Quality Standards of Ghee

B.P. Pushpa
Assistant Professor, Department of Dairy Chemistry, Dairy Science College, KVAFSU, Hebbal, Bengaluru, Karnataka
*Corresponding Author: pushpadc819@gmail.com

Ghee is a high value food having unique flavour which increase the acceptability of the product as compared to any other fat rich products or vegetable oils. Ghee is a clarified butter accounts for about 45% of the total milk produced in India. Ghee is primarily used for cooking and frying and as dressing or toppings for various foods. It is also used in the manufacture of snacks and sweets often mixed with vegetables, cereals, fruits, and nuts. In some parts of the world, ghee is considered as a sacred product and is used in religious rites. Ghee is used in Ayurveda, which is a system of traditional medicine developed in India several thousand years ago as an alternative medicine.

Chemically ghee is a complex mixture of glycerides, free fatty acids, phospholipids, sterols, sterol esters, fat soluble vitamins (A, D, E, K), tocopherol, carbonyls, hydrocarbons, carotenoids (only in ghee derived from cow milk), small amounts of charred casein and traces of calcium, phosphorus, iron etc. It contains not more than 0.5 % of moisture and glycerides constitute about 98-99 % of the total material. Remaining 1-2 % comprises of phospholipids (0.2-1.0 %), sterols (major cholesterol; 0.25-0.40 %) and traces of free fatty acids, waxes, squalene, fat soluble vitamins etc.

Quality Standards of Ghee

Competition in the organized ghee production sector leads to create brand value to the product, which comes with quality and special features. Quality of ghee in consumer's point of view may possess pleasing flavour, granular texture, attractive colour and freshness including clean packaging material. Quality of ghee is mainly affected by its source of raw material, processing, season, species, feed of animal, region, storage and adulteration. Ghee quality can be assessed by determining the fat constants such as Butyro refractometer reading, Reichert Meissl value, Polenske value, Iodine value, Saponification value and Fatty acid profile. Moisture content of ghee and free fatty acid content important in controlling the quality of ghee. To assess the quality and to check adulteration of ghee FSSAI has brought some new regulations by adding additional parameters (Fig. 1).

According to literature, ghee is a lipophilic product with 99-99.5% lipids from which 46-47.8% is saturated fat, 36% monounsaturated and 18% polyunsaturated fatty acids. The classification for fatty acid includes saturated fatty acids including Butyric acid 1 -5%, Hexanoic acid (Caproic acid) 0.5 – 2.2%, Octanoic acid (Caprylic acid) 0.4 – 1.5%, Decanoic acid (Capric acid) 0.8- 5%, Dodecanoic acid (Lauric acid) 1.5 – 4%, Tetradecanoic acid (Myristic acid) 6- 13%, Hexadecanoic acid (Palmitic acid) 22-38%, and Octadecanoic acid (Stearic acid) 8-19% (FSSR, 2021).

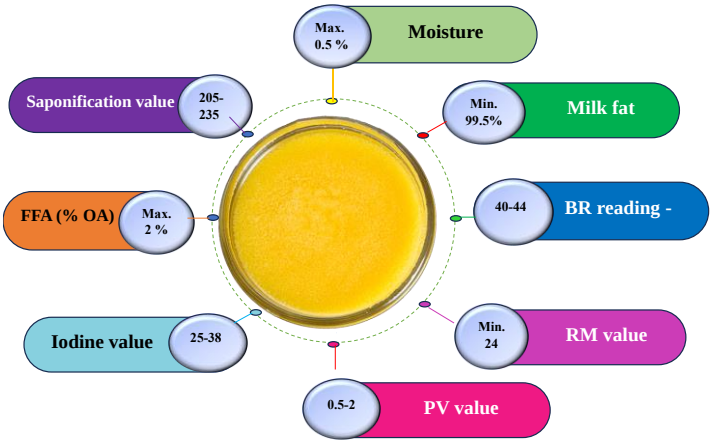

Fig. 1: FSSAI (2022) Standards for GHEE.

