat-soluble vitamins, minerals, and energy [1]. The quality parameters of butter are fat and water content contents. The fat and water are very important from a butter adulteration point of view. At the expense of milk fat, butter producers adulterate the butter by adding some vegetable fats [2]. Nutritional studies on butter have indicated that this product should contain at least 80% fat, however water content and non-fat milk components should not exceed 16 and 2 %, respectively. Further, from spoilage and shelf concern of butter aldehydes, acid number and peroxides are much important [3]. Historical review on butter has revealed that the word butter is derived from the Latin word butyrum and Greek word boutyron. It has constructive meaning i.e. cow cheese. The root word shows the relevance with the name butyric acid which is a compound that is found in dairy products and rancid butter [4].

The butter production technique has a long history. The colder areas of the globe are mostly inhabited by creamery butter producers, where gravity creaming remains successful. It has also been stated that references to butter are mentioned in the Old Testament. In past centuries butter was considered a sign of wealth as well as an article of commerce [5]. Butter production in factories on

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a commercial-scale was unknown till mid of 19th century. In past centuries butter was mostly prepared from cream obtained by the gravity creaming at the farm. With the invention of butter churns, cream separators, fat test kits, and artificial refrigeration technologies, etc the industrial butter production has arisen rapidly. These latest technologies have lead butter among the most demanding dairy products by consumers in the world [6]. Many types of butter are commonly available in the market. Few important types include unripened cream butter, ripened cream butter, pasteurized cream butter, unsalted butter, salted butter, sour cream butter, sweet cream butter, cold storage butter, fresh cream butter, peanut butter, dairy butter, cocoa butter, and creamery butter [7]. In Pakistan curd and cream of buffalo followed by the cow, sheep, goats, and yaks are used for manufacturing the most common form of butter, however, in other parts of the world cow milk is preferred for preparing the most common form of butter. Further, giving attractiveness, palatability, and extended shelf life to the butter some types of salts, preservatives, and flavoring agents are often used [8].

Consumers are gradually shifting towards purchasing butter as an alternative due to increased health concerns as well as awareness regarding the harmful influence of other dietary fat resources [9]. Most dietary fat resources possess artificially produced trans-fats from the hydrogenated oils, however, butter is free from hydrogenated oils. Butter contains not lower than 80% fat, approximately 1.5% curd, and 3% common salt. Besides, vitamin A, 30% monounsaturated fat, and a small quantity of natural trans-fat are also found [10]. Butter being a naturally beneficial and valuable dairy product commonly consumed by the people in every part of the country is not so far evaluated yet deeply for its standards and quality in Pakistan. Thus the present study was designed to evaluate the quality characteristics of market sweet and sour cream butter.

2 MATERIAL AND METHODOLOGY

2.1. Cream Samples

Both the sour and sweet cream samples were procured from different dairy shops of Hyderabad district i.e. (Ambala dairy, Energy dairy and sweet, Light dairy, Hyderabad dairy, and Shah Latif dairy) and also prepared from buffalo milk at the laboratory of Animal products Technology, Sindh Agriculture University Tandojam.

2.2. Starter Culture

Buffalo milk was fermented with a culture of natural butter and artisanal starter culture was prepared. Starter culture was purified by repeating the culturing several times.

2.3. Production of Butter

A total of 5 trials was performed to prepare butter according to the procedure shown in Fig. 1. Trials were repeated twice for having replicated data. Butter was prepared from market sweet and sour/ ripened cream, as well as from Laboratory sweet and ripened cream from buffalo milk as control.

2.4. Analysis of Butter

2.4.1. Refractive Index (RI)

The Refractive index was analyzed as per the recommended method of AOAC, [11]. Atago refractometer (Atago Co, Ltd) was used during the technique.

2.4.2. Iodine Value

Iodine value was observed as per the procedure of AOAC, [12]. Butter sample (0.25 g) was dissolved in Chloroform ($CHCL_3$) (10ml) and then Hanus I solution (25ml) was transferred. 15% potassium Iodide solution (10 ml) was poured after let it stand for 30 min in dark. The solution was boiled, thoroughly shack, cooled, and then 100ml distilled water transferred. Using 0.1N $Na_2S_2O_3$ solution and titration kit resultant sample was titrated till turned from yellow colure to colorless. Some drops of starch (1g / 100 ml dist. water) indicator was added and continued the titration with $Na_2S_2O_3$ (0.1 N) until the blue color entirely disappeared. Besides, two blank samples were also titrated similarly to obtain an accurate result. The volume of used $Na_2S_2O_3$ was recorded and iodine value was calculated using the below-given formula:

