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Araştırma Makalesi (Research Article)

SADE DONDURMA İLE ÜZÜM ÇEKİRDEĞİ KATKILI DONDURMANIN DUYUSAL ANALİZİ

Sensory Analysis of Plain Ice Cream and Grape Seed Ice Cream

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Özet

Günümüzde yaşam standartlarını iyileştirme arzusu ve hızlı yaşam temposu, tüketicileri sağlıklı, besleyici değeri yüksek ve çok yönlü gıdalara yönlendirmiştir. Bu eğilim, vücuda temel besin ögelerini sağlamanın ötesinde, belirli bir ya da birden fazla fonksiyonel işlev sunan ve hastalık risklerini azaltıcı etki gösteren fonksiyonel gıdalara olan talebi artırmıştır. Gıda endüstrisinde popüler bir tüketim ürünü olan dondurma, formülasyon değişikliklerine uygun yapısıyla fonksiyonel gıda geliştirme çalışmalarında önemli bir potansiyele sahiptir. Bu çalışmada, antioksidan özellikleri ve zengin fenolik içeriğiyle bilinen siyah üzüm çekirdeği tozunun dondurmanın fonksiyonel özellikleri, besin değerleri ve duyusal kalitesi üzerindeki etkilerinin belirlenmesi amaçlanmıştır.

Araştırma kapsamında iki farklı reçeteye sahip dondurma üretimi gerçekleştirilmiştir. İlk grup, herhangi bir fonksiyonel katkı içermeyen standart sade dondurma (kontrol grubu) olarak hazırlanmıştır. İkinci grup ise formülasyonuna belirli oranda toz haline getirilmiş siyah üzüm çekirdeği eklenen fonksiyonel dondurma olarak üretilmiştir. Geliştirilen ürünlerin kalitatif ve kantitatif özelliklerini belirlemek amacıyla besin analizi değerleri incelenmiştir. Ürünlerin tüketici beğenisini ve kabul edilebilirliğini ölçmek amacıyla, belirlenen tadım

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ölçütleri doğrultusunda 30 panelistin katılımıyla duyusal analiz testleri uygulanmıştır.

Elde edilen besin analizi sonuçları, siyah üzüm çekirdeği tozu ilavesinin dondurmanın fonksiyonel bileşenlerinde ve besleyici değerinde olumlu değişimler meydana getirdiğini göstermiştir. 30 panelist ile yürütülen duyusal analiz değerlendirmelerinde, üzüm çekirdeği tozunun dondurmanın renk, tekstür, tat, koku ve genel kabul edilebilirlik gibi parametreleri üzerindeki etkileri ortaya konmuştur. Sonuç olarak, siyah üzüm çekirdeği tozunun dondurmaya fonksiyonel bir nitelik kazandırdığı, hem besin değerini artırdığı hem de duyusal açıdan tüketilebilir bir alternatif sunduğu tespit edilmiştir. Bu çalışma, fonksiyonel dondurma pazarındaki ürün çeşitliliğine ve sağlıklı ürün geliştirme literatürüne katkı sağlamaktadır.

Anahtar Kelimeler: Fonksiyonel gıdalar, üzüm çekirdeği, dondurma, sağlıklı beslenme.

Abstract

Today, the desire to improve life standards and the fast-paced lifestyle have directed consumers toward healthy, highly nutritious, and versatile foods. This trend has increased the demand for functional foods that offer one or more functional benefits and show risk-reducing effects against diseases, moving beyond merely providing basic nutrients to the body. As a popular consumer product in the food industry, ice cream holds significant potential for functional food development due to its suitability for formulation modifications. This study aims to determine the effects of black grape seed powder, known for its antioxidant properties and rich phenolic content, on the functional properties, nutritional values, and sensory quality of ice cream.

Within the scope of the research, two different ice cream recipes were produced. The first group was prepared as standard plain ice cream (control group) without any functional additives. The second group was manufactured as a functional ice cream with a specific ratio of powdered black grape seed added to its formulation. To determine the qualitative and quantitative characteristics of the developed products, their nutritional analysis values were examined. To measure consumer appreciation and acceptability, sensory analysis tests were conducted with 30 panelists based on designated tasting criteria.

The results of the nutritional analysis demonstrated that the addition of black grape seed powder led to positive changes in the functional components and nutritional value of the ice cream. In the sensory analysis evaluations conducted with 30 panelists, the effects of grape seed powder on parameters such as color, texture, taste, aroma, and overall acceptability were revealed. In conclusion, it was determined that black grape seed powder imparted a functional quality to the ice cream, enhanced its nutritional value, and offered a sensorily acceptable alternative. This study contributes to product diversity in the functional ice cream market and to the literature on healthy product development.

Keywords: Functional products, grapes, ice cream, healthy eating.

Introduction

In the current period, with the increase in living standards in most countries, people want to have information about the properties of the foods they consume and whether the products have a health-improving contribution as well as their nutritional value.

In this case, a more sensitive and conscious nutrition structure emerges. This awareness of people as consumers has driven the production companies to develop new products and the food sector in general to a new innovation. As a result of these searches, the concept of functional food emerged. In the definition made by AAFC (Agrıculture and Agri-Food), functional foods are defined as foods that are included in the daily diet, have a standard food appearance, reduce the risk of chronic discomfort as well as physiological usefulness. In today's modern life, people do not want to consume too much time in health institutions in order to make good use of their time. In addition, they have directed their demands to functional foods in order to reach a healthier treatment in natural ways as a substitute for medication and to have a healthier life. The concept of functional food aims to maximise the physiological functions of human beings in order to make them more comfortable and healthy while minimising the risk of getting sick throughout the life of the individual (Karaağaç, 2010) .

The primary objective of this study is to develop a new product by utilising the high antioxidant level of grape seeds in accordance with the definition of functional food and to reveal whether it has a curative effect on human health. For this purpose, product development, sensory analysis and nutritional analysis methods were used. In the following sections of the study, the conceptual framework, the materials and methods used, the findings obtained and finally the conclusions and recommendations are given.

Açu (2014) added raspberry and blackberry sauces to ice cream and examined the development of functional properties of ice creams. According to this study, it was observed that fruit sauces increased the functionality of ice cream.

Uyanık (2021) produced ice cream using geographically marked kars honey and kars kashar cheese. It was observed that the honey and kashar cheese used in the production were effective in the taste and texture profile of the ice cream, and the cheese caused a sandy structure in the ice cream. This situation was associated with the amount of cheese used in the mix and the ripening time.

