



Review Article

A review on Gelato: An Italian delicacy

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Abstract

Gelato is very popular in the western world and is gaining popularity in India as well. The consumption of low-fat products has been increasing in recent years due to potential health benefits and nutritional advantages. Gelato has received much attention for both its health benefits and amazing taste. It is a fully natural variety of ice cream. Because of its serving condition (i.e. 10-15°C lower than traditional ice cream), gelato has a rich mouthfeel and offers a better taste. Vast varieties of different flavors make gelato a unique product as compared to the general ice cream available in the Indian market. Different fruits and horticultural products such as flowers, berries, and aromatic plants can also be incorporated into it. Fresh and natural ingredients such as milk, cream, skimmed milk powder, sugar, egg yolk and WPC (optional) make the gelato a natural and chemical-free delicacy. The health benefits of gelato are very diverse. The antioxidants present in gelato helps to reduce the free radicals which in terms reduces the aging effect on the human body. Regular consumption of gelato can boost the immune system thereby preventing several health hazards. The natural ingredients in the gelato make it costlier than the normal ice cream. The attractive color and delicious taste add beauty to the product. The serving condition and environment also affect consumer perception towards Gelato. Several research studies and advancements are being done to make it more palatable, acceptable, and nutritious.

Keywords flavors, formulation, gelato, gelato ingredients, health benefits, low-fat product

Introduction

Ice cream and frozen desserts are the categories of the food products that are characterized by normally being aerated and eaten frozen [1]. Globalization, higher disposable incomes, and exposure to emerging trends in world cuisine have fueled the growth of flavors in ice cream and frozen desserts in the last few years. As the high-fat products upon consumption are found to accelerate the risks of obesity and coronary heart diseases, consumers have shifted their interest towards reduced or low-fat products [2-3]. Gelato falls in the category of low-fat ice cream. Gelato in Italian means "frozen"[4].

The origin of Gelato dates back to the 16th century. Though who and where the gelato was invented is still a confusion, most stories credit to Bernardo Buontalenti, a native of Florence, who delighted the court of Catherina dei Medici with his creation. The credit for introducing Gelato to rest of the Europe goes to the Italians. One of the most influential individuals in the history of Gelato was a Sicilian-born Francesco Procopio dei Coltelli, who is considered to be the first to sell Gelato to the public. In Italy, the art of traditional gelato-making passed on from one generation to another with improved versions right up to the 20th century, when many gelato makers

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began to emigrate, taking their expertise to the rest of Europe [4]. Ice cream and frozen desserts, which include fruit, nut, and chocolate ice creams, frozen yogurts, sherbets, ices, dynamically and quiescently frozen novelties, and Bellarine (i.e. filled ice cream), play very important nutritional and social roles in our diet. Besides their nutritive nature, the popularity of ice cream and frozen desserts is mainly due to their refreshingly cool and sweet attributes [5]. The consumer’s perception of low-fat frozen desserts is not only dependent upon the nutritional parameters but also on sensory attributes such as appearance, flavor, and texture [6-7]. Unlike other varieties of ice cream, Gelato is an Italian style ice cream which has got a lower level of fat (4-8%) and total solids (32-42%) content as compared to regular ice cream but typically has higher sugar to give it a soft and scoopable texture [5; 8]. Gelato is rich in flavor and generally with very low overrun (25-60%) [9]. Gelato is gaining popularity around the globe due to richness in flavor, attractive, and better nutritional attributes. Some of the popular and renowned gelato flavors around the world are the most common chocolate, strawberry, lemon, banana, peach, custard, dark chocolate, chili, and many more. Gelato is frozen in a batch freezer and is not subjected to hardening [10]. The colloidal structure formed in gelato is less as whipping is done at a low shear rate and low overrun. Upon melting, the viscosity of the gelato ice cream is higher as compared to any other ice cream. This higher viscosity of the melted gelato helps in imparting higher flavor to the gelato when consumed [11].

Difference between gelato and ice cream

Though the difference between ice cream and gelato is difficult to judge from a distance, they are quite distinct. There are significant differences between traditional gelato and a North American style ice cream. Gelato and ice cream are creamy, frozen desserts made from ingredients that are of both dairy and non-dairy origin. The major differences between gelato and ice cream lies in the level of fat, SNF, stabilizer, and emulsifiers and overrun [12]. It is to be noted that no stabilizer or emulsifier is recommended for the formulation of gelato [11].