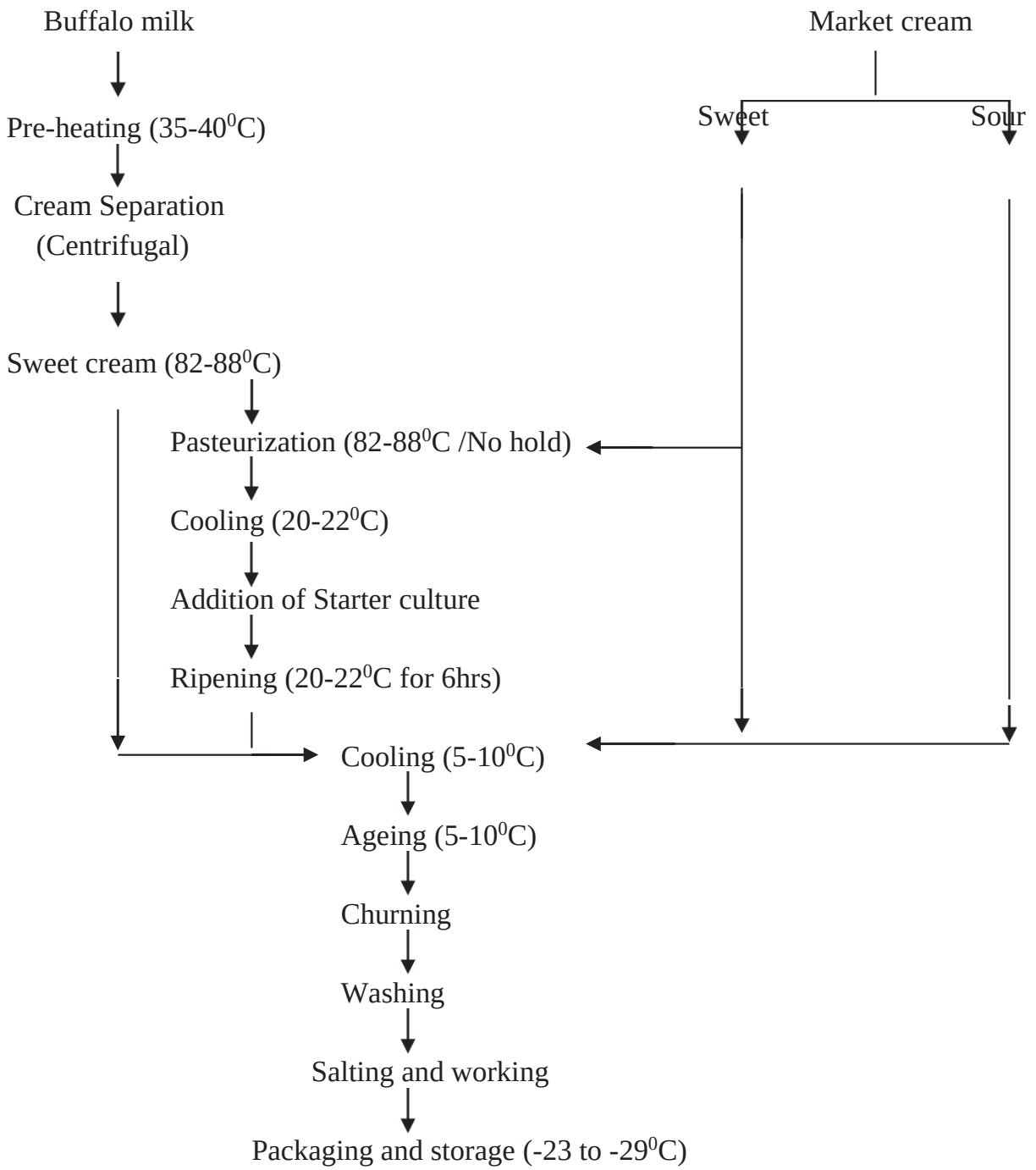


Fig. 1. Schematic representation of butter-making from sweet and sour/ripened cream

$$\text{I value} = \frac{[(B-S) \times N \times 12.69]}{\text{Sample (g)}}$$

Where N = normality of $Na_2S_2O_3$ solution,
B = blank test
S = is for a sample test