In a study investigating the effect of quince seed extract on ice cream production, it was concluded that the % dry matter, % ash, % protein, % titratable acidity data of the ice cream recipes produced during 60 days of storage were close to each other and the differences were not statistically significant. Antioxidant and phenolic matter values decreased during the storage period and the highest antioxidant and phenolic matter values among the ice cream recipes were determined in ice cream with quince seed extract added. (Demir, 2019) .

In a study in which fibre concentrate obtained from pumpkin was used in ice cream production, pumpkin fibre added to the mix increased the dry matter, viscosity values and ash amounts of ice creams. In addition, an increase was observed in the total dietary fibre, total phenolic matter and antioxidant activity values of the ice creams (Kahveci Erdoğan, 2016)

Hacıbektaşoğlu (2019), in his study investigating the usability of red beetroot in ice cream production, concluded that the nutritional value of the ice cream with red beetroot added compared to the control sample is higher, the sugar content is lower due to the use of beetroot and a functional ice cream that is liked in sensory evaluation can be produced.

In the study investigating the possibilities of using pea protein isolate as a substitute for milk powder in ice cream production, it was concluded that pea protein isolate improved the textural and physical properties of ice creams, but high levels of pea protein isolate added to the mix had a negative effect on sensory properties (Avkan, 2020) .

With proper and conscious consumption, nutrition is an important factor that has positive effects on health, in other words, it protects people from diseases, provides physical and chemical development of the body, gives energy and strength to the body, instils the power to withstand the difficulties people face throughout their lives and leads to success (Demirci, 2014) .

A study was conducted by Yıldız et al. in 2020 to examine the effects of pumpkin, ginger, cinnamon, and coconut on the sensory, chemical, and microbial quality of ice cream. In this study, four groups of ice creams were made and stored at -18°C. Samples were analyzed microbiologically, chemically, and sensorially on days 10, 20, and 30 (control group). According to the findings, statistically significant differences were found between the groups in terms of dry matter, non-fat dry matter, and fat values ($p < 0.05$). In conclusion, this research suggests that it is possible to produce high-quality, more diet-friendly, and nutritious ice cream with pumpkin, which has a very low sugar content; and that the quality of the ice creams can be maintained for at least 30 days by storing them at -18°C (Yıldız et al., 2020).

In their study, they investigated the effect of using dietary fibers produced from apple, orange, and pumpkin fruits at different concentrations (1.5% and 3.0%) on the quality and nutritional properties of ice cream. It was observed that the dry matter values of apple, orange, and pumpkin fibers were similar, but there were differences in protein, ash, pH, and color parameters (L*, a*, and b*). The highest water-binding and swelling capacity values were determined in pumpkin fiber, while the highest solubility values and total phenolic and flavonoid content were found in apple fiber. Overall, the addition of fruit fiber increased the dry matter, protein, ash, and viscosity values of ice creams, while decreasing pH, fat, and volume increase values. Fruit fiber addition decreased L* values and increased a* and b* values. All fibers increased the total phenolic and flavonoid content of ice creams in proportion to their addition rates. Sensory perception showed that samples containing 1.5% fiber were more preferred, and ice creams containing pumpkin fiber were more popular than other varieties(Gürpınar et al., 2022).

1. Grape, Grape Seed and Ice Cream

Grape, which is one of the first fruits included in the culture in the world, is a product consumed in the nutrition of all societies that have lived from the past to the present. Among the reasons why it is the most produced product in the world, besides its aroma and flavour, it is suitable for use in many areas (İlknur et al., 2020).

Grape fruits and seeds are characterised as a natural source of antioxidants due to the high level of phenolic compounds and anthocyanins they contain. (Özden Mustafa, 2009)

The fleshy part of the grape and the part that has higher nutritional values than the skin is the grape seed. Researches show that grape seeds are richer in antioxidants and phenolic substances. Over time, when this awareness has been raised in producers, the potential of utilising the grape seed after wine production in different areas has increased instead of being a waste. It is known that the oil obtained from grape seeds is rich in proanthocyanins with high antioxidant properties and unsaturated fatty acids such as linoleic and oleic acid. Compared to other vegetable oils such as sunflower oil and corn oil, which are consumed more in daily life, the essential fatty acid of grape seed oil is higher (Ilknur et al., 2020) .

Ice cream is a seasonal food that was first discovered by combining foods such as crushed fruits, sherbet and honey with ice. Today, it is a food product that can be offered in many varieties by combining milk, sugar, eggs, sahlep, sweeteners, stabilisers, emulsifiers, flavour and colouring agents and freezing them. The techniques that produce today's ice cream were first developed by the Italians, French and British. The Italians, one of the biggest pioneers of modern ice cream, spread it to North America and Europe and offered their products for sale in the most popular cities of the world.

According to the Turkish Food Codex Communiqué on Ice Cream, it refers to a mixture that contains milk and dairy products, drinking water, sugar and permitted additives depending on the taste and type, and optionally contains ingredients such as salep, eggs, flavourings and condiments (hazelnuts, peanuts, almonds, walnuts, fruits, fruit puree, fruit concentrate, coffee, cocoa and chocolate, etc.) that have not yet been frozen. It is the product that is produced by processing and freezing the mixture in accordance with the technique after pasteurisation and consumed in soft form or after hardening. (Türk Gıda Kodeksi, 2005) . The data on the composition of ice cream in the Turkish Food Codex Communiqué on Ice Cream (Communiqué No: 2004/45) are shown in Table 1.

Table 1. Turkish Food Codex Ice Cream Composition

Product Groups	**Features**			
	Total Dry Matter (% by weight)	Milk Fat (% by weight)	Fat Free Dry Matter (% by weight)	Skimmed Milk Dry Matter (% by weight)
Half Fat Ice Cream (Minimum)	31	3	28	10

Fat Ice Cream (Minimum)	36	8	28	10
Full Fat Ice Cream (Minimum)	40	12	28	10
Fatty Maraş ice cream (minimum)	32	4	28	8
Half-fat Maraş ice cream (minimum)	30	2	28	8
Fatty Maraş style ice cream (minimum)	32	4	28	8
Half-fat Maraş style ice cream (minimum)	30	2	28	8

It is recommended to consume ice cream in a healthy diet programme. In addition to vitamins A, D, E, K, B and C group vitamins, ice cream also contains minerals such as high calcium content, phosphorus, potassium, magnesium, zinc, sodium and iron. For this reason, ice cream consumption is important to meet the need for calcium, especially in children. Milk proteins in ice cream are known to have high biological values as they contain all essential amino acid sources that are not synthesised in the body. In addition to the proteins contained in milk in ice cream produced using milk, it is also possible to contain more protein than the protein in milk thanks to the various nutrients added to the ice cream mixture (Açu., 2014).

