

Ghee: Traditional and Industrial Production, Nutritional Value, and Health Effects

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Abstract

Ghee is a highly clarified form of butterfat that has been widely used as an important culinary ingredient in South Asian households and traditional practices. This study provides a comprehensive overview of ghee, focusing on its production, characteristics, nutritional composition, major commercial brands, and potential effects on human health. Ghee is produced through the concentration of milk fat, followed by heat clarification and the removal of moisture and milk solids. These processes result in a stable, shelf-friendly product with a characteristic golden colour, nutty aroma, and high smoke point, making it suitable for various cooking methods, including frying and sautéing. Ghee also contains fat-soluble vitamins, such as vitamins A, D, E, and K, and is described as a source of energy and beneficial fatty acids, including butyric acid. The study further discusses traditional household preparation methods as well as industrial-scale production techniques, including cream separation, pasteurization, heating, clarification, centrifugation, and filtration. Major commercially available brands, including Amul, Gowardhan, Patanjali, and Mother Dairy, are also comparatively discussed with respect to their characteristics and nutritional benefits. Although moderate consumption of ghee may contribute to energy intake, nutrient absorption, and digestive health, excessive consumption may have adverse effects because of its high calorie and saturated fat content. Overconsumption may contribute to weight gain and increased cardiovascular risks, particularly among sedentary individuals or those with existing health concerns. Overall, ghee remains an important traditional food product, and its incorporation into a balanced diet in appropriate quantities may help maximize its nutritional benefits while minimizing potential health risks.

Keywords: Ghee, clarified butter, butterfat, nutrition, health effects

INTRODUCTION

Ghee is a traditional dairy product that has occupied an important place in South Asian cuisine and Ayurvedic practices for centuries. It is valued for its characteristic aroma, rich flavour, nutritional properties, and versatility in cooking. Chemically, ghee is a highly clarified form of butterfat obtained by removing most of the water and milk solids present in butter. The clarification process produces a stable fat with a distinctive golden appearance and a pleasant nutty flavour [1].

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KEY CHARACTERISTICS OF GHEE

- **High Smoke Point:** Ghee has a relatively high smoke point, making it suitable for cooking methods involving high temperatures such as frying, sautéing, and roasting. Its thermal stability makes it a commonly preferred cooking fat.
- **Low Moisture and Milk Solids:** During the preparation of ghee, most of the water and milk solids are removed. This contributes to its characteristic composition and improved stability compared with ordinary butter.

- *Shelf Stability:* The low moisture content of ghee helps reduce the possibility of spoilage and allows it to remain stable for a longer period when stored under appropriate conditions.

Ayurvedic and Nutritional Importance

In the Indian tradition, ghee is not only considered a cooking medium but also an important component of traditional dietary practices. It contains various fatty acids and serves as a source of energy. Ghee may also assist in the absorption of fat-soluble nutrients, including vitamins A, D, E, and K. Additionally, it contains butyric acid, a short-chain fatty acid that has been associated with digestive and gut health [2].

Scientific Principle of Ghee Production

The production of ghee involves a series of physical and thermal processes that separate milk fat from water and other milk components. The major stages involved in its preparation are described below.

- *Concentration of Fat:* The first stage involves concentrating the fat present in milk. This may be achieved by separating cream from milk and subsequently converting the cream into butter. Centrifugal separation may also be used to obtain milk fat efficiently.
- *Heat Clarification:* Heat clarification is one of the most important stages in ghee production. During heating, the water present in butter gradually evaporates. As the moisture decreases, the proteins and other milk solids become concentrated and separate from the fat phase [3].
- *Sedimentation and Filtration:* Following the removal of moisture, the denatured milk solids separate from the clarified fat and either settle at the bottom or collect near the surface. These residues are subsequently removed through sedimentation and filtration. The final product is clarified butterfat with a low moisture content and improved stability [3].

WHAT IS GHEE?