Table 1. Compositional differences in ice cream and gelato [1]

Group	Milk fat	MSNF	Sweeteners	S/E	TS
Ice cream (Economy)	8-10	10-12	15-17	0.4	32-36
Gelato-style ice cream	4-8	9-12	15-24	0.5	32-42

MSNF: Milk Solids Not Fat
S/E: Stabilizers and Emulsifiers
TS: Total Solids

The differences between Gelato with ice cream are not limited to its composition. Their quality differs from one another in terms of their production methodology and storage too [12]. Typically, Gelato is produced fresh by using a Batch freezer and is extruded immediately. Thus, extruded Gelato is highly viscous and has a semi-frozen consistency [5]. On the other hand, the US-style ice cream is typically produced in an industrial scale continuous freezer in which it is aerated and frozen. The ice cream is then stored at about -18 to -22°C for hardening. The ideal serving temperature for ice cream is -10 to -12 °C [13].

Gelato and Ice cream also differ from one another in terms of their nutritional profile, texture and flavor aspects. As per the [14], a serving of 1/2 -cup (78 g) of vanilla-flavored ice cream will contribute to 210 calories and 16 g of sugar, while a serving of gelato (88 g) contains about 160 calories and 17 g of sugar. As compared to ice cream, Gelato is much silkier in texture and denser than ice cream. This is the reason behind Gelato being able to pack much more flavor than any other traditional ice cream and, Gelato takes its flavors from natural ingredients [12].

Basic gelato ingredients

Kopfer [15] studied the different traits that are imparted by the various ingredients added to the gelato ice cream. Water in the gelato ice cream can be imparted by alcohol, corn syrup, cream, eggs, fruits, milk, and sour cream. Likewise, sugar can be obtained possibly from alcohol and certainly from chocolates, corn syrup and cream, fruits, milk, and sugar. Fatty attributes can be achieved by incorporating chocolate, cocoa powder, cream, egg, milk, nuts, and sour cream. Ingredients such as chocolates, cocoa powder, corn

syrup, cream, eggs, milk, nuts, salt, and sugar impart solids to the gelato ice cream. Flavoring can be achieved by the addition of alcohol, cocoa nibs, cocoa powder, fruits, and spices [15].

The function of each component in gelato

The milk fat present in gelato is of great importance. Other than increasing the richness of flavor it also lubricates and insulates the mouth which helps in its better and easy consumption. The non-dairy fat provides good structure and texture at a lower cost than the milk fat [3]. The milk solids-not-fat improves body and texture (protein) through emulsification and water holding capacity and also promotes the development of overrun [16]. The addition of sugar lowers the freezing point, imparts sweetness, and improves the flavor and texture. The stabilizers enhance smooth texture, provide body, and enhance shelf life [17]. The egg yolk solids improve the whipping ability and provide a custard-like flavor [18]. The flavoring and coloring aids in improving its overall acceptability. The color in gelato also aids in its flavor identification [9].

Method of preparation of gelato

There are several methods for the preparation of gelato. The old-fashioned way, hot process and cold process. The first and foremost step during the preparation of gelato is the preparation of the gelato mix [19]. For the mix preparation, various ingredients such as milk, fresh cream, skimmed milk powder, sugar, natural flavoring agents, egg yolk (optional), etc. are selected and are mixed in a suitable proportion [20]. The level of fat and SNF is so adjusted that it lies in the range of 4-8% and 32-42% respectively [1]. After a suitable mix is formulated, the mix is blended. During blending, the dry, as well as liquid ingredients, are mixed thoroughly with a bit of agitation. After blending is complete, the mix is subjected to pasteurization followed by homogenization.