2. Material and Methods

In this part of the research, it includes data on materials and methods, product development process plan, preparation of recipes, collection of necessary materials, ice cream production, sensory analyses.

The milk used in the ice cream production stage was Pınar brand full fat and the cream was Rama Professional Multipurpose for Cooking and Whipping brand. Sugar and sahlep were obtained from local markets in Bodrum district of Muğla province. Black grape seeds were obtained from online web sales platforms to be used in ice cream with grape seed additive. In addition, sorbet was made from black grapes to prevent the bitter taste of grape seeds in grape seed-added ice cream. The grapes used were obtained from local markets of Bodrum District. Within the framework of the recipes, firstly plain ice cream was produced and then ice cream with grape seed powder was made. Ice cream samples were stored at -18°C during chemical, physical and sensory analyses.

The ice cream mixtures were then left to mature at –18 °C. After 6 hours, when the mixtures began to thicken, they were blended using a 'Robot Coupe MP 450' blender to ensure a homogeneous structure. After this process, the ice creams were stored at –18 °C.

During the production process of the ice cream, the amount of the ice cream mixture was calculated based on the quantity of UHT whole milk. To observe the effect of grape seed, both ice cream mixtures were prepared with the same ingredient ratios. To achieve a smoother texture and stabilize air bubbles within the ice cream, the cream was whipped in a 'KitchenAid' mixer for 5 minutes. A portion of the milk and sugar

in the mixer was transferred to a stainless steel pot and subjected to heat treatment. Meanwhile, the remaining milk, sugar, and salep were mixed in a separate container. The salep mixture was then added to the main mixer. This method was used to prevent clumping of the salep, which can occur if it is added directly to hot milk.

For the grape seed–enriched ice cream, black grapes were boiled in a pot to extract their juice and aroma. The cooked grapes were strained using a fine mesh sieve to separate the pulp. The resulting grape juice was added to the second ice cream mixture. Both mixtures were then pasteurized at 85 °C for 15 minutes with regular stirring. After pasteurization, the mixtures were cooled to 4 °C. Following the cooling step, grape seed powder was added to the second mixture in a predetermined amount.

Sensory analysis method was used in our study. The product recipes obtained with the product development plan were applied and then the first sensory analysis was carried out.

Ice cream production with the developed recipes was carried out in the industrial kitchen of Xanadu Island Hotel. After the production stage, sensory analyses of two different ice creams were carried out.

A panel of 30 individuals, consisting of 20 men and 10 women working as kitchen staff at the Xanadu Island Hotel, was formed for the sensory evaluation. The scoring chart used for the sensory analysis of the ice creams was developed based on the criteria from a study conducted by Aime et al. in 2001.

During the evaluation, panelists assessed the ice cream samples based on the following attributes: cold intensity, mouthfeel (fullness), firmness, viscosity, smoothness, color, appearance, taste, and aroma. Each of these attributes was evaluated under the category of overall acceptability, with panelists assigning scores ranging from 0 (lowest) to 10 (highest). In this scoring system, an average score of 5 was considered neutral.

Prior to the sensory evaluation, panelists were given preliminary information about the ice cream samples and the quality criteria. Both the grape seed–enriched ice cream and the control group (plain ice cream) were tasted and evaluated by the panelists. To ensure independent decision-making, water was provided between tastings to cleanse the palate.

2.1. Ice Cream Production

The most important stage of the ice cream production process is the preparation of the mixture. Firstly, the recipe of the mixture should be created and then the percentage ratios of the substances to be included in the recipe should be calculated. After determining the amounts of the substances to be added according to the amount of the mixture, as the last stage, the substances whose percentage ratios are calculated should be mixed according to their qualities (Megep, 2011) . If each of the main ingredients in the recipe contains a single source or only one of them contains two sources, such mixtures are called simple mixtures. These mixtures generally consist of

sugar, milk powder, cream, condensed milk stabiliser mixtures. Mixtures in which at least one of the main ingredients to be added to the mixture is obtained from more than one source are known as complex mixtures. Mathematical formulas or algebraic operations are used in the calculation of complex mixtures.

Care should be taken when calculating the proportions of the substances that make up the mixture so that flavour and quality are not affected (Uyanik, 2021) .

2.2. Ingredients Used in Ice Cream Production

In ice cream production; milk, fat, sweeteners, skimmed milk dry matter, stabilisers, emulsifiers, flavouring and colouring agents must be present. Each food additive has certain properties in ice cream. These food additives must meet the safety conditions in the Turkish Food Codex communiqué (Kır, 2007) . Fat, skimmed milk dry matter, flavourings and stabilisers are used in ice cream production.

Ice cream recipe formulations were prepared by considering the legal limitations of the required substances in the Turkish Food Codex Regulation Ice Cream Communiqué. The ice cream recipes produced are given in Table 2.

Table 2. Ingredients and Quantities Used in Ice Cream Production

Materials Used	Plain Ice Cream	Ice Cream with Grape Seed Powder
Milk	2000 ml	2000 ml
Cream	400 ml	400 ml
Sugar	300 g	300 g
Sahlep	20 gr	20 gr
Grape Seed Powder	-	20 gr
Grape Juice	-	100 ml

During the production phase, the amount of ice cream mix was calculated based on the amount of UHT fat milk. In order to understand the effect of grape seeds, the weights were kept at the same ratio in both ice cream mixtures. The cream was whipped in a 'Kitchen Aid' brand mixer for 5 minutes in order to create a more silky texture in the ice cream and to form a stabilised bond of air bubbles. Some of the milk and sugar in the mix was taken into a steel pot and subjected to heat treatment. The remaining milk, sugar and salep were mixed in a separate bowl. The mixture with sahlep was then added to the main mixer. Since agglomeration may occur when sahlep is added directly to hot milk, this technique prevented agglomeration of sahlep. The black grapes obtained for ice cream with grape seed additive were taken into a pot and boiled to remove the water and flavour. The cooked grapes were separated from the pulp with the help of a wire strainer. The grape juice obtained was added to the second ice cream mixture. Then these mixtures were pasteurised at 85 °C for 15 minutes by stirring at regular intervals. Firstly, the finished ice cream mixtures were cooled to 4 °C. After the cooling phase, grape seed powder was finally added to the second ice cream mix at the determined scale. The ice cream mixtures were left to mature at -18 °C. After 6 hours, the ice cream mixtures were blended with a 'Robot Coupe MP 450'

brand blender to obtain a homogenous structure. After this process, the ice creams were stored at -18 °C. The production stages of the ice creams are given in Table 3.