Ghee is a highly clarified dairy fat obtained from butter or cream. Ordinary butter contains butterfat along with water and milk solids, including proteins and lactose. During the preparation of ghee, the butter is heated to remove moisture and separate the milk solids from the fat. The remaining clarified fat is generally golden in colour and possesses a characteristic aroma and flavour. Due to its low moisture content and the removal of most milk solids, ghee has greater stability and a longer storage life than ordinary butter.

HOMEMADE PROCESS OF GHEE PREPARATION

Ghee can be prepared at home using either unsalted butter or collected milk cream, commonly known as *malai*. Both methods involve heating the dairy fat carefully until the moisture evaporates and the milk solids separate.

Method A: Preparation of Ghee Using Unsalted Butter

This method is a convenient approach for preparing ghee at home using commercially available unsalted butter.

- *Preparation:* Approximately 500 g of unsalted butter is cut into small pieces to ensure uniform melting.
- *Melting:* The butter is placed in a heavy-bottomed pan and heated over low to medium heat until it melts completely.
- *Simmering:* After melting, the butter begins to produce foam and crackling sounds as the water content gradually evaporates.
- *Separation of Milk Solids:* As heating continues, the foam settles and the clarified fat becomes visible, while the milk solids separate and settle at the bottom of the pan.
- *Completion of Heating:* When the milk solids develop a light golden-brown colour and the crackling sound decreases, heating is discontinued.
- *Filtration and Storage:* The prepared ghee is allowed to cool slightly and is then filtered through a fine strainer or muslin cloth to remove the remaining solids. The clarified ghee is subsequently stored in a clean, dry glass container [4].

Method B: Traditional Preparation Using Malai (Cream)

The traditional method of preparing ghee involves the use of collected milk cream or *malai*. Cream obtained from milk over several days is collected and processed to obtain butter, which is subsequently heated to separate moisture and milk solids. The clarified fat obtained after filtration is referred to as traditional or homemade ghee [4].

INDUSTRIAL PROCESS OF GHEE PRODUCTION

Commercial production of ghee is carried out on a large scale using specialized equipment and controlled processing conditions. The industrial process involves the separation and concentration of milk fat, followed by heating, clarification, removal of residues, and controlled cooling. Large dairy manufacturers use mechanized systems to ensure uniformity and efficiency in production.

Cream-to-Ghee Method

The cream-to-ghee method is commonly used for commercial-scale ghee production and involves the following stages:

- *Cream Separation*: Raw milk is subjected to centrifugal separation to obtain cream with a relatively high fat content.
- *Pasteurization*: The separated cream is heated to reduce the microbial load and improve its suitability for further processing. In some processes, the cream may also undergo controlled ripening to develop the desired flavour characteristics.
- *Heat Clarification*: The processed cream is transferred to large steam-heated stainless-steel vessels, where it is subjected to controlled heating. This process promotes the removal of moisture and separation of the milk solids from the fat.
- *Moisture Control*: The temperature and heating conditions are carefully monitored to reduce the moisture content and obtain the required quality and stability of the final product.
- *Centrifugation and Clarification*: High-speed clarifiers or centrifuges are used to separate the remaining ghee residue and suspended milk solids from the clarified fat.
- *Cooling and Granulation*: The clarified ghee is cooled under controlled conditions. Slow agitation during cooling may help produce the characteristic granular or *danedar* texture preferred by many consumers.

Thus, both traditional and industrial methods follow the basic principle of separating milk fat from water and milk solids. However, industrial production uses controlled equipment and standardized processing conditions to ensure uniform quality, safety, and stability of the final product [5, 6]. A comparative overview of major ghee brands, their key products, and market specialities is presented in Table 1.

Table 1. Comparative overview of major ghee brands, their key products, and market specialities in India.

Company	Key brand	Speciality
GCMF (Amul)	Amul Ghee	The market leader; Known for consistent quality and the blue tin.
Mother Dairy	Mother Dairy Ghee	High presence in North India; Known for a “homemade” aroma.
Patanjali	Patanjali cow Ghee	Focuses on premium, refined texture and long shelf life.
Organic India	Organic Ghee	Focuses on grass-fed, ethically sourced “A2” cow ghee.