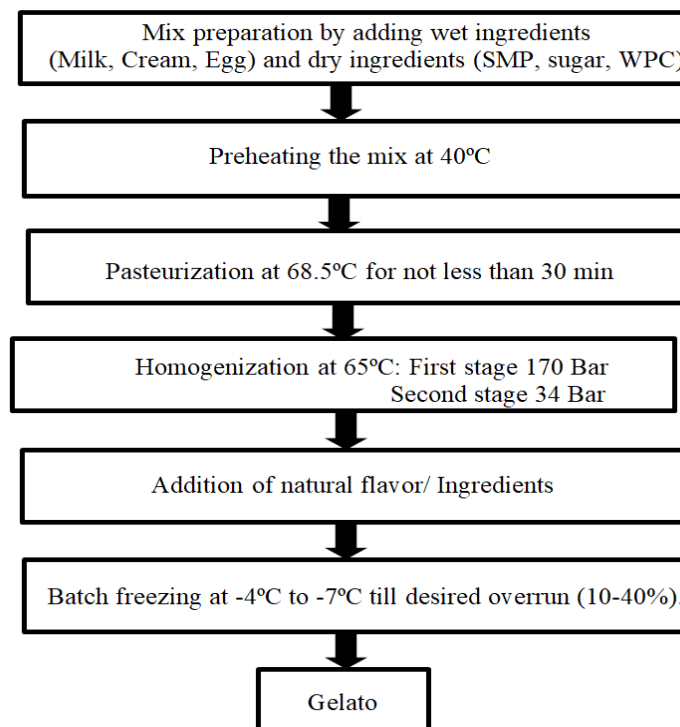


Figure 1. Flow diagram for preparation of Gelato [11]



Homogenization of the mix is usually done at a temperature ranging from 63-77°C and a pressure of 2000-2500 psi on the first stage and 500 psi on second stage is implied for better results in an average mix. The mix is now subjected to cooling (temperature below 4°C). This increases viscosity and will aid in not melting of Gelato smoothly. This temperature retards the growth of bacteria [21]. After cooling is done, the gelato mix is subjected to aging preferably for 24 hours at 4°C [10]. This results in hydration of milk proteins, crystallization of fats, and an increase in viscosity. The duration of aging should not be more than 24 hours as lower temperature facilitates the growth of psychrotrophs. The desirable quantity of natural flavor and color is added to the mix and then the mix is subjected to batch freezing. The frozen product is not subjected to hardening and is rather drawn into shallow tubs from which it can be scooped [1].

Recent studies on gelato

The search for new flavors in the frozen dairy product is important since consumer expects the ice cream industry to come up with a new flavor that can render ‘mouthwatering appeal’, in addition to giving a refreshing and pleasing experience. Several research studies have been conducted around the globe regarding the preparation of gelato with improved physico-chemical characteristics, flavors, and affordable cost.

Alfaifi and Stathopoulos [22] studied the changes in physical attributes of vanilla flavored Gelato ice cream by using different levels of sweet whey protein concentrate (WPC) substitutions over two levels of egg yolk (4.5% and 9%) during the four weeks storage period. The authors set one control sample with no WPC addition and four levels of WPC substitutions (three replications of each treatment) for each level. The result of the study indicated a significant ($P < 0.05$) difference in hardness among the samples with 4.5% and 9% addition of egg yolk during the stated storage period. The increasing levels of WPC on the other hand led to a significant ($P < 0.05$) decrease in melting rate between 9% egg yolk samples with increased storage, while there was no significant ($P > 0.05$) effect on melting rate among 4.5% egg yolk samples.

Alfaifi and Stathopoulos [18] reported the use of whey protein isolate (WPI) as a substitute for egg yolk in Gelato. Gelato was prepared with two different levels of egg yolk (4.5% and 9%) and for each level, the samples were prepared with and without the addition of whey protein isolate. The results of the study showed that the texture and melting rates of the Gelato sample with 9% egg yolk addition were relatively higher than that of samples containing 4.5% egg yolk over the storage period. The hardness of the gelato ice cream was found to be increased significantly with the addition of WPI in both the cases. The result of the research also reflected that the mentioned approach could deliver functionality at a lower cost and can produce a good quality Gelato.