Picture 1. Stages of Ice Cream Production

 1. Add the cream into the mixer and whisk for 5 minutes.	 2. The resulting whipped cream.	 3. Put the milk and sugar on the stove and Heat up to 60 °C. Then the sahlep mixture is added to the mix and pasteurised at 85 °C for 15 minutes.
 4. Cleaned black grapes Put into the pot and cook.	 5. Black grape seed.	 6. Powdered black grape seeds.
 7. Grapes whose cooking phase is completed.	 8. Put the grapes into a wire strainer and drain it.	 9. Grape juice obtained after
	 11. Freezing mix to 4 °C	

10. Grape juice is combined with ice cream mix	determined after cooling grape seed powder in quantity add to the mixture.	12. Pulling ice cream with grape seed powder added

SENSORY ANALYSIS FORM

Name and Surname of the Panellist: **../…../20…**

1. Coldness Intensity

0___1___2___3___4___5___6___7___8___9___10

Low Coldness **Coldness**

2. Tightness

0___1___2___3___4___5___6___7___8___9___10

Soft **Hard**

3. Viscosity

0___1___2___3___4___5___6___7___8___9___1

Low viscosity **High Viscosity**

4. Smoothness

0___1___2___3___4___5___6___7___8___9___10

Rough **Smooth**

5. Color and Appearance

0___1___2___3___4___5___6___7___8___9___10

Too bad **Very good**

6. Mouth Fullness

0___1___2___3___4___5___6___7___8___9___10

Low Mouth Fullness **High Mouth Fullness**

7. Taste and Smell

0___1___2___3___4___5___6___7___8___9___10

Very bad **Very good**

8. General Acceptability

0___1___2___3___4___5___6___7___8___9___10

Low **High**

Figure 1. Sensory Analysis Form (Badıllı, 2020).

Take a teaspoon of sample from the sample container. If necessary, it can also be taken from the sides. Mark the numbers on the horizontal lines on the form to indicate the score of each sample. Rinse your mouth with water before assessing each characteristic on the form. Evaluate each feature by comparing it with the control sample.
1. Coldness intensity: Put the sample in your mouth and swirl it around with your tongue. The cold effect of the sample as it melts in the mouth is defined as coldness. If a very sharp coldness is felt while turning the sample in the mouth, it is expressed as extremely cold, if it gives a low degree of coldness, it is expressed as mild coldness.
2. Firmness: Take the sample in your mouth and press it against your palate. The force required to flatten the ice cream indicates firmness. If less force is applied to flatten the ice cream, it is soft, if it flattens with more force, it is expressed as firm (hard).
3. Viscosity: Take ½ teaspoon of sample into the mouth. It is gently rotated and moved between the tongue and palate. During the dissolution of the sample, i.e. before complete dissolution, the ease of movement in the mouth is evaluated. High viscosity means resistance to movement, non-melting and sticking in the mouth. Low viscosity is defined as the sample melting very quickly, showing little resistance to movement and not sticking.
4. Smoothness: The sample is spread over the upper palate with the tongue and the degree of smoothness is evaluated. An ice cream that is not smooth leaves a rough and gritty feeling, while a very smooth ice cream spreads softly and homogeneously in the mouth and does not create a gritty and rough feeling.
5. Colour and Appearance: When evaluating the appearance and colour of the specimen, the score decreases from light to dark and from dull to shiny and from very bad to very bad.
6. Mouth Fullness: Rinse your mouth with water to remove any residue. Take the sample in your mouth and eat it by moving it in a circular motion between the tongue and palate. The density of the film layer remaining in the mouth after swallowing is

referred to as mouth fullness.

Figure 2. Sensory Analysis Application Guide (Aime et al., 2001).

3. **Findings And Discussion**

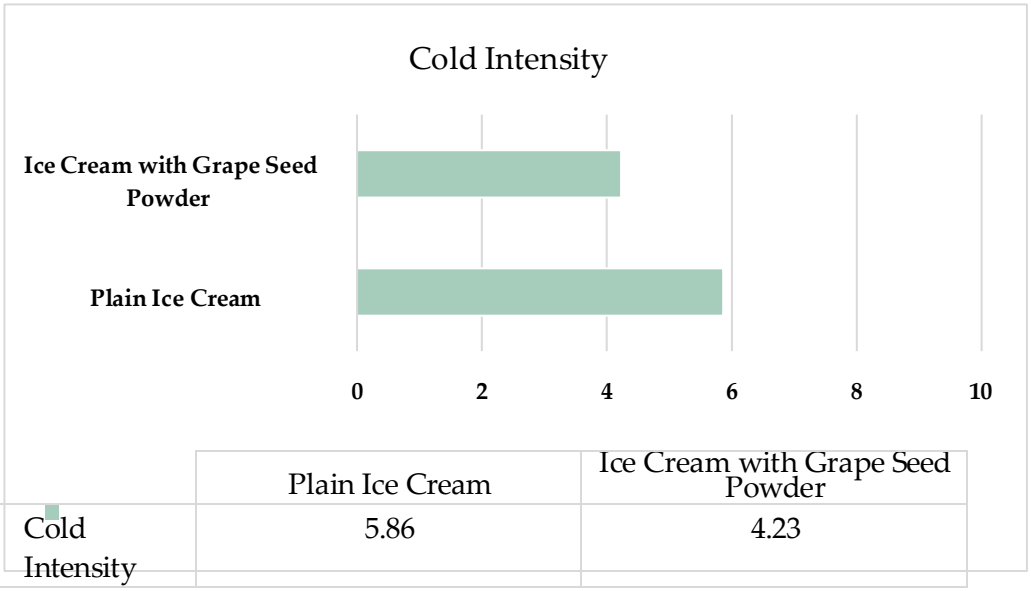
3.1. Sensory Analysis Results of Samples

It was aimed to observe the changes in terms of sensory characteristics of the ice creams developed within the thesis study by applying sensory analysis. The arithmetic mean and standard deviation data of sensory analyses of ice cream samples are given in Table 3.