FAT-SOLUBLE VITAMINS IN GHEE

Ghee is a rich source of dietary fat and can also serve as a medium for the absorption of fat-soluble vitamins. Depending on the source and processing of the milk, ghee may contain several important vitamins that contribute to different physiological functions.

- *Vitamin A*: Vitamin A plays an important role in maintaining normal vision, supporting immune function, and promoting healthy skin.

- *Vitamin E*: Vitamin E acts as an antioxidant and helps protect cells from oxidative damage.
- *Vitamin K*: Vitamin K is involved in normal bone metabolism and supports the effective utilization of calcium in the body.
- *Vitamin D*: Vitamin D contributes to calcium absorption and helps maintain healthy bones and teeth.

MAJOR BRANDS OF GHEE

Several brands of ghee are commercially available in India. Some of the commonly recognized brands include:

- Amul.
- Gowardhan.
- Patanjali.
- Mother Dairy.

These brands offer different types of ghee prepared from milk or cream and are widely used for cooking and other traditional purposes [7].

AMUL GHEE: NUTRITIONAL IMPORTANCE AND HEALTH EFFECTS

Nutritional Value and Energy

Amul Ghee is a concentrated source of dietary fat and energy. Like other forms of ghee, it can be used as a cooking medium and as part of a balanced diet. Dietary fats are important for providing energy and supporting various functions of the human body.

Ghee also acts as a carrier for fat-soluble vitamins, including vitamins A, D, E, and K. These nutrients play important roles in maintaining vision, supporting immunity, protecting cells, and promoting bone health [8].

Potential Benefits for Digestive Health

Ghee contains butyric acid, a short-chain fatty acid that has been associated with the maintenance of digestive and intestinal health. When consumed in appropriate quantities as part of a balanced diet, ghee may contribute to the overall dietary intake of beneficial fatty acids.

Because ghee is a concentrated source of fat, it may also provide sustained energy. However, its contribution to metabolism and body weight depends on the total diet, physical activity, and amount consumed [9].

High Saturated Fat Content and Associated Risks

Ghee consists primarily of fat and contains a considerable proportion of saturated fatty acids. Excessive consumption of saturated fats may contribute to increased levels of low-density lipoprotein (LDL) cholesterol in some individuals.

A consistently high intake of saturated fat may be associated with an increased risk of cardiovascular problems. Therefore, ghee should be consumed in moderation, particularly by individuals with existing cardiovascular risk factors [10].

Calorie Density and Weight Management

Ghee is highly energy-dense, and even a relatively small quantity can contribute a significant number of calories to the diet. Regular consumption in large amounts, particularly without considering total calorie intake and physical activity, may contribute to weight gain.

Therefore, while ghee can be included as part of a healthy diet, portion control is important. Moderate consumption, along with regular physical activity and a balanced dietary pattern, may help individuals

obtain its nutritional benefits while reducing the potential risks associated with excessive intake [11]. Amul Ghee is traditionally associated with several potential health and culinary benefits, as presented in Table 2.

Table 2. Potential health and culinary benefits associated with Amul Ghee.

Area of life	Benefit of Amul Ghee
Physical Strength	Lubricates joints and strengthens muscles.
Skin s Beauty	Acts as a natural moisturizer, giving skin a “glow” from within.
Immunity	Antioxidants help the body off infections.
High-Heat Cooking	With a smoke point of 250 c, it doesn’t release toxic fumes when frying.

GOWARDHAN GHEE: NUTRITIONAL IMPORTANCE AND HEALTH CONSIDERATIONS

Potential Nutritional Benefits

Gowardhan Ghee is a commonly consumed dairy-based cooking fat. Like other types of ghee, it is a concentrated source of dietary fat and energy. When consumed in moderate quantities, it can contribute to the overall energy requirements of the body and may be incorporated into a balanced diet.

Ghee contains different types of fatty acids and may also provide small amounts of fat-soluble vitamins. These nutrients play important roles in various physiological functions, including energy metabolism and the maintenance of normal body functions.