2.4.3. Peroxide Value

Peroxide value was analyzedas per the recommended method of AOAC, [13]. The sample of butter (5 g) was mixed with Acetic Acid-Chloroform (HOAc-CHCl) (30 ml) and 0.1 ml saturated potassium iodide solution was poured. The mixture was mixed and freshly boiled and cooled dist. water (30 ml)

was added. The sample was titrated with (Sodium Thiosulfate) $Na_2S_2O_3$ (0.01 N) solution using titration kit until the yellow solution turns almost gone and were added few drops of starch (1g/100ml H_2O). The sample was again titrated with $Na_2S_2O_3$ (0.01 N) until the blue color disappeared. The used volume of $Na_2S_2O_3$was recorded and the peroxide value was computed by the given formula.

$$\text{Peroxide value} = \frac{S \times N \times 1000}{\text{Sample (g)}}$$

Note: N= Normality $Na_2S_2O_3$ solution,
S= ml $Na_2S_2O_3$ (Blank corrected)

2.4.4. Saponification Value

The method recommended by AOAC, [14] was used for analyzing the saponification value. 50 ml potassium hydroxide (40 g/l) was transferred to the 5g butter sample and the resultant mixture was gently boiled till complete saponification. In the presence of an indicator namely phenolphthalein (1g/100 ml) excess potassium hydroxide was titrated with HCl (43.01 ml / l). The saponification value was expressed in terms of required mg of potassium hydroxide saponification of 1g butter sample.

2.4.5. Acid Degree Value

Acid degree value was observed using the recommended procedure of AOAC, [15]. The butter sample (5 g) place in a flask and to which Alcohol-ether (50 ml) was mixed. Using potassium hydroxide solution and titration kit the resultant sample was titrated till the appearance faint pink color persisted for ≥ 10 sec. During the titration, phenolphthalein (0.1 ml) acted as an indicator. The calculation was made using the following formula:

Acid degree value = mL alc. KOH soln x normality alc. KOH soln x 56.1/ sample (g)

2.5. Statistical Analysis

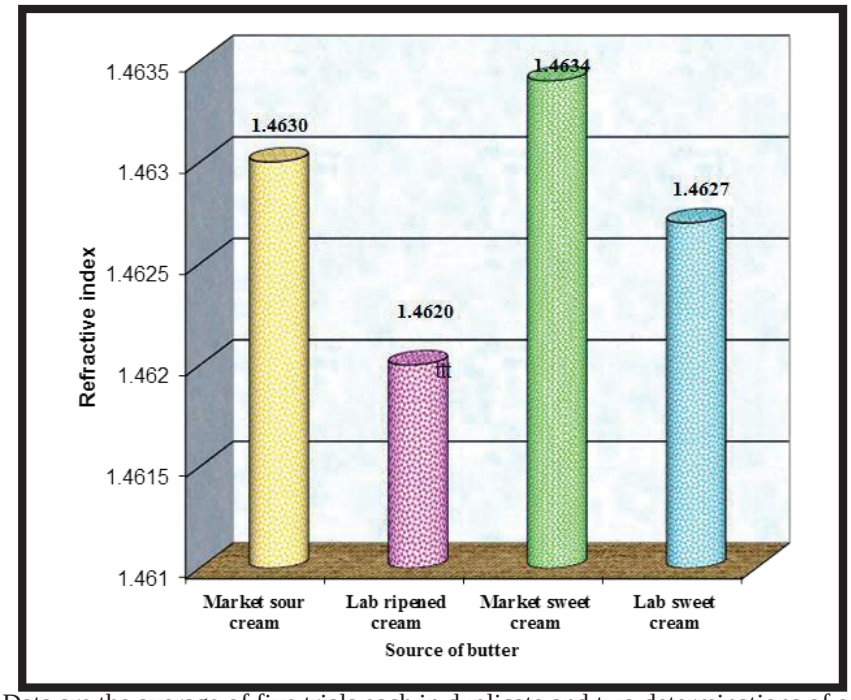
Data was gathered and analyzed by statistical program i.e. Student Edition of Statistix (Sxw), version 1.0 (Copyright 1996, Analytical Software, USA). Statistical test namely Analysis of Variance was performed to observe any significant variation among means. Means were considered significantly different at ($P > 0.05$).

