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Effects of caper (*Capparis spinosa* L) jam on the physical and chemical properties of ice cream

Engin GÜNDOĞDU[1], Ahmed MENEVSEOGLU[1]*, Hilal COLAKOGLU YENİAY[1] and Fatma HEZER[1]

[1]Gumushane University, Faculty of Engineering and Natural Sciences, Department of Food Engineering, Gumushane, Turkey, 29100

Abstract

Caper is a plant known for its therapeutic properties as well as its nutritional purpose, and tea made from its roots is used in the treatment of rheumatism. This research was aimed to investigate the usability of capers, which have positive effects on human health and are used in the production of different products in the food industry, in the production of fruit ice cream and to develop a product that appeals to both the eyes and the palate with improved sensory properties. In this research, three different ratios (5, 10, and 15%) of caper jam were evaluated to determine the effects on some physical and chemical properties of ice cream. Dry matter, ash, pH, viscosity, overrun, first dripping time, total melting time, and color values were determined, and sensory tests were conducted. Our results showed that dry matter increased, pH and viscosity decreased as caper jam ratio increased. The sensory evaluation with 28 untrained panelists indicated that there was no statistically significant difference between the control sample and jam added ice creams.

Key words: caper, functional food, ice cream, sensory evaluation

Introduction

Caper plant is used for treatment of rheumatism because it has therapeutic properties. It is also used for cancer treatments, and diseases such as hip, spleen, scurvy etc. Moreover, it has been traditionally used for paralysis treatment, and for hemorrhoids (Kara, 2012). Flower buds, fruit and root shells of the self-grown capers in the world and in Turkey are very beneficial for health. It has been used widely among the public for a long time, and the demand of its use has increased with the reveal of its richness in nutrition by the studies (Tlili et al., 2011; Dursun & Dursun, 2005). Caper is one of the first plants that comes to mind when it comes to balanced nutrition, and the flower buds and fruits of this plant are rich in mineral and protein content. Caper plant is grown for very different purposes and different parts of the plant are used in different sectors such as food, cosmetics, and medicine (Kayis, 2008). Capers, which are not a basic food consumed alone, generally add to the structure of other products improve their taste. In addition, the caper plant is used as a garnish. Pickles, salads, cold and especially hot sauces, frozen products, vegetarian foods, cheeses, culinary oils, eggs and bakery products, ready-to-eat products, appetizers, vegetables, etc., are some of the products in which capers are used (Cil, 2006).

One of the main reasons for the increasing number of studies evaluating foods in terms of healthy nutrition is that there is a very close relationship between human health and the foods consumed. Chronic diseases such as diabetes, heart diseases, and cancer that occur because of aging have led to the increase in health expenditures. This has led to an increased demand for functional foods, and relevant organizations have accelerated the production of special-purpose and health-protective foods (Altun, 2012).

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*Corresponding author e-mail: amenevseoglu@gumushane.edu.tr

Advances in ice cream technology have increased the interest in ice cream and similar products. For example, plain ice-cream, reduced fat, low fat, nonfat, fruit, and nut ice-creams, sherbet, frozen yoghurt, besides other frozen products are available commercially (Hiranrangsee et al. 2016). Enhancing of ice cream functionality studies focused on probiotic and prebiotics, whey, dietary fibers, omega-3 fatty acids and minerals enrichment, reducing fat and/or sugar content and increasing antioxidant capacity (Türkmen and Gürsoy, 2017). For that reason, the variety of fruit-flavored products (such as strawberry, raspberries, blueberry, cherry, melon, peach, lemon as well as dessert flavors such as chocolate, vanilla, caramel, and gum drops) begin to take place in market shelves (Kavaz-Yüksel, 2015).

The ice cream sector is a sector that shows the fastest development in the field of food technology and dairy technology and its importance is increasing day by day due to the abundance and variety of raw materials and the rapid increase in consumer demand (Ersöz, 2012). The plant and plant products are added in ice-cream to improve the properties of ice-cream such as color, viscosity, or antioxidant activities (Hiranrangsee et al. 2016). Using of fruit pulp, juice or molasses in the ice cream mix is thought as one of the simple way to boost the nutritional value of product (Tsev et al. 2019). In the literatüre for the producing functional ice-cream cactus pear pulp by (Samahy et al. 2015), juice from kiwifruit by Sun-Waterhouse et al, (2013), broken rice by (Abd Rabo and Dewidar, 2017), date pulp by Farahat et al. (2011). In a study by Tlili et al. (2010) was found to be buds of *C. spinosa* has a significant level of phenolic substance especially, rutin, tocopherols, carotenoids and vitamin C and results confirmed the nutritional and medicinal value of caper. In another study, in-vitro bioaccessibility of polyphenols, antioxidants and flavonoids were analyzed of caper and after digestion, caper jam and marmalade were found to have the highest bioaccessibility in terms of phenolic substances when compared dry salted caper, dried caper, caper tea, pickled caper, pickled caper berry kinds (Tayiroğu 2020). Routine which the most abundant phenolic compound was found in caper jam with high level (420.71±5.58 mg /Kg) (Kuşçu, 2018).