Brain and Nervous System Function

Dietary fats are important components of a balanced diet and contribute to normal body functions. Essential fatty acids, obtained from a variety of dietary sources, are important for the normal functioning of the brain and nervous system. However, ghee should not be considered a specific treatment for improving memory or cognitive performance.

Joint and Physical Health

Ghee is often traditionally associated with maintaining physical strength and overall well-being. However, the direct role of ghee in improving joint flexibility or reducing joint stiffness has not been conclusively established. Its consumption should, therefore, be considered as part of overall dietary intake rather than as a treatment for joint-related conditions.

Skin Health

Ghee contains dietary fats and may contain fat-soluble vitamins that contribute to normal nutritional requirements. However, claims regarding significant improvements in skin appearance or hydration should not be generalized. A balanced diet and adequate hydration remain important for maintaining healthy skin.

High-Temperature Cooking

Ghee has a relatively high smoke point and is commonly used for cooking methods that require moderate to high temperatures. Its stability during heating makes it suitable for frying, sautéing, and other cooking applications when used appropriately.

POTENTIAL HEALTH RISKS OF EXCESSIVE CONSUMPTION

Weight Gain

Ghee is calorie-dense because it consists primarily of fat. Excessive consumption may increase total calorie intake and contribute to weight gain, particularly when combined with low levels of physical activity.

Cardiovascular Health

Ghee contains saturated fatty acids, and excessive consumption may increase the intake of saturated fat. Individuals with high cholesterol, cardiovascular disease, or other related health concerns should consume ghee in moderation and follow appropriate dietary guidance.

Digestive Discomfort

Although moderate quantities of dietary fat can be part of a balanced diet, consuming large amounts of ghee at one time may cause digestive discomfort in some individuals. Therefore, portion control is recommended.

Individual Health Considerations

The suitability and quantity of ghee consumption may vary depending on an individual's dietary requirements and health status. People with specific medical or dietary concerns should seek appropriate professional dietary advice.

Appropriate Consumption

Ghee can be included as part of a balanced diet when consumed in moderate quantities. Its use should be adjusted according to overall calorie intake, physical activity, and individual nutritional requirements. Excessive consumption should be avoided because of its high calorie and saturated fat content.

PATANJALI GHEE: NUTRITIONAL IMPORTANCE AND HEALTH CONSIDERATIONS**Potential Nutritional Benefits**

Patanjali Cow Ghee is a dairy-based fat prepared from milk and is commonly used as a cooking medium. Like other types of ghee, it primarily provides dietary fat and energy. When consumed in moderate amounts, it can be incorporated into a balanced diet.

Fat-Soluble Vitamins

Ghee may contain fat-soluble vitamins such as vitamins A, D, E, and K. These vitamins are involved in several important physiological functions, including maintaining normal vision, supporting immune function, protecting cells from oxidative damage, and maintaining bone health. The actual concentration of these vitamins may vary depending on the milk source and processing conditions.

Suitability for Cooking

Ghee has a relatively high smoke point and can, therefore, be used for cooking methods involving moderate to high temperatures such as sautéing and frying. Its low moisture content also contributes to its storage stability.

Butyric Acid and Digestive Health

Ghee contains short-chain fatty acids, including butyric acid. Butyrate is associated with normal intestinal function and is an important energy source for cells of the colon. However, the presence of butyric acid in ghee should not be interpreted as evidence that ghee can treat digestive disorders.

POTENTIAL HEALTH RISKS**Saturated Fat and Cholesterol**

Ghee contains a substantial amount of saturated fatty acids. Excessive intake of saturated fat may contribute to increased LDL cholesterol levels in some individuals. Therefore, people with elevated cholesterol or cardiovascular risk should consume ghee cautiously and within their recommended dietary fat intake.

Weight Management

Ghee is highly energy-dense, providing approximately 9 kcal per gram of fat. Regular consumption in excessive quantities can increase total calorie intake and may contribute to weight gain, particularly in individuals with low physical activity.