A study on the effect of egg yolk substitution by sweet whey protein concentrate (WPC), on physical attributes of Gelato ice cream, was conducted by Alfaifi and Stathopoulos [23]. Two different levels of egg yolk were set in the sample and for each level, one control sample with no WPC80 addition and four levels of WPC80 substitution (20%, 50%, 80%, and 100%) were made. After the four-week storage duration, the samples were analyzed for physical properties such as viscosity, overrun, and texture and the result showed that among two levels of egg yolk (4.5 and 9%), Gelato containing 9% egg yolk was more viscous than those containing 4.5% egg yolk. Similarly, increased overrun and improved textural characteristics was observed with the increasing WPC substitution in the Gelato samples.

Siripinyo et al., [24] studied the effect of jellose and passion fruit concentration on the physical properties and sensory attributes of passion fruit Gelato. The research was aimed to study the effect of jellose substituted to guar gum as a stabilizer on some physical properties and sensory characteristics of the Gelato. Three different levels of jellose, guar gum i.e 100:0, 50:50, 0:100(w/w) and passion fruit concentrate 18°Brix at level 10% , 15% and 20% (w/w) was set . The physical properties such as viscosity, overrun, melting rate, and hardness were inspected for the prepared gelato ice cream. The authors found the Gelato ice cream using jellose: guar gum 100:0 (w/w) as a stabilizer and mixed with passion fruit concentrate (28°Brix) 10% (w/w) had the highest acceptance score. The mixed viscosity, overrun, melting rate, hardness, ash, fat, and protein values for the sample was 7958.50cP, 6.67%, 0.62ml/ml, 2597.10g



force, 4.07%, 30.98%, and 13.83% respectively. The microbial analysis revealed the Total plate count to be 1.2×10^4 cfu/g.

Casiraghi et al., [25] used alternative sweeteners viz. honey, trehalose, and erythritol in the hand-crafted gelato. The study showed that honey makes the product creamier with improved spreadability. Likewise, trehalose in the formulation of hand-crafted gelato makes the product resistant to melting and reduces the spreadability and creaminess. Erythritol on other hand makes the product lesser in calories with improved texture and melting resistance.

Rinaldi et al., [26] conducted research on innovation in Italian ice cream production by analyzing the effect of different phospholipid emulsifiers (soy, milk, and rice phospholipids). The study revealed that the control sample showed not only the highest overrun and non-freezable water values but also the lowest fat destabilization percentages. On the other hand, gelato added with soy phospholipids exhibited the greatest melting resistance, high-fat destabilization ratio, and harder texture as compared to others. The attributes such as richer volatile profile with herbal and green notes were revealed by the samples with rich phospholipids. The lowest performances among the samples were exhibited by the gelato in which milk phospholipids were added as emulsifier, as this sample showed higher mix viscosity, lower overrun, hardness, and stickiness values.

Alika and Atma [27] determined the effect of fish bone gelatin addition (0%, 0.4%, 0.8%, and 1.2%) on the physical, chemical, and organoleptic characteristics of Gelato. The organoleptic, physical, and chemical characteristics of gelato were found to be affected by the fish bone gelatin addition. The best concentration for the fishbone gelatin addition was found to be 1.2% and Gelato with concentration 1.2% fish bone gelatin have texture, taste, color, aroma, and aftertaste in neutral range and like slightly in organoleptic value range i.e. between 2.62 until 3.70. Thus, obtained gelato has pH of 6.6, overrun of 30.48%, and melting time of 38.4 min. The protein, fat, and sugar values were 3.62%, 6.32%, and 15.62% respectively.

Sacchi et al., [28] studied sensory profile, biphenolic and volatile compounds of an artisanal ice cream ('gelato') functionalized using extra virgin olive oil (EVOO) and showed that the total phenolic content of the functional EVOO ice-cream was 25 ± 0.94 mg kg^{-1} . Some key volatile compounds, including trans-2-hexenal, 1-hexanol, cis-3-hexen-1-ol and trans-2-hexen-1-ol were found in the ice cream due to the addition of EVOO.

Kanse et al., [29] developed vitamin c and antioxidants enriched Gelato by incorporating gulkand. The authors prepared Gelatos by using different combinations of gulkand (0%, 6%, 10%, 14%, 18%) and gelato mix whose fat, SNF and sugar was maintained constant at 5%, 10% and 15% respectively. The authors concluded that 10% level of gulkand was optimum for Gelato Ice cream.