Table 3. Sensory Analysis Scores of Ice Cream

	Plain Ice Cream	Ice Cream with Grape Seed Additives
Cold Intensity	5,86±0,86	4,23±0,43
Tightness	5,80±0,89	6,60±0,49
Viscosity	5,96±0,76	6,73±0,58
Smoothness	6,76±0,43	8,13±0,34
Colour and Appearance	7,30±0,46	8,83±0,37
Mouth Fullness	6,73±0,44	8,40±0,49
Taste and Odour	7,83±0,94	8,93±0,44
General Admissibility	8,06±0,80	9,13±0,34

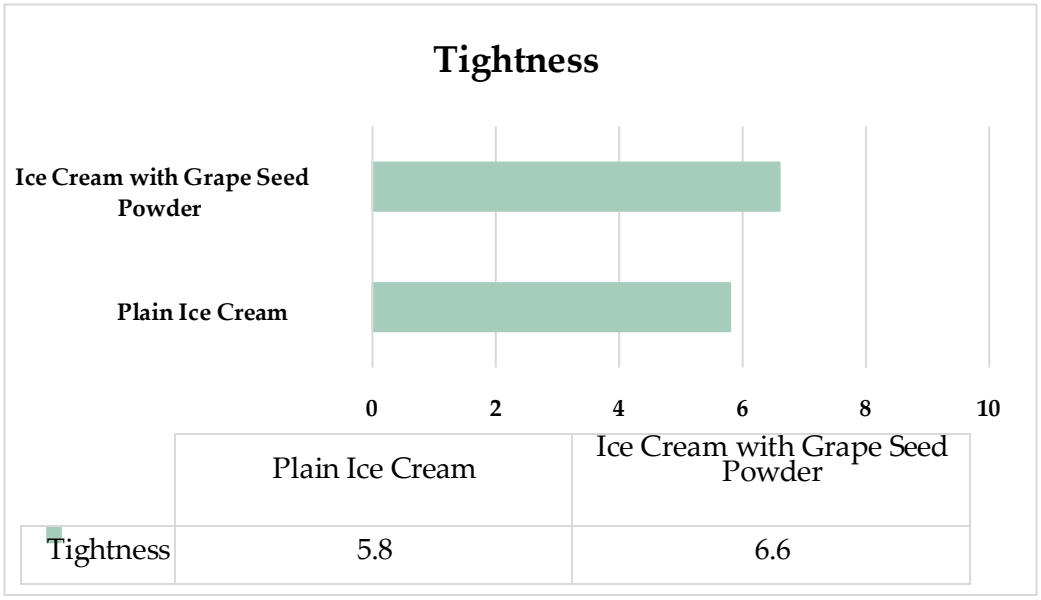
Figure 3. Cold intensity data of ice creams



The cold effect that occurs as a result of melting of ice creams in the mouth through the tongue during consumption is called coldness intensity. If a very intense coldness occurs from the moment the ice cream starts to melt in the mouth, it is defined as high coldness and if a milder coldness occurs, it is defined as low coldness.

The coldness intensity scores given to the ice creams by the panellists are given in Figure 3 together with their standard deviations. Considering the data, the product with higher cold intensity was plain ice cream with a score of 5.86. As a result of a study conducted with ice cream samples produced using different sugar ratios, it was observed that ice cream with higher sugar content had lower cold intensity and crystallisation level in ice cream (Koeferli et al., 1996) . The reason for the lower cold intensity score (4.23) of the ice cream with grape seed additive compared to plain ice cream is thought to be due to the increase in the flavour and sugar content with the added grape juice.

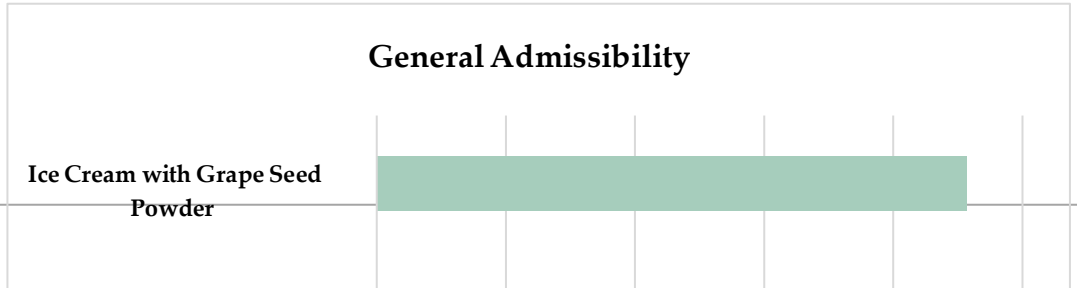
Figure 4. Firmness Data of Ice Creams



In sensory analysis, the force spent by pressing the ice cream with the tongue in the mouth expresses the firmness. If less force is applied with the tongue to flatten the ice cream, it is understood that the ice cream has a soft consistency and if more force is applied, it is understood that the ice cream is harder.

The firmness scores given to the ice creams by the panellists are given in Figure 4 together with their standard deviations. Considering the data, the product with the highest firmness value was the ice cream with grape seed additive with a score of 6.60. On the other hand, plain ice cream with a lower firmness value, in other words, softer than grape seed added ice cream with a score of 5.80.

Figure 5. Viscosity Data of Ice Creams



	Plain Ice Cream	Ice Cream with Grape Seed Powder
General Admissibility	8.06	9.13

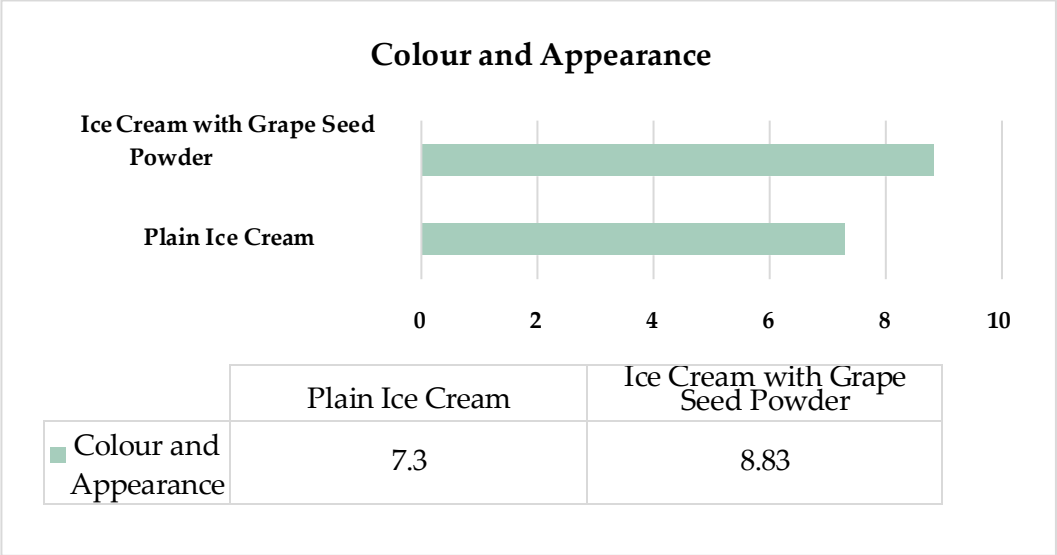
The resistance of ice creams against melting during the movement between the tongue and palate in the mouth is called viscosity. With this resistance to melting, ice creams melt slowly in the mouth and show stickiness is called high viscosity, while faster melting ice creams show less resistance to melting and do not show stickiness in the mouth is called low viscosity.