3. RESULTS AND DISCUSSION

The present study was organized to produce and compare market sweet and sour cream butter. The study indicated that ingredients used for butter production considerably influenced the chemical properties and quality characteristics of the end product i.e. butter. Some well-known fat constants were used to observe the quality characteristics of cream (sweet or sour) as well as butter. Those constants served as an indication of the types of components/fatty acids present in particular fats. Some of the more commonly used constants are presented and discussed below.

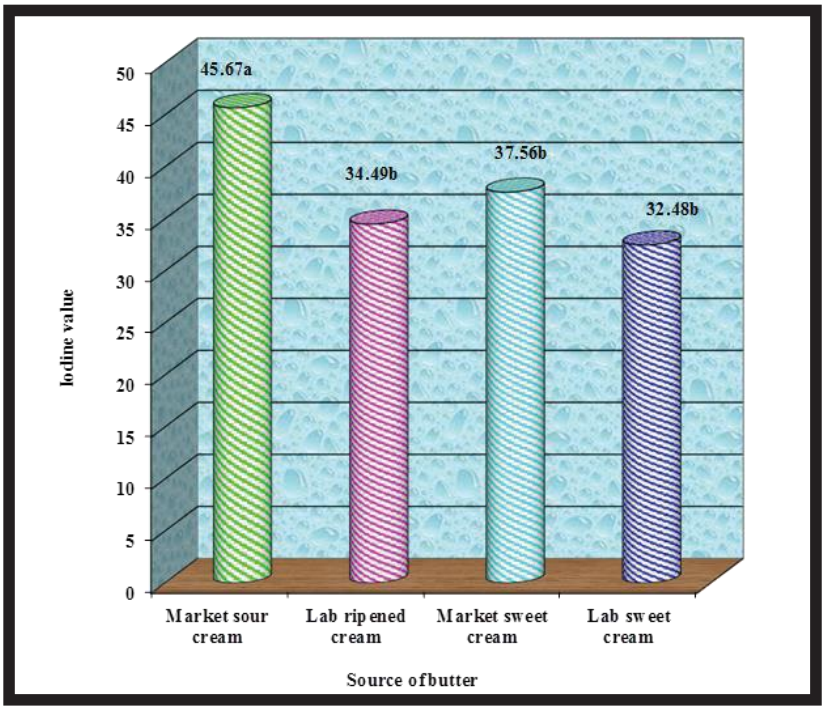
The Refractive index of market sour cream butter (1.4630 ± 0.001) was lower than market sweet cream butter (1.4634 ± 0.004), but not significantly different ($P>0.05$). The result of the refractive index of butter made from market cream (sweet or sour) was higher than laboratory-made cream (sweet or ripened) butter. This indicates that market cream (sweet or sour) butter had more unsaturated fat compared to laboratory-made cream butter, but, there were no statistical differences ($P>0.05$) between them (Fig. 2). However, the refractive index of butter observed in the present study is within the range of reported values i.e. from 1.4538 to 1.4578 [16].

Iodine values are given in Fig. 3, which indicate that the Iodine value of market sour cream butter (45.67 ± 1.60) was significantly ($P<0.01$) higher than market sweet cream butter (37.56 ± 2.03). It indicates that market sour cream butter could take up more iodine compared to market sweet cream butter due to the presence of unsaturated linkage [17]. However, the iodine values in both types of kinds of butter were significantly ($P<0.01$) higher than butter made from laboratory ripened cream butter (control). It was further noticed that iodine values of butter made from either market sweet cream or laboratory sweet cream (control) were not significantly different ($P>0.05$). While values of iodine in laboratory sweet or ripened cream butter were within the normal range of reported values [18].



Data are the average of five trials each in duplicate and two determinations of each.