Individual Dietary Considerations

The amount of ghee appropriate for an individual depends on their overall dietary pattern, energy requirements, physical activity, and health status. Ghee should be considered a source of dietary fat rather than a medicinal product. Comparison between Patanjali & Amul is given in Table 3.

Table 3. Comparison of Patanjali Cow Ghee and Amul Ghee.

Feature	Patanjali COW GHEE	Amul Ghee
Milk source	Marketed as cow ghee	Product composition depends on the specific Amul variant.
Texture	May have a granular or semi-solid texture	Texture may vary depending on storage and processing.
Aroma	Characteristic dairy and ghee aroma	Characteristic dairy and ghee aroma.
Primary use	Cooking and traditional food preparations	Cooking and food preparation.

The characteristics of commercially available ghee may vary according to the specific product formulation, milk source, processing conditions, and storage practices. Therefore, product labels should be consulted when comparing nutritional composition (Table 3).

MOTHER DAIRY GHEE: NUTRITIONAL IMPORTANCE AND HEALTH CONSIDERATIONS

Nutritional Importance

Mother Dairy Ghee is a dairy-based product that serves primarily as a concentrated source of dietary fat and energy. Like other types of ghee, it can be used as a cooking medium and may be included in a balanced diet when consumed in appropriate quantities.

Ghee may also contain small amounts of fat-soluble vitamins, depending on the source of milk and the processing conditions. These nutrients contribute to various normal physiological functions in the body.

Energy and Dietary Fat

The primary nutritional contribution of ghee is its high energy content. As ghee consists mainly of fat, it provides approximately 9 kcal of energy per gram. It can, therefore, contribute significantly to daily energy intake even when consumed in relatively small amounts.

Use in Food Preparation

Mother Dairy Ghee can be used in various cooking applications, including sautéing, roasting, and frying. The low moisture content and thermal stability of ghee make it suitable for several food preparation methods.

POTENTIAL HEALTH RISKS

High Calorie Intake

Ghee is highly energy-dense. Excessive consumption may increase total calorie intake and contribute to weight gain, particularly when combined with a sedentary lifestyle.

Saturated Fat Consumption

Like other forms of ghee, Mother Dairy Ghee contains saturated fatty acids. Excessive consumption of saturated fat may not be suitable for all individuals, particularly those with elevated cholesterol levels or cardiovascular risk factors. Therefore, moderation is recommended.

Individual Dietary Considerations

The amount of ghee that can be included in the diet varies according to an individual's energy requirements, physical activity level, and overall health status. Individuals with specific dietary restrictions or health concerns should consider appropriate professional dietary guidance.

SUMMARY

Mother Dairy Ghee can be used as a source of dietary fat and energy and is suitable for a variety of cooking applications. However, because of its high calorie and saturated fat content, it should be consumed in moderation as part of a balanced and varied diet.

CONCLUSION

Ghee is an important traditional dairy product that is widely used in cooking and has long been valued in South Asian dietary practices. It is a highly clarified form of butterfat produced by removing moisture and most milk solids through controlled heating and clarification. This process gives ghee its characteristic flavour, aroma, stability, and suitability for various cooking applications. Ghee is a concentrated source of dietary fat and energy and may contain fat-soluble vitamins, including vitamins A, D, E, and K. It can also contain fatty acids such as butyric acid. The nutritional composition and quality of ghee may vary depending on the source of milk and the method of production. The present study discussed different methods of ghee preparation, including traditional household methods and industrial-scale processing. It also reviewed commonly available brands, such as Amul, Gowardhan, Patanjali, and Mother Dairy, and considered their general nutritional importance and potential health implications. Although ghee can be included as part of a balanced diet, moderation is important because it is highly energy-dense and contains saturated fatty acids. Excessive consumption may increase total calorie and saturated fat intake and may contribute to weight gain and cardiovascular risk in susceptible individuals. Overall, ghee remains an important and widely used food product. When consumed in appropriate quantities as part of a balanced and varied diet, it can contribute to dietary energy and fat intake while providing a stable and versatile medium for food preparation.

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