The viscosity scores of the ice creams by the panellists are given in Figure 5 together with their standard deviations. Considering the data, the product with the highest viscosity value was ice cream with grape seed additive with a score of 9.13. Plain ice cream has a lower viscosity value with a score of 8.06 compared to ice cream with grape seed additive. Due to the high fibre content in grape seeds, it is thought to make an important contribution to the positive development of the structure of ice creams in order to increase the viscosity values of ice cream mixtures due to their high water retention ability.

The homogeneous distribution of ice creams in the mouth during spreading through the tongue to the palate and mouth is defined as smoothness. Homogeneity is at the forefront in ice cream with a smooth feature, it should not leave a sandy feeling in the mouth. If the sandy and bad feeling mentioned occurs in the mouth, it is expressed as a non-smooth ice cream.

The smoothness scores given to the ice creams by the panellists are given in Figure 6 together with their standard deviations. Considering the data, ice cream with grape seed additive had the highest value with 8,83 points. Plain ice cream had a lower smoothness value with a score of 7.30 compared to the ice cream containing grape seeds. The reason for this difference between the smoothness data of the ice creams is that as a result of the interaction of the carbohydrates in the grape seed with the stabilisers in the ice cream mixture, the ice crystallisation value in the ice cream decreases in parallel with the increase in the water retention ability and the ice crystals occur in smaller sizes and the ice cream structure becomes homogeneous.

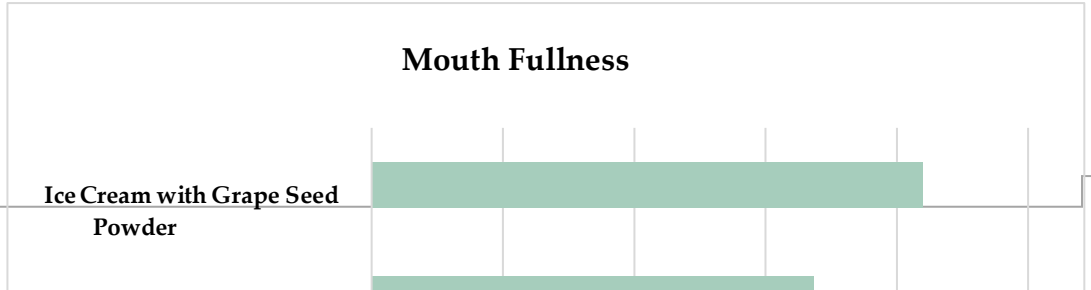
Figure 6. Colour and Appearance Data of Ice Cream



The evaluation of colour and appearance scores is evaluated as the reduction of colour from light to dark and appearance from dull to shiny. The plain ice cream produced was expected to have a slightly yellowish colour due to the milk and salep in the mix. In the ice cream with grape seed and grape juice added, it was expected to have a purple colour due to the dominant colour pigments of the added grape juice. However, no intense purple colour was observed in the ice cream with grape seed addition. The reason for this is thought to be the amount of grape juice added to the mix. The colour desired to be obtained in Maraş ice cream with geographical indication is whiter. In the production phase of this product, carotene etc. colouring agent is not included. In addition, Maraş ice cream, which is mostly produced from buffalo and goat milk, is seen as another factor affecting the whiter colour of ice cream due to the absence of carotene and carotenoids in the content of goat and buffalo milk (Bilgici, 2014). Therefore, it is stated that the colour characteristics of milk and dairy products used in the ice cream mix also affect the colour and appearance of ice cream.

The colour and appearance scores given to the ice creams by the panelists are shown in Figure 7 together with their standard deviations. Considering the data, ice cream with grape seed addition had the highest value with 8,83 points. Plain ice cream had a lower colour and appearance score of 7.30 compared to ice cream with grape seed addition.

Figure 7. Mouth Fullness Data of Ice Cream

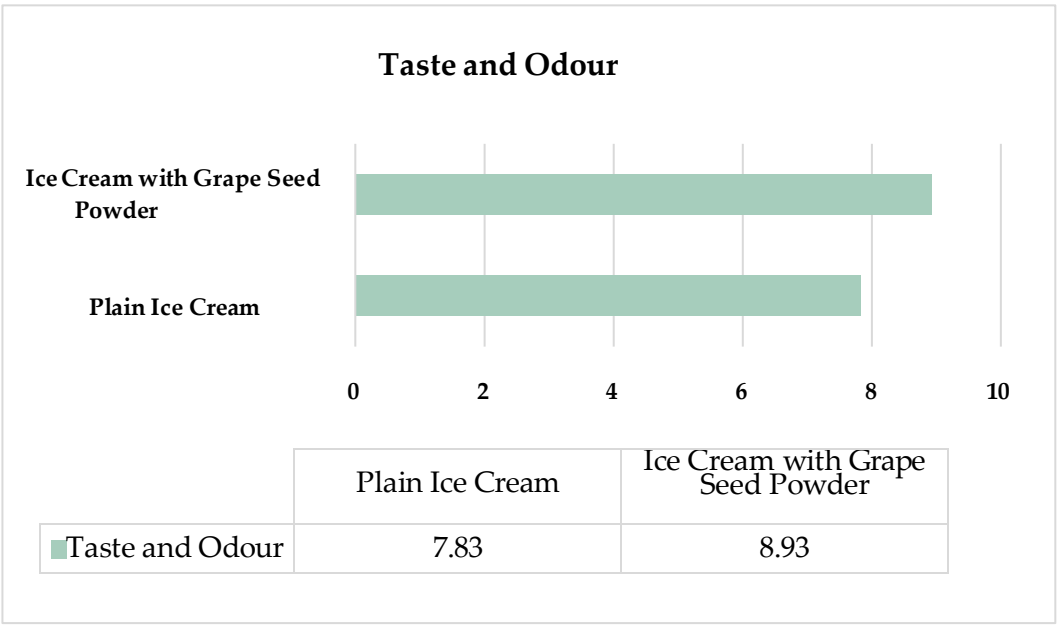


	Plain Ice Cream	Ice Cream with Grape Seed Powder
Mouth Fullness	6.73	8.4

The degree of density of the film layer remaining in the mouth after the ice cream samples are taken into the mouth and moved circularly between the tongue and palate and swallowed is expressed as mouth fullness.