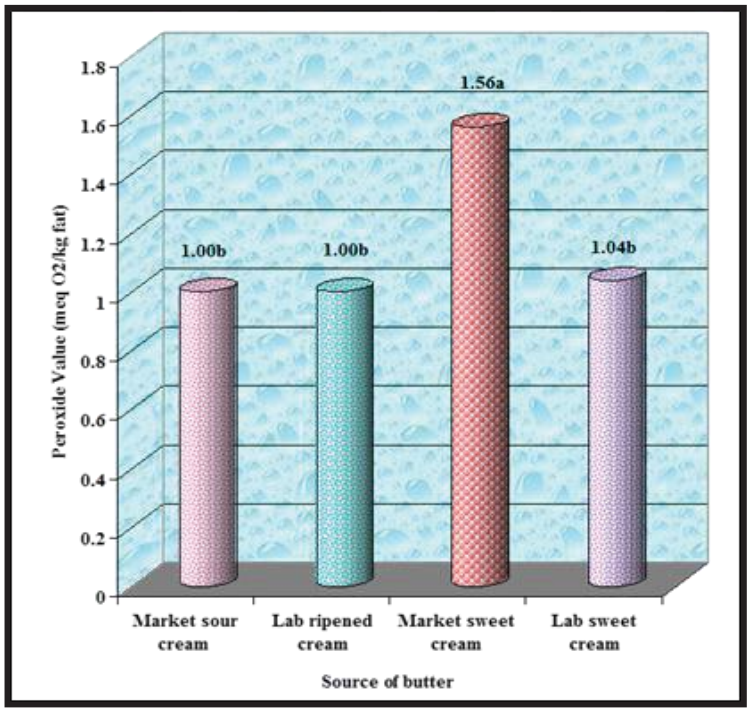
Fig. 2. Refractive index of butter made from sour/ripened and sweet cream



LSD (0.05) = 7.84
SE± = 3.70

Data are the average of five trials each in duplicate and two determinations of each

Fig. 3. Iodine values of butter made from sour/ripened and sweet cream



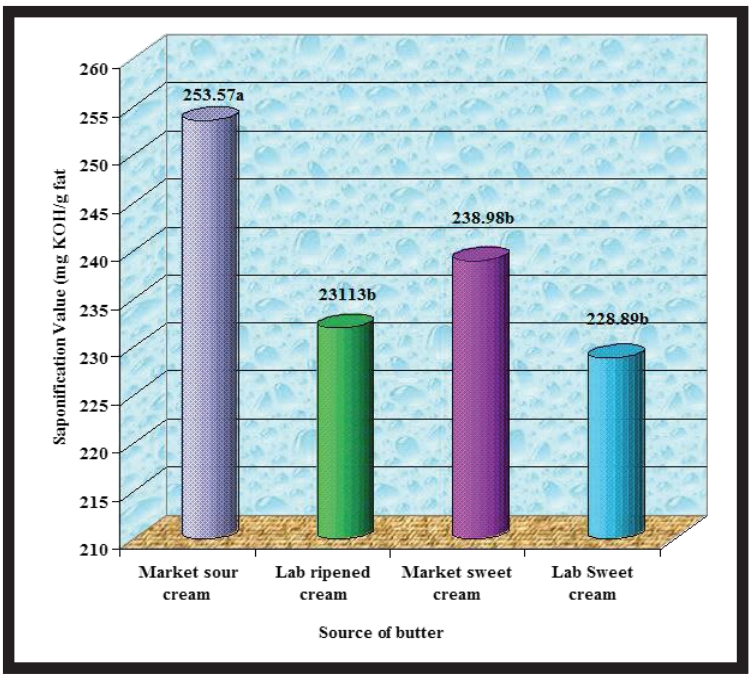
LSD (0.05) = 0.38
SE± = 0.18
Data are the average of five trials each in duplicate

Fig. 4. Peroxide value (meq O_2/kg fat) of butter made from sour/ripened and sweet cream

Peroxide value, one of the tests to measure the oxidation level in butterfat was analyzed in Fig. 4. It was observed that the peroxide values in market sweet cream butter (1.56 ± 0.17 meq O2 / kg fat) were comparatively higher than market sour cream butter (1.00 ± 0.08 meq O2 / kg fat). It was further found that market sweet cream butter (1.56 ± 0.17 meq O2/kg fat) had more peroxide values (amount of active O2) compared to laboratory-made sweet cream butter (control) i.e. 1.04 ± 0.11 meq O2/kg fat.

