

## An overview on the earliest representative of today vegan and vegetarian ice cream

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### Abstract

Known as ice cream, gelato, sorbet, granita, frozen yogurt or sherbet all are frozen desserts, preferred by consumers especially in the hot summer days. Ice cream was and is the most popular dessert of all times. Even its ancestor is represented by the sorbet, more and more popularity was gained by the frozen desserts based on milk. This situation was changed by the vegan and vegetarian trends. So, sorbet and other frozen desserts with a low content of dairy regained their importance. The consumers care and attention for the products with high fats, sugars and additives dethrones the ice cream against the vegetal frozen desserts. So, this study aims to present and describe the main characteristics of the earliest representative of frozen desserts.

**Keywords:** ice cream, sorbet, vegetal, vegan

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### 1. Introduction

The need of diversification and subsistence related to the valorisation of all edible parts of fruits and vegetables, as well as the need of food waste minimization led to the rediscovery of a well known family of ice creams. The consumerism and the consumers particular tastes induced the necessity of an assortment upgrade. So, the raw material represented by milk was substituted by juices or purees from fruits or vegetables or by milk surrogates. As it is expected, fruits and vegetables are an important source of vitamins, which are not synthesized by the human metabolism.

Consumers which decided to have a vegan or vegetarian diet, as well as other which choose a healthy diet with low fats, free of synthetic additives, create the need of the sorbet or other types of non dairy frozen desserts existence.

Sorbet is one of the earliest representatives of today vegan and vegetarian frozen desserts. Created in the 1<sup>st</sup> century BC by Romans and Persian inventors became popular all over the world [1].

It seems that the first frozen dessert entitled ice cream doesn't appear per se, but as an evolution of the beverages with snow to the nowadays frozen desserts. From the Venetian merchant Marco Polo to Catherine de Medici, iced water or other iced beverages which are the ice cream ancestor are mentioned in specialty literature. The first important step in frozen desserts evolution was made at the middle of the seventeenth century, even the method was known since 1530 in Italy. The method consists of water freezing using salt (or saltpeter) and ice. So, water ices were beginning to be served at the banquet tables of the European royal courts and nobility [2].

Until the nineteenth century, harvesting ice and storing it for use during summer was a challenge and frozen desserts seem to be a food for the rich only.

Over the years sorbet was underrated because of the existence of other frozen desserts especially ice cream and the rich assortment range.

The main differences between ice cream and sorbet are: the raw material, the consistency, the quantity of added additives and the technological process, which is more simple for sorbet making. Apart from them there are many different structural and textural characteristics of both frozen desserts.

Many definitions of sorbet are available. A common one is a frozen sweet dessert that is made usually from fruit or fruit juices [3]. According to [4], sorbet is a flavored syrup with a slushy texture; it is sometimes called a water ice, and contains no dairy ingredients. Another similar definition is brought by [5], where is mentioned that sorbet is made from two main ingredients, fruit and sugar, which are churned like ice cream. Occasionally, water or other natural flavors could be added as well.

Standing on definitions, sorbet is an aerated non-dairy frozen product that is churned in a batch freezer or pacotized in a Pacojet. Fruits or vegetable juice or puree could be the main raw material, an infused or flavored liquid, a wine or a liqueur could be added to offer more tastiness to the product [6].

Sorbet is a good replacer of ice cream especially for people with lactose intolerance, milk allergies, cardiovascular problems or other illnesses produced by fat contribution.

The incidence of lactose intolerance is very high in Asian countries. So there, the ice cream's surrogates are very popular [7].

The absence of milk from the alimentation may cause many nutritional disadvantages such as calcium, phosphorus and vitamins deficiencies, which could be supplemented by fruits and vegetables consumption. Moreover rice milk, soybean milk, almond milk, sesame milk as well as hempseed milk could be used for sorbet making.

## **2.A simple composition of a tasty frozen product**

Almost all the non-dairy frozen desserts have a quite simple composition especially based on: vegetal milk or fruit juice/puree, sweetener (sugar or a substitute), flavors and maybe a stabilizer or an emulsifier, by case.

## **3. Main researches in the field of frozen desserts**

### **Cow milk substitution**

Several studies presents different types of composition of the vegetal ice creams or the partial or total substitution of some important components from frozen desserts.

