JUDGING OF DAIRY PRODUCTS

Module 6. Fat rich dairy products

Lesson 21
GHEE AND AMF: GRADE OF GHEE AND AMF, SPECIAL REQUIREMENTS OF QUALITY GHEE AND AMF, DEFECTS IN GHEE AND AMF, GHEE SCORE CARD, SENSORY EVALUATION OF GHEE AND AMF

21.1 Introduction

The sensory attributes of ghee are affected by many factors, such as quality of base material, extent of lactic acid fermentation, time and temperature of heating,rate of cooling, package type, filling conditions, presence of oxygen and contaminants such as iron and copper, exposure to sunlight and temperature, and duration of storage. These factors should be controlled to produce ghee of premium quality.

The quality of ghee is judged by the desirable flavour, texture and co lour, and freedom from suspended serum residues. The consumer wants an assurance of purity, freshness and wholesomeness. These attributes are assigned relative weight in a descriptive mode by the overall assessment of quality. A perfect score of 60 for flavour, 25 for texture, 10 for colour and 5 for freedom from suspended impurities is recommended for the judging of ghee. The intensity of each defect is given on a weighted rating scale.

21.2 Flavour

Aroma and taste constitute the flavour of ghee. A perfect ghee flavour is characterized by a multitude of sensory perceptions which are pleasant,enjoyable and lingering in the mouth. Consumers always resist any change in the flavour of ghee as this is one characteristic which predominantly determines acceptability. There are regional preferences for flavour in ghee. The preferred ghee flavours range from 'slightly curdy' to

'pronounced curdy', 'cooked' to 'caramelized' and, at times, slightly oxidized in some quarters of the population. The village-produced ghee is characterized by a curdy flavour which lingers in the mouth.

The quality and the amount of SNF present in the base material, as well as the intensity of heating separately and cumulatively, affect the flavour of ghee.Technologies have been developed using various alternate methods to produce ghee with both 'curdy' and 'cooked' type flavours.

The flavour of ghee is mainly contributed by the heat interaction products formed between the unfermented serum portion, comprising the native carbohydrate and protein system, and by metabolic products of the starter culture when ripened cream is used for ghee-making. The flavour components of ghee have been discussed in an earlier lecture. The 'curdy' flavour in ghee could be produced by mixing of 'desi' ghee with dairy ghee in varying proportions, by the addition of lactic cultures to butter at heating, by incubating the molten butter with a lactic culture, or by the addition of 1assi' powder at the time of heating.

'Cooked' flavour could be simulated by clarifying butter at temperatures of 115°C for 10min, or 120°C for 5 min, or 125°C without any holding time.

21.3 Texture

Granulation of ghee is an important criterion for its selection; a good grainy texture is very much appreciated by consumers, and such ghee develops a lower degree of rancidity than ghee kept in the liquid state. Milk fat has the unique property of forming grains because it is made up of a wide variety of complex triglyceride mixtures with varying melting points. The texture of ghee will depend on the source of the fat (animal species), method of preparation, temperature of clarification, rate of cooling, amount of FFAs, rate of seeding, and storage temperature. The presence of FFAs markedly increases the grain size, but the quantity of grains is increased only to a limited extent. Seeding with grains of ghee at the rate of 2% by weight of ghee improves grain formation. The grain shape becomes needle-like, in contrast to the spherical shape obtained without seeding. The large number of fatty acid residues present in ghee result in a wide variety of crystallization patterns.

The maximum amount of solid fraction (about 74%) is obtained at 28°C in 20-24 hr from buffaloes' ghee, closely followed by cows' ghee (69.5°/0) and a distinct low in goats' I) ghee (30%). There can be significant differences in the melting curves of fat tram the milk of buffaloes, cows and goats. The changes in the conditions of cooling can have a pronounced effect on ghee texture. If ghee is cooled rapidly, a larger number of very fine crystals will be formed, all consisting of mixtures of high and low-melting fats, leading to smooth, grease-like character. Slow cooling of ghee from a temperature higher than the melting point will lead to formation of a few crystals with a high melting point. As cooling proceeds, more and more fat solidifies, forming a mass of large crystals suspended in liquid fat. Hard, greasy or waxy texture is not liked by consumers.

21.4 Colour

Buffaloe's ghee appears whitish in colour owing to the absence of carotene, which imparts a yellow colour to cows' ghee. In the village method of ghee-making, the development of greenish-yellow tinge in buffaloes' ghee is caused by the action of lactic acid bacteria. Ghee produced by the direct cream method has a darker colour compared to that prepared by the creamery butter process. Stratification results in a light colour. A more intense heating in the presence of a high SNF content will result in a darker colour, especially if the raw material has been fermented. Brown discolouration is a serious defect in ghee.

21.5 Common Flavour Defects of Ghee

Although ghee has a better capacity to resist spoilage by elemental and microbial attack than any other milk product, it is common knowledge that, upon prolonged storage at ambient temperature, it undergoes oxidative changes. Reaction of oxygen with the 'unsaturated fat' is a major cause of spoilage. It gives rise to a typical, strong and disagreeable odour. Production of off-flavours accompanies the loss of nutritive value.

Auto-oxidation of ghee is aggravated by metallic contamination and sunlight. The 'acceleration' effect of light is dependent on its wave-length. The visible light accelerates the decomposition of hydroperoxides. The effect of ultraviolet light on ghee is more pronounced than the impact of other rays. High energy radiations such as b and g rays exert a pronounced acceleration effect because they split hydroperoxides and also generate free radicals from molecules of unoxidized substrate.

The shelf-life of ghee is affected by the degree of unsaturation of fat, the temperature at which ghee is stored, the manner in which millk, for ghee-making is handled, uncontrolled fermentation during curdling, uneven heating during manufacture, and sanitary conditions of the vessels used for the production and storage of ghee.

A number of synthetic antioxidants, such as gallates (ethyl, propyl, octyl), butylated hydroxy toluene (BHT), tertiary butyl hydroquinone (TBHQ), ascorbic acid, a -tocopherol phospholipids, and some natural antioxidants, namely curry leaves, betelleaves, soya bean powder, safflower and 'amla' (*Phyllanthus ambica*), can be added in small amounts (permitted legally in different countries) with a view to achieve either prevention or retardation of the oxidation of fat during storage. Traditional practice of ghee-making in India involves the use of certain plant leaves for anti oxidative properties. Curry and betel leaves are two commonly used herbs which are rich in phenolic compounds, predominantly hydroxy chavicol. These leaves also contain ascorbic acid, which may act synergistically. Curry leaves and betel leaves also contain many amino acids which serve as antioxidants. Studies have proved that the practice of boiling betel and curry leaves with desi butter at the time of clarification helps to improve the flavour, colour and shelf life of ghee.

Other commonly encountered flavour defects in ghee are burnt, smoky, rancid and

tallowy. The origin of these flavour defects will be discussed.

21.6 Grading

After computation of the data recorded in Table by the panelists, the following gradation should be specified

Table 21.1 Grading of ghee

Quality	Score	Grade
Excellent	90 or more	A
Good	80-89	B
Fair	60-79	C
Poor	59 and below	D