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# PHYSICAL PROPORTIES OF GHEE PREPARED FROM HIGH ACIDIC MILK-II

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## ABSTRACT

**Ghee samples showed an average moisture of 0.24% in cow and 0.21% buffalo milk ghee. Insoluble impurities were ranging from 2.1 to 2.0 per cent. Color units of cow ghee (15.90) were about five times higher than those from buffalo ghee (3.56). Comparatively higher liquid portion was observed in desi ghee (64.4%). Smallest grain size was observed in ghee from direct boiling of ripened cream (200.66m). Significantly higher melting point (33.64 °C) was observed in buffalo ghee than cow ghee (32.20 °C ). Specific gravity demonstrated that, cow ghee is lighter than buffalo ghee. Higher viscosity value was recorded with cow ghee (33.893 cP.) irrespective of methods of preparation.**

## INTRODUCTION

The methods of preparation, yield and sensory evaluation of ghee with special reference to use of high acidic milk from cow and buffalo was discussed in Part – I. The physical properties of milk components, affect the functional properties and quality attributes of foods in which they are used. The basic knowledge of physical properties in determining the quality attributes as per the legal standards is essential particularly, when the product is to be sold in the market. The physical properties of ghee are markedly affected by environmental and processing conditions. There is paucity of reported work on the changes taking place in physical constants during ghee making via different methods using substandard milk. Hence, attempt was made to study the physical properties of ghee obtained from high acidic cow and buffalo milk.

## MATERIAL AND METHODS

**Source of Material** : Neutralization, separation of high acidic milk (COB + ve) and ghee making were discussed in part – I. In all sixty types of ghee samples were analyzed comparing thirty each from cows and buffaloes. Data were statistically analyzed by split plot method of analysis. The variables used in all the experiments include two kinds of milk and five methods of ghee preparation.

**Analysis of ghee** : Ghee samples were analyzed for moisture, insoluble impurities, colour (tint metric method). BR value and melting point as per procedure laid down in ISI Hand book of food analysis (1981). The method described by Joshi and Vyas (1976) was used for determining the liquid portion and grain size of ghee. Diameter of 100 grains was measured and average value was used. Specific gravity was estimated by using Pycncometer at 40 °C (Tambat and Srinivasan , 1979).

## RESULTS AND DISCUSSION

**Moisture** : Cow milk ghee tended to carry higher (0.24%) moisture content than buffaio milk ghee (0.21 %). In the present case, the ghee was clarified at 115 °C. This might be the reason for low moisture content in all the ghee samples, much below the limits fixed under the PFA Act (1954). Similar values were reported by Persai (1949) and Deshmukh *et al.*, (1990).

**Insoluble impurities** : Ghee obtained from fresh milk by creamery butter method showed lower insoluble impurities (1.6%) as compared with the ghee samples prepared by other methods using high acidic milk (Table 1). These impurities appeared to be contributed by fine particles of ghee residue which escaped the

filtration, protein fraction and other foreign material.

**Colour** : The average colour unit of ghee samples prepared from cow milk were about five times higher (15.90) than those of ghee from buffalo milk (3.56). Treatments of high acid cow milk with neutralizer reduced the colour units of ghee in all the methods except in desi. However, such treatments in case of buffalo milk increased the colour units significantly. Deshmukh *et al.*, (1990) observed highest (19.2) and lowest (16.8) units of colour, in ghee prepared from fresh and high acidic cow milk using creamery butter method. However, direct boiling of ripened cream from fresh and high acidic milk showed 17.4 units. Lalitha and Dastur (1956) reported that colour formation occurs in milk which was allowed to sour either naturally or with addition of starter culture in buffalo milk. Thus, the increase in the tint meter reading in ghee samples prepared from soured milk could be influenced by the micro-organisms since these samples were allowed to get curdled.

**Butyrorefractometer (BR) value** : The cow milk ghee showed higher BR values(42.31) than those obtained for buffalo samples(41.52) at 40 ± 1 °C. The souring of milk followed by neutralization exerts a diminishing influence on the BR values. Gupta *et al.*, (1986) did not observe any change in BR reading of ghee after curdling or neutralization of milk.

**Liquid portion and Grain size** : Desi ghee (64.4%) prepared from cow milk showed comparatively higher proportion of liquid portion than ghee prepared from buffalo milk irrespective of other methods used. Acidic condition in milk leading to increase in liquid portion may be attributed to the less time available for major portion of ghee to form the crystal nucleus. Consequently the crystals got comparatively less time to grow in size. The minor differences in the composition of triglycerides and specific glyceride structure of fat can also cause differences in the liquid portion. Joshi and Vyas (1976) reported that, composition, processing and season also exert profound influence on liquid portion of ghee. The grain size showed higher crystal size in buffalo milk ghee specially those prepared by desi method (286.25μ). The smallest grain size was observed in ghee samples prepared from direct boiling of cream. Arumughan and Narayanan (1979) observed the crystal size in the liquid fraction were very small. This may explain why low melting triglycerides in liquid portion will produce smaller size grain. They found support in these observation by studying the fatty acid composition of different fractions. Deshumukh *et al.* (1990) also obtained similar trend for liquid portion and grain size of ghee obtained from high acidic cow milk.

**Melting point** : The highest average melting point was observed in ghee prepared by desi method (33.19 °C), because low melting glycerides in this method are transferred to butter milk. There was not much difference in melting points of ghee prepared by direct boiling of cream or by creamery butter method. According to Doctor *et al.*, 1940, the melting point of ghee is affected by the type of breed and the season. The chemical composition of ghee also affects the melting properties. Lakshminarayan and Rama Murthy, (1985) reported an average melting point 35.8 °C for buffalo milk fat and 34.2 °C for cow milk fat. Melting point of ghee is influenced by the kind of milk, rate of cooling, extent of crystallization and entropy enthalpy changes (Rajorhia and Sherbon, 1986).