The mouth fullness scores given to the ice creams by the panellists are given in Figure 8 together with their standard deviations. Considering the data, ice cream with grape seed additive had the highest value with 8,40 points. Plain ice cream had a lower mouth fullness value than grape seed ice cream with a score of 6.73. It is thought that the carbohydrates and especially polysaccharides contained in grape seeds, in addition to the increase in water retention ability related to the interaction with milk proteins in the ice cream content, create a cohesion effect and positively affect the ice cream structure and cause an increase in mouth fullness data.

Figure 8. Taste and Odour Data of Ice Cream

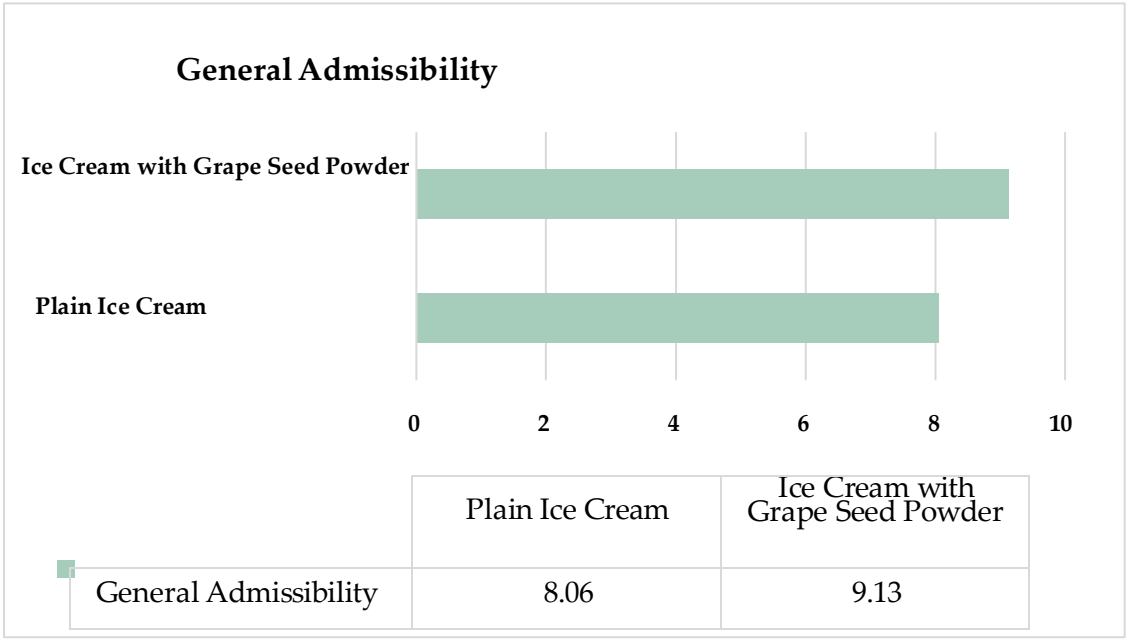


	Plain Ice Cream	Ice Cream with Grape Seed Powder
Taste and Odour	7.83	8.93

The taste is perceived as a result of the hydrofolic molecules reacting with saliva dissolving and interacting with the receptor in the mouth. A food that does not have its own unique odour and taste is unlikely to be in demand and liked.

The taste and odour scores given to the ice creams by the panellists are presented in Figure 9 together with their standard deviations. Considering the data, it is seen that ice cream with grape seed addition has the highest value with 8,93 points. Plain ice cream scored 7.83 points and had a lower score compared to ice cream with grape seed addition. It can be seen that the addition of grape seed powder and grape flavour contributed positively to the taste and odour profile of the ice cream to a certain extent.

Figure 9. General Acceptability Data of Ice Creams



The overall acceptability scores given to the ice creams by the panellists are given in Figure 10 together with their standard deviations. Ice cream with grape seed powder addition had the highest value with 9,13 points. It is seen that plain ice cream has a lower score with 8,06 points compared to ice cream with grape seed powder addition. As can be understood from the data obtained, the addition of grape seed powder positively affected all other sensory properties on the ice cream and also contributed positively to the general acceptability values and it was the ice cream with the highest scores. The sensory analysis data of the ice creams are given in the graph in Figure 10.

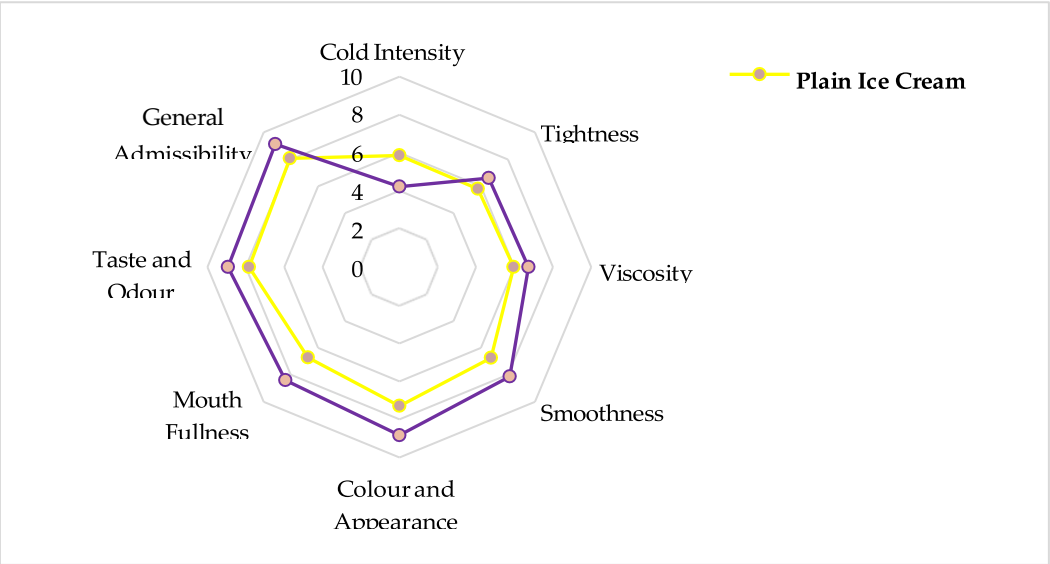


Figure 10. *Sensory Analysis Data of Ice Cream*

3.2. Nutritional Value Data of Samples

Table 5. *Nutritional value data of ice cream (100gr)*

Nutritional Values (for 100 g)	Plain Ice Cream	Ice Cream with Grape Seed Powder
Energy	207 kcal	319 kcal
Carbohydrate (g)	23,6	49,05
Protein (g)	3,5	4,31
Oil (g)	11	11,8
Fibre (g)	0,7	0,93
Calcium (mg)	128	146
Potassium (mg)	195	270
Sodium (mg)	80	80
Vitamin A (iu)	421	467
Vitamin C (mg)	0,6	1,2
Iron (mg)	0,09	0,09

The nutritional values calculated on the basis of the products used in the ice cream mix were obtained from the US Department of Agriculture National Food Database (USDA) and the National Food Database (TURKOMP). The data in both databases were evaluated and averaged and used in this study.