So, in the study of [8] are presented as raw material hemp milk and sesame milk in the formulation of the vegetable ice cream. Sesame milk contains sesamol that causes resistance against oxidation and lignin having antioxidant properties and has also a considerable quantity of vitamin E. Further, sesame milk consists of unsaturated fatty acids like oleic and linoleic acid having dietary and health importance.

The textural parameters also were influenced by the raw material, such as the sorbet with sesame milk registered an increase in hardness. Frozen desserts texture depends on the size of ice crystals structure, lactose crystals (if appropriate), fat mass and air cells order [9]. Cocoa and coffee were added as well in these types of frozen desserts and the result was the acceptance of the samples by the panelists, the most preferred one being that with coffee addition. The melting and aeration properties were affected by the substitution of cow milk, but this is an expected result. It is well known that melting time is increased by the fat presence, while aeration is directly related to the amount of the incorporated air into the frozen desserts during manufacture [10].

Soy milk seems to be a very good choice for cow milk substitution because is a rich protein source with balance essential amino acids contents [11]. Many benefits of soy milk consumption are related to lowering the risk of cancers, diseases associated with heart and vascular systems, hypercholesterolemia, diabetes, bone and kidney related diseases [12].

When used as soy protein isolates to replace skim milk powder important results were obtained such as the enhancing of viscosity, melting time and hardness of ice cream samples [13]. Soy lecithin was involved as emulsifier and helps in enhancing the viscosity, stability, texture and in extending the melting time of the ice cream [14].

Being easy to be digested, coconut milk is a very rich source of minerals and antioxidants. The prevention of arteriosclerosis and other heart related illness is given by the high oleic and lauric acids contained by coconut milk. The increasing of the ice cream mix viscosity and reducing of melting rates could be positively influenced by the addition of coconut milk but in combination with whey protein concentrate [15].

However, there is also a disadvantage, which needs to be controlled, the stability of the colloidal system.

In the study of [16] are presented the using of two raw materials represented by lupin and peanuts milk to obtain probiotic ice cream. The desserts are not vegan or vegetal exclusively, because of the powder skimmed milk and butter addition, but the main ingredient is vegetal. Stabilizers containing cellulose gum, guar gum, mono- and diacylglycerol's of fatty acid were used. The peanuts ice cream was the preferred one reported to the lupin. The probiotics seems to have a good evolution after 30 days of storage. So, *Bifidobacterium bifidum* has been acting better than *Lactobacillus acidophilus*. Even so, there was registered a decline of the viable probiotic bacteria number. This could be put on account of the mechanical stresses associated with the mixing and freezing process associated with cell injury [17].

In the study of [18] is presented the influence of adding kappa carrageenan and its hydrolysates in order to observe the differences between the recrystallization processes in sorbet. Strawberry as frozen and syrup is the main raw material. The hydrolysis of k-carrageenan causes positive results in retardation of excessive ice crystal growth.

Special sorbets of fruits and vegetables are processed by [19] using innovative cryo and nanotechnologies methods. The fruits used for the experiment are blackberry, cherry, apple, lemon, sea buckthorn, pumpkin and apricot, while the vegetables are spinach and olive. The vegetal material is used fresh as well as frozen in order to produce sorbet. Away from the special tastes remains the health properties of the used fruits and vegetables. The frozen method at -60 to -100°C led to minimize the particles size to a tenth of than ones of traditional sorbets and frozen puree from fruit of vegetable.

A high nutritional raw material represented by the mashed squash (*Cucurbita Maxima*) was added in different proportions in ice cream as [20] has reported in 2015. While such an ice cream with pumpkin addition could be a nutritional alternative to the classical ice cream, there are no significant differences in the acceptability in terms of texture and taste.

Pureed kiwi fruits of green, gold and red color were used to manufacture ice cream. Next to the nutritional benefits of kiwifruit's the unique color and natural flavor could be an important substitute of the commercial flavoring and coloring agents.

The study of [21] presented the influence of kiwi flesh addition (about 49%) in an ice cream matrix. The results revealed the amount of antioxidants from kiwi and the consequent lower elasticity of the ice cream. The ice cream containing green kiwifruit had a shorter melting time and lower overrun than the other ice cream with golden and red kiwi. Ice cream own the natural and pleasant flavor of the kiwifruit used.