**Specific gravity** : The average specific gravity for cow ghee (0.8988) and buffalo ghee (0.9161) demonstrated that cow ghee is lighter than buffalo ghee. The highest value was associated with desi ghee. The minor differences in specific gravity of buffalo milk fat and cow milk fat could be attributed to differences in fatty acids composition, density

**TABLE 1.** Effect of Species and methods of ghee preparation on Physical Properties of ghee.

| Methods of ghee Preparation | Moisture (%) | | | Insoluble Impurities. % | | | Colour (Tintomenter Scale) | | | B.R. Value | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cow | Buffalo | Mean | Cow | Buffalo | Mean | Cow | Buffalo | Mean | Cow | Buffalo | Mean |
| Control | 0.24 | 0.21 | 0.22 | 1.4 | 1.8 | 1.6 | 20.50 | 0.51 | 10.50 | 42.48 | 41.56 | 42.02 |
| CBM | 0.26 | 0.22 | 0.24 | 2.1 | 2.5 | 2.3 | 12.33 | 2.83 | 07.30 | 42.40 | 41.58 | 41.99 |
| Desi | 0.26 | 0.22 | 0.24 | 1.5 | 2.0 | 1.6 | 16.83 | 6.16 | 11.50 | 42.27 | 41.60 | 41.93 |
| RCM | 0.24 | 0.21 | 0.22 | 3.2 | 2.0 | 2.5 | 15.00 | 4.5 | 09.75 | 42.29 | 41.43 | 41.86 |
| UCM | 0.23 | 0.23 | 0.23 | 2.3 | 2.7 | 2.5 | 14.83 | 4.33 | 09.58 | 42.14 | 41.44 | 41.79 |
| Mean | 0.24 | 0.21 | —— | 2.1 | 2.2 | —— | 15.90 | 3.56 | ——— | 42.31 | 41.52 | —— |
| SE(m) ± | 0.057 | 0.037 | 0.052 | 0.075 | 0.172** | 0.244** | 0.193** | 0.393** | 0.556** | 0.048** | 0.048** | 0.067 |
| 'F' test | NS | NS | NS | NS | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | NS |

SE (m) ± Significant at 1 % level**. Control (Fresh milk with creamery butter method), CBM (Creamery butter method), Desi ( Desi method), RCM (Ripened cream method), UCM (Un ripened cream method).

**TABLE 2.** Physical properties as influenced by methods of ghee preparation.

| Methods of ghee Preparation | Liquid portion (%) | | | Grain size (m) | | | Melting point (°C) | | | Specific gravity | | | Viscosity (cP) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cow | Buffalo | Mean | Cow | Buffalo | Mean | Cow | Buffalo | Mean | Cow | Buffalo | Mean | Cow | Buffalo | Mean |
| Control | 64.1 | 33.4 | 48.7 | 223.0 | 291.3 | 257.16 | 31.90 | 33.45 | 32.68 | 0.8989 | 0.9162 | 0.9076 | 31.160 | 31.061 | 31.111 |
| CBM | 65.0 | 39.0 | 52.3 | 241.6 | 323.0 | 282.33 | 32.14 | 33.75 | 32.94 | 0.9026 | 0.9137 | 0.9081 | 30.284 | 29.440 | 29.862 |
| Desi | 64.4 | 44.6 | 54.6 | 243.3 | 329.1 | 286.25 | 32.45 | 33.93 | 33.19 | 0.9053 | 0.9166 | 0.9109 | 31.997 | 29.401 | 30.699 |
| RCM | 56.6 | 55.9 | 56.2 | 162.1 | 239.1 | 200.66 | 32.26 | 33.63 | 32.95 | 0.8923 | 0.9168 | 0.9046 | 30.951 | 30.271 | 30.611 |
| UCM | 59.2 | 52.1 | 55.7 | 173.3 | 243.3 | 208.33 | 32.25 | 33.41 | 32.84 | 0.8949 | 0.9173 | 0.9061 | 30.074 | 30.439 | 30.277 |
| Mean | 61.9 | 45.1 | —— | 208.7 | 285.2 | —— | 32.20 | 33.64 | ——— | 0.8988 | 0.9161 | ——— | 30.893 | 30.130 | ——— |
| SE(m) ± | 0.860** | 0.721** | 1.020** | 9.50** | 8.54** | 12.5 | 0.23** | 0.10* | 0.14 | 0.0012** | 0.0011** | 0.0016** | 0.1218** | 0.195** | 0.275 |
| 'F' test | Sig | Sig | Sig | Sig | Sig | NS | Sig | Sig | NS | Sig | Sig | Sig | Sig | Sig | Sig |

SE (m) ± Significant at 1 % level*., Significant at 5 % level**.

of separated fats and temperature used in ghee preparation. Specific gravity values of ghee reported by other workers are 0.9358 to 0.9443 (Plymen and Aiyer, 1921), 0.9340 to 0.9444 (Godbole and Sadgopal, 1939) and 0.911 to 0.913 (Singh, 1948).

**Viscosity :** Higher values were recorded for cow milk ghee (30.893 cP). The methods of ghee preparation also affected the viscosity of ghee. The lowest viscosity was observed in ghee samples from high acidic milk via creamery butter method (29.8624 cP). The values recorded in present investigation are in accordance with the findings of Deshmukh *et al.*, (1990) for ghee prepared from high acidic milk. Viscosity study helps in developing suitable process line for pumping, packing, designing and fabrication of continuous method of ghee making.

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