According to the data in Table 5, plain ice cream was produced from milk, cream, sugar and salep and the carbohydrate value for 100 g was 23.6 g. In the ice cream with the addition of grape seed powder, grape seed powder was added to milk, cream, sugar and sahlep, and grape juice was added to add flavour, and the added foods increased the carbohydrate value of the ice cream by 25.45 g and reached 49.05 g carbohydrate value. While the average protein value in plain ice cream was 3.5 g, this value was calculated as 4.31 in ice cream with grape seed powder addition. The fat values calculated by considering the brands and fatness ratios of milk and cream used in the mix were 11 g in plain ice cream and 11.8 g in ice cream with grape seed powder

addition. While grape juice added to the mixture does not contain fat in its content, grape seed contains 0.8 g of fat. In terms of fibre content, while plain ice cream was 0.7 g, this value increased to 0.93 g in ice cream with grape seed powder addition. When the calcium values of the ice creams were examined, plain ice cream was calculated as 128 mg and ice cream with grape seed powder addition was calculated as 146 mg. Potassium mineral, which is effective in regulating the osmotic pressure of liquids and acid-base balance in the human body, was found 195 mg in plain ice cream, while this value was found 270 mg in ice cream with grape seed powder addition. The amount of sodium was equal to 80 g in both ice creams. While plain ice cream contains 421 iu vitamin A, ice cream with grape seed powder addition contains 467 iu vitamin A. The increase in the amount of 46 iu is thought to come from the grape juice added to the mix. When database sources and various researches were considered, no source of vitamin A in grape seed was found. Vitamin C was found to be 0.6 mg in plain ice cream, whereas this value was 1.2 mg in ice cream with the addition of grape seed powder. In terms of iron source, both ice creams contained equal amounts of 0.09 g. It is thought that the iron source contained in ice cream comes from milk. No iron source was found in other foods in the mix.

As a result of some studies analysing the composition of grape seeds, it is reported that the amount of protein in grape seeds is 5.0-11.0%, the amount of fat is 5.2- 17.1%, the amount of dietary fibre is 20.1-42.5% and the amount of ash is 1.2- 2.4% (Aghamirzaei et al., 2015; Lachman et al., 2013; Özcan et al., 2012) . It is thought that the values obtained as a result of the studies vary due to reasons such as climate, environmental conditions, agricultural practices, geography of cultivation and genetic characteristics of grapes.

Another important factor in human health is antioxidant activity. Foods with high antioxidant content provide functionality to foods. In this context, grape seed powder is thought to increase the antioxidant level of ice cream.

Bekar (2017), in his study, examined the effect of grape seed addition to cakes on the quality characteristics of cakes. According to this study, it was observed that antioxidant activity increased in cakes to which grape seeds were added. In addition, as the amount of grape seeds added to the cakes increased, the antioxidant activity increased.

In a study in which 9 different cupcakes were prepared by adding grape seeds to different flours, it was observed that the addition of grape seed flour increased the antioxidant levels of cupcakes (Yalçin, 2020) .

Significant increases have been recorded on the actioxidant levels of cookies, biscuits, yoghurt and salad dressing prepared by adding grape seed powder and grape pomace (Hoye, 2009; Karnopp et al., 2015; Zhu et al., 2015) .

In a study conducted to enrich the functionality of biscuits by adding blueberry, poppy and grape seed to the biscuit content, blueberry was the product that increased

the antioxidant level. Grape seed was found to have the highest antioxidant activity after blueberry (Aksoylu et al., 2012) .

Conclusions and Recommendations

This study aims to produce a healthier and more nutritious type of ice cream by enhancing the functional properties of ice cream, a dairy product widely enjoyed by the general public for its taste and health benefits. To enhance the functional qualities of ice cream, grape seeds were used, a food by-product known to contain phenolic and flavonoid compounds along with components of high biological value and high antioxidant activity, according to recent research. In addition to developing a functional product, the study also aimed to provide an alternative use for grape seeds, which are typically considered production waste.

Within this scope, plain ice cream and ice cream enriched with a specified amount of grape seed powder were produced. The nutritional values of the produced ice creams were analyzed and compared. A sensory analysis was conducted, evaluating characteristics such as cold intensity, firmness, viscosity, smoothness, color and appearance, mouthfeel, taste and smell, and overall acceptability.

As a result of the findings, the ice cream prepared with grape seed powder had higher nutritional values compared to the plain ice cream. Sodium and iron minerals present in plain ice cream were not detected in the grape seed–enriched version, hence those values remained the same. It is recommended that future studies on this topic include more detailed analyses.

In the study, the sensory properties of the produced ice creams were examined, and the effect of grape seed powder addition on these sensory attributes was found to be significant. The panelists stated that the color and aroma of the grape seed powder–enriched ice cream were better. The high overall acceptability score was considered an important finding; in this context, it was concluded that grape seed powder could be evaluated as a natural additive in ice cream production. The impact of grape seed addition on the health and functional properties of ice cream may be the subject of more detailed analyses in future studies.

Many studies have shown that the foods we consume have significant effects on health. In recent years, with increasing consumer awareness and demand for healthy food consumption, the food industry has been trying to meet this demand either by developing new products or by enhancing the functionality of existing ones. To produce health-promoting foods, plant-based fibers can be added to food products. While the edible parts of foods contain valuable nutrients, the non-edible parts can also include beneficial components. In this study, grape seed is used as a non-edible part of the food. Utilizing low-cost yet valuable components such as grape seeds is highly important both for diversifying functional food products and for recycling food waste.

As a result, this study concluded that it is possible to produce a high-quality ice cream enriched with grape seed, using a low amount of sugar, which is more dietary, hygienic, of good quality, and has high nutritional value. The use of grape seed in ice cream production does not pose a risk in terms of quality. This method could introduce a new product variety to the ice cream industry and contribute positively to the sector.

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