A novel combination of non-dairy prebiotic ice cream based on milk rice and passion fruit pulp was presented by [22] in 2020. Rice milk is an available and cheap by-product, but with a highly energetic value containing around 90% of starch, proteins (7–8%), mineral salts (phosphorus, iron, and calcium) and B vitamins [23]. The prebiotics and the passion fruit pulp presence give more functionality to the obtained ice cream due to the antioxidant and the inulin.

Other types of substitution of milk base in order to obtain a lighter and a lower calorie product are presented in the study of [24] in 2018. They have reported the partial substitution of milk from ice cream with hazelnut oil and olive oil. It has been showed that combined oils created blends with similar physicochemical properties with broad applications, so the application of different kinds of oils in ice creams is a successful idea. For the samples with the maximum substitution (50%) the melting time was the lowest, which I expected because other studies reported the same behavior. The using of other types of vegetal fats was to provide to the consumer a greater mouthfeel and a healthier type of ice cream.

Fruit or vegetable pulp or juice is added as a raw material in sorbet and as an auxiliary material in other types of frozen desserts.

#### 4. Fruit and vegetable addition

In the study of [25] is reported the addition of persimmon puree at different concentrations (8, 16, 24, 32, and 40%). The results shown that a concentration of 24% of persimmon puree added in ice cream formulation have gained the best physicochemical, sensorial and textural properties. Next to the improvement of the ice cream properties, the puree added a possible functionality to the product. Passion fruit pulp was added to obtain a vegetal ice cream in the study of [22]. A new type of sorbet, which contains lemon juice concentrate addition was tested by [26] in order to

observe the performances of a scraped surface heat exchanger. In the study of [27] carrot and tomatoes were used as an antioxidant source in classic ice cream manufacturing. Carrot ice cream improved the most of sensory attributes, moreover the specific gravity and resistance of melting were improved. Another fruit used for ice cream processing is guava, which is recognized being a rich source of ascorbic acid. The results of the study realized by [28] are more than satisfactory and could be used on other types of fruits in order to obtain highly nutritive frozen desserts. Cherries, apples, lemons, apricots, sea buckthorn, spinach, olives and pumpkin represent the main ingredient for the sorbet being an important source of tanning substances, ascorbic acid,  $\beta$ -carotene, anthocyanins, chlorophylls, pectin, organic acids, proteins and many others bioactive compounds. Near to milk substitutes there could be use fruits or vegetables in the frozen desserts making.

### 5.Sweetners

Another important part of the frozen desserts composition is sugar, which could be used per se or like powdered or atomized glucose, dextrose, inverted sugar or trimoline, honey, lactose (found in nonfat dry and liquid milk) and sugar free sweeteners. The sugar free sweeteners used for frozen desserts production are sucralose, aspartame, saccharin, cyclamates, acesulfame-K, and many others.

The ratio of sweeteners is very important for the final taste of the dessert and for the melting rate, which is influenced by the sugar content [29]. The sweetness of the sorbet is also assured by the carbohydrates from the vegetal milk as well as from the added fruits and vegetables.

### 6.Stabilizers and emulsifiers

These are used to stabilize the emulsion used to obtain the frozen dessert. Emulsifiers have the aim to place the fat and protein in interfacial spaces to create the mix emulsion. To create the specific structure of a frozen desserts it is important to obtain a stable emulsion. So, hydrocolloids are used for thickening, gelling and stabilizing emulsions. The most significant hydrocolloids are pectin, xanthan, alginate, carrageenan, and galactomannan [30].

Emulsifier are surface active agents used to improve the sensory quality of frozen desserts, which are aiding the whipping process, improving air cell distribution and enhancing the products heat shock resistance. The most known are mono- and diglycerides and polysorbate [31].

### 7.Conclusions

The vegetable kingdom represents an inexhaustible source of fruits and vegetables as much as grains, seeds or by-products, which could be used to manufacture vegetal or vegan ice cream. Adding fruits and vegetables to frozen dessert or the substitution of cow milk with vegetal milk types increases significantly the nutrition value of the product by fiber, carbohydrate, minerals and vitamins contribution. The rheological behavior and the textural properties could be improved by the addition of several vegetal raw materials.

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