This study was carried out to evaluate some physical and chemical properties of ice cream made with caper jam. This study was aimed to investigate the usability of caper, which can have positive effects on human health, and which are used in the production of different foods in the industry, in the production of fruit ice cream, and to develop a product that appeals to both the eye and the palate with improved nutritional quality and sensory properties.

Materials and Methods

Materials

UHT milk, milk powder, cream, sugar, stabilizer, emulsifiers were obtained from an ice cream producer in Erzurum, Turkey. Caper jam was purchased from a grocery store in Gumushane, Turkey. Icecream mixes were prepared in Food Engineering Department Laboratuary of Gümüşhane University, Turkey. Icecreams were produced in a Divan patisserie in Gümüşhane.

Methods

Ice cream production

Ice cream mixtures were standardized to 5% milkfat, 15% sucrose, 11% milk solids nonfat,, 0.6% stabiliser and 0.2% emülsifier content.

Ice creams were produced with four different proportions of caper jam (0%, 5%, 10% and 15%). Briefly, cream was added after the milk was heated up to 40°C, and when it reached 50°C, milk powder was added followed by granulated sugar. When it reached 60°C, stabilizer and emulsifier were added and divided into four separate parts as of 3 kg each. Caper jam was non added to the first part (it was used as control sample). The other three parts, caper jam was added at the rates of 5%, 10%, and 15%. Then, it was homogenized with a hand blender and pasteurized at 70°C for 20 minutes. It was then quickly cooled to 25°C and left to mature at 4±1°C for 24 hours. After maturation, it was frozen in an ice cream machine (-5°C; Ugur Cooling Machineries Co., Nazilli, Turkey). Dry matter, pH, color and viscosity measurements were made after stored at -18°C for one day.

pH measurement and titratable acidity

For pH measurements, 25 g of sample were weighed and passed through a blender. 25 mL of pure water was added and mixed thoroughly. The pH of the obtained filtrate was measured with the help of a pH meter (HANNA HI2202-02).

The titratable acidity calculated as percentage of lactic acid was determined by titration with 0.1 N of sodium hydroxide (Akalın and Erişir, 2008).

Dry matter measurement

Approximately 2-3 grams of ice cream sample, which were dried in the oven and cooled in a desiccator, were weighed first at 70ºC for 1 hour, then dried in the oven at 105ºC until constant weighing. The calculation was made using the following formula (Kurt et al. (2007)

$$Dry\ matter\ \% = \frac{(last\ weight\ of\ the\ sample - the\ weight\ of\ the\ container)\ x\ 100}{Sample\ weight}$$

Ash measurement

Ash analysis was performed according to Kurt et al. (2007). Clean glass crucibles were kept in the furnace at 350±10ºC for 60 minutes, cooled in a desiccator, and weighed. Approximately 3 grams of the ice cream was put into the crucible. Then, the oven temperature was gradually increased until 550ºC for four hours until they turned to white in color. Then, samples were cooled about 30 minutes, and weighted. Ash content (%) was calculated as below.

$$\%\ ash = \frac{M2 - M1}{m} x100$$

M_2 = crucible + ash (after burnt) (g)
M_1 = crucible (g)
m = sample weight (g)

Viscosity measurement

The viscosity of the ice cream samples was measured at 20 and 50 rpm with J. P Selecta ST 2020 R (Spain) unit. The results were given as cP by taking the average of the readings (Cakmakci et. al 2016).

Overrun, first dripping and complete melting time

The measurements were based on the weight of a certain volume of ice cream mix and ice cream. For this aim, first the mix was weighted in a container then, the ice cream sample was placed in the same container and its weight was measured. Overrun in ice cream samples was calculated using the following formula (Jimenez-Flores et al., 1993).

$$\%\, overrun = \frac{mixed\ weight - ice\ cream\ weight}{ice\ cream\ weight} x\ 100$$

First dripping and complete melting times were recorded as seconds. For this, 25 g of samples were left to melt on the sieve with mash size 0.2 cm at the room temperature (Güven and Karaca, 2002).