AGMARK is a certification mark of Government of India to ensure the purity and quality of Agricultural and allied products in India. Under Agmark, ghee is graded into three categories differ in free fatty acid content (% Oleic acid); 'Special' (Agmark Red Label; Max.1.4 % OA), 'General' (Green Label; Max. 2.5 % OA) and 'Standard' (Chocolate Label; Max. 3.0 % OA) (Fig. 2) with moisture content of not more than 0.3 %, Butyro Refractometer reading of 40-43 at 40°C, RM value not less than 28.0, Poleske value between 1.0-2.0 and Boudoin test should be negative. Adulteration of ghee in India is more prevalent especially in unorganized sector, with Vanaspati (Hydrogenated vegetable oil), Refined (de-odourized) vegetable oil and Animal body fat.

Government has made it compulsory that all Vanaspati must contain a maximum of 5% of Sesame oil which can be identified in ghee by a simple colour test known as Baudouin test, which can be detected upto 3 % level.

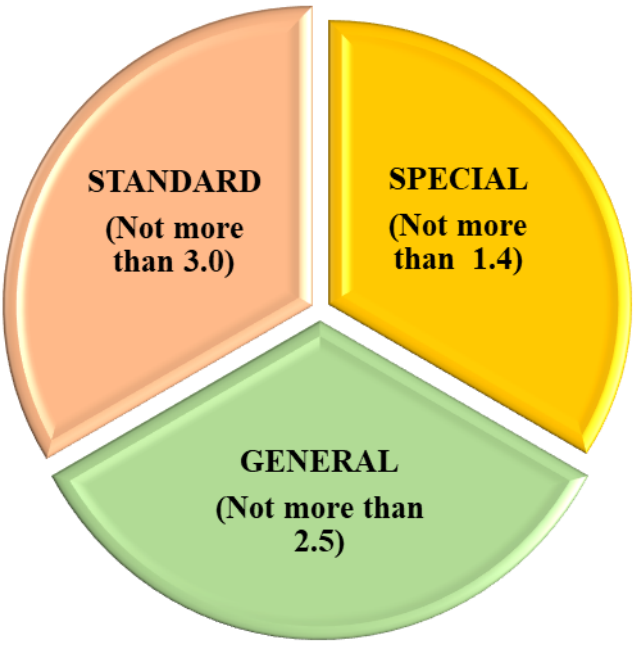

Fig. 2 Different Grades (Free fatty acids %OA) of Ghee under AGMARK

Storage Changes in Ghee: Quality of ghee may be affected due to the production of off flavour in ghee as a result of different chemical reactions viz. hydrolysis of tri acyl glycerols (fats) to produce free fatty acids; and oxidation of fat to produce saturated and unsaturated aldehyde, ketones, alcohols and hydrocarbons.

Free Fatty Acid (FFA) content

The FFA is defined as the percentage by weight of free acid groups in the oil or fat. Free fatty acids (FFA) are an indication of hydrolytic rancidity, but other lipid oxidation processes can also produce acids. The value is a measure of the number of fatty acids (% Oleic acid) which have been liberated by hydrolysis from the glycerides due to the action of moisture, temperature and/or lipolytic enzyme lipase. Free fatty acids are significant for the quality of the milk fat because they increase the fat's susceptibility to oxidation and can contribute to bitter or soapy flavours. Rancid flavour developed due to fat hydrolysis due to lipase action in milk, cream, curd, butter and ghee may deteriorate the quality of ghee. This problem can be overcome by inactivating the lipase by proper heat treatment and clarify fat at optimum temperature which ensures minimum moisture content in ghee.

Peroxide Value

The peroxide value is used to determine the oxidative rancidity in ghee is the milli equivalents of oxygen per kilogram of sample. The higher peroxide value determines the age of ghee with rancid flavour production. Flavour defect of ghee is mainly due to fat oxidation by direct contact of milk, curd, cream, butter and ghee with copper or iron, exposure of these products to sunlight lead to oxidized, oily or metallic flavour. Oxidized flavour can be prevented by storage of fat products in properly tinned or aluminium alloy or stainless-steel vessels, filling ghee upto the brim to minimize the headspace and using opaque containers and avoiding ghee storage at high temperature (>21^{o}C) for long time.

Conclusion

Chemical composition of ghee as determined by fat constants is helpful in assessing the quality of ghee. Knowledge of fatty acid profile of different fats or oils is helpful to analyse the quality differences due to species, breed, region, and adulteration. Use of some advanced techniques is helpful in quick determination of ghee quality and a greater number of samples can be screened to reduce the malpractices.

* * * * * * * *