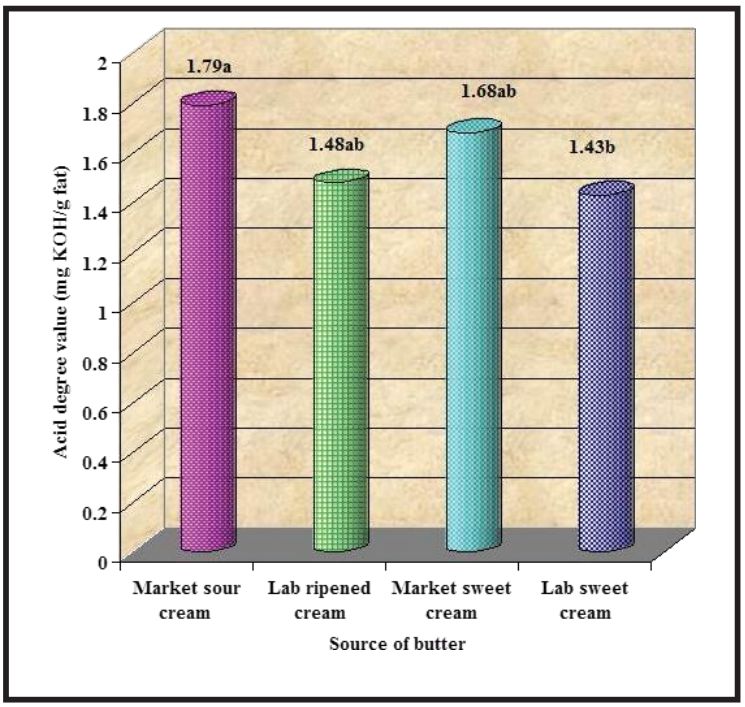
While market sour cream (1.00 ± 0.08 meq O2/kg), and laboratory ripened cream butter (1.00±0.10 meq O2/kg fat) were not statistically different (P>0.05) from one another in peroxide values. However, the peroxide values observed in the present study either sweet or sour market cream butter or laboratory-made cream (sweet or ripened) butter were comparatively lower than cookery-type butter produced at Erzurum, Turkey i.e. 3.10 ± 0.22 and 2.79 ± 0.31 meq O2/kg fat, respectively from the samples of family plants and small dairies [19]. Saponification values of market sour cream butter (253.57 ± 5.98 mg KOH/g fat) and market sweet cream butter (238.98 ± 7.22 mg KOH/g fat) were not statistically different (P>0.05) from one another. However, saponification values of market sour cream butter and butter made from market sweet cream ripened in the laboratory were comparatively different (P<0.05) from laboratory ripened cream butter (control). While saponification values of market sweet cream butter were higher than butter made from laboratory sweet cream butter (control) (228.89 ± 5.72 mg KOH/g fat) but statistically not different (P>0.05) from one another (Fig. 5). In general, fats containing a relatively higher amount of short-chain fatty acids result in relatively larger quantities of fat of low molecular weight, the saponification values runs quite high, usually ranging between 220 and 230 [20].

The trend of saponification values found in the present study was not in line with the values observed by [21], while relatively similar to that reported by [22] for LMF, AMF, and a very high melting fraction (VHMF) i.e. 245, 240 and 234 mg KOH/g fat, respectively. Acid degree value is an important factor for assessing butter quality. It is measured as free fatty acids. It is considered



LSD (0.05) = 17.60
SE± = 8.30
Data are the average of five trials each in duplicate

Fig. 5. Saponification value (mg KOH/g fat) of butter made from sour/ripened and sweet cream



LSD (0.05) = 0.32
SE± = 0.15
Data are the average of five trials each in duplicate and two determinations of each

Fig. 6. Acid degree values (mg KOH/g fat) of butter made from sour/ripened and sweet cream

an essential index estimating the lipolysis of milk fat [23]. This acid degree value is an indicator for assumed the rancidity level appearing due to the breakdown of free fatty acids. In butter, off-flavor was observed when the acid degree value reached 1.8 mg KOH per gram fat [24]. However, in the present study acid degree value (Fig. 6) for market sour cream butter (1.79 ± 0.07 mg KOH/g fat) or market sweet cream butter (1.68 ± 0.16 mg KOH/g fat) was higher than butter made in the laboratory as a control i.e. from laboratory-made ripened cream (1.48±0.04 mg KOH/g fat) or laboratory sweet cream (1.43 ± 0.11 mg KOH/g fat). While these values are below the level reported by [25] where off-flavor can be felt. No doubt butter made in the present study was much better in acid degree value than cookery- type butter produced at family plants (7.10 ± 1.21 mg KOH/g fat) or small dairies (3.14 ± 1.17 mg KOH/g fat) of Erzurum, Turkey (Celik and Bakirci, 2000).

4. CONCLUSIONS

The study concludes that the Iodine, saponification, and Acid degree, values of market sour cream butter are higher than market sweet cream butter and laboratory sweet cream butter. Market sweet cream butter and laboratory sweet cream butter possess similar Iodine values. The peroxide value of market sweet cream butter is higher compared to sour cream butter and laboratory ripened cream butter. While the peroxide value of market sour cream is similar to the laboratory ripened cream butter**.**

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