Health benefits of gelato

Depending on the gelato, fresh fruit, dried fruit, nuts or cocoa, etc. can be incorporated into it, providing a bounty of nutrients. Gelatos made by incorporating fresh berries may be rich in antioxidants. Antioxidants bind with the free radicals liberated in the body which eventually helps in better health by preventing diseases and retarding senescence [30]. Vitamin C is one such antioxidant, which is important for a strong immune system, healthy skin, and repairing and maintaining your cartilage, bones, and teeth. Calcium, iron, vitamin A and protein source in Gelato can also be added, though the amount can vary widely depending on the company and the flavor. Natural antioxidants in ice cream are capable of reducing oxidative stress which eventually improves the vascular and physical function of an individual [31]. Gelato comprises of simple sugars and carbohydrates which our body can absorb and easily liberate the energy to do work. Several enzymes are found in the fruits such as pineapples, berries which are helpful in Gelato. The high palatability of gelato stimulates the flow of digestive juices which enhances digestion [10]. Being rich in moisture, gelato can aid in hydration of the body too. Ice cream contains about 10-15% milk fat (or more), but gelato generally contains 0-8% total fat. As gelato is lower in fat, it makes it more flavorful than ice cream. Thus, the addition of sugar to experience that flavor is reduced. The low-fat content in gelato helps in reducing the risks associated with obesity and heart diseases [32]. As gelato is made from milk, it a great source of calcium for non-milk drinkers [4].

Music and gelato perception

The effect of music on gelato perception in different eating contexts was studied by Kantono et al., [33]. The perception of chocolate flavor Gelato across the different eating environments (laboratory, Immersive, and natural eating environment) was measured using the Temporal Check All That Apply (TCATA) method under liked, neutral, disliked, and silent (control) conditions. The result of the study showed that cocoaeness, sweetness, and milkiness were cited more in the natural eating environment than in the laboratory setting. The result also revealed that bitterness and creaminess were the least cited. The sweetness citations were found to be increased by liked and neutral music whereas the bitterness citations were increased in disliked music.

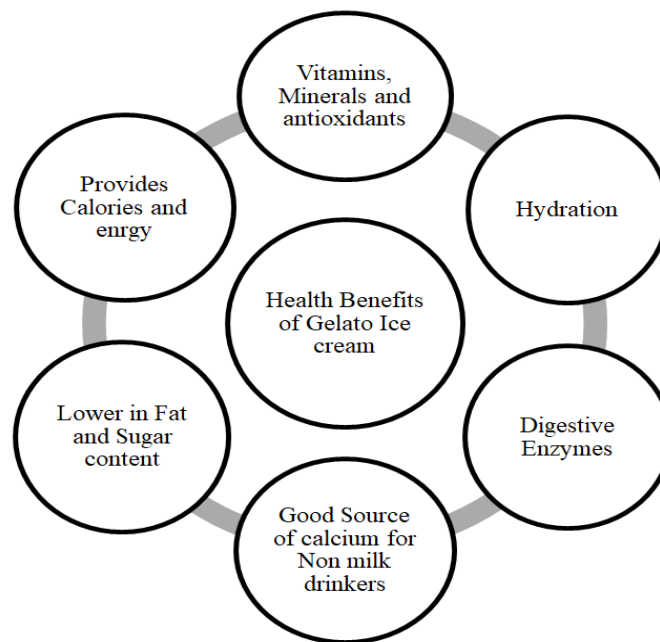


Figure 2. Health benefits of gelato

Conclusion

Gelato is a delicacy that comprises natural ingredients making it healthier and taste, lighter, and arguably more refreshing. Gelato is very popular in the western world and is gaining popularity in India as well. Churning Gelato at a slower rate makes it denser and intensifies its flavor. Gelato has a short shelf life and generally must be sold the same day that it is made. As the high-fat products upon consumption are found to accelerate the risks of obesity and coronary heart diseases, nowadays, consumers have shifted their interest towards reduced or low-fat products. The health benefits of gelato are very diverse. The antioxidants in gelato, which mostly enter into it via added fruits and flowers help to reduce the free radicals and help to reduce the aging effect on the human body. Regular consumption of gelato can help boost the immune system thereby preventing several health hazards.

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