Color determination

Color measurement in ice cream samples, Konica Minolta colorimeter device (Chroma Meter, CR-400, Japan) was used and L*(white-to-black), a* (red to green), b* (yellow to blue) values were read at four different points of ice cream samples.

Sensory evaluations

A consumer test was performed for the sensory evaluation of caper jam added ice creams and control sample. For this aim, all the jam added ice creams and control sample were prepared in the same environment to prevent any outsource issue and served to panelists on the same day. Hedonic scales between 9 and 1 (9 the most liked, 1 the least liked) were used to determine the color and appearance, texture, gumminess, flavor, sweetness, and general acceptability. The test was performed with 28 untrained panelists (between 20-23 years old, Food Engineering students). The samples were randomly numbered with three-digit numbers and served to the panelists. Panel forms were prepared to Bodyfelt et al. (1988) and Altuğ (1993) with some modifications.

Data analysis

Statistical analyses were performed by using the SPSS program (Windows release version 22, IBM Ltd., IL, USA). Differences between groups were analyzed by one-way analysis of variance (ANOVA).

Results and Discussions

Physical and chemical analysis results

Some physical and chemical results were given in Table 1. Based on the results, dry matter increased as jam ratio increased. However, there was no statistically significant difference in dry matter content between the ice creams with 10% and 15% jam. This was as expected since jam addition would increase the dry matter due to its sugar content. We would expect more dry matter in the 15% jam added to ice cream, however, there was no statistically difference between %10 and %15 jam added ice cream. Dry matter content of the samples was between 34.58 and 38.43%. Topdas et al. (2017) reported that cherry paste addition to ice cream decreased the dry matter in total.

Ash content did not change statistically as ratio in the ice cream increased. There is no statistically significant difference between the samples. This result could be explained as jam's ash content did not contribute to the total ash content of the ice cream. Ash content of the samples were between 0.92 and 0.95%. Similar results can be found in the literature Topdas et al. (2017) reported cherry jam addition to ice cream did not change the ash content. Similarly, Cakmakci et al. (2016) reported that kumquat addition to ice cream did not change the ash content.

pH of the samples was statistically different from each other. As jam ratio in the ice cream increased, pH decreased. This can be explained as pH of the jam was quite lower than the ice cream itself. Caper jam's pH was reported as 3.15 (Kuscu & Yildirim, 2013) which could help to decrease the pH of jam added ice cream.

Titratable acidity results showed that only %15 caper jam added ice cream was statistically different from the others. Kuscu & Yildirim (2013) reported caper jam's titratable acidity value was 0.76 g/100 g citric acid. Caper jam addition might contribute the total titratable acidity value of the ice cream.

Overrun results indicated that addition of jams decreased the overrun compared to control sample. Overrun is a significant parameter for ice cream evaluation. It is related to volume increasing during the ice cream production. Hwang et al. (2009) reported that addition of grape paste to the ice cream decreased the overrun. This might be due to the water content of the jam. As the water content of the jam is low, so overrun could be the lower. Similarly, the presence of sugar may decrease the overrun.

First dripping and complete melting time are another quality parameter of the ice cream. Jam addition decreased the first dripping time whereas increased the complete melting time. 10% addition of caper jam decreased the complete melting time. Cherry paste addition to ice cream increased both first dripping and complete melting times (Topdas et al. 2017). Sakurai et al. (1996) reported that as the overrun decrease melting time decrease. However, in our study, overrun decreased where complete melting time increased. Factors such as overrun, stabilizer level and type, ice crystal content as well as emulsifier level and type have effect in ice cream meltdown behavior by modifying ice cream microstructure (Wu et al. 2019).

Table 1. Some physical and chemical properties of control sample and jam added ice creams

Sample	Dry matter (%)	Ash (%)	pH	Titratable acidty (g/100g lactic acid)	Overrun (%)	First dripping time (sec)	Complete melting time (sec)
Control	34,6±0,22[a]	0,92±0,01[a]	6,58±0,01[a]	0,2±0,01[a]	23,0±0,04[a]	2865±106[a]	5565±106[a]
5% jam	37,8±0,2[b]	0,95±0,03[a]	6,52±0,01[b]	0,2±0,01[a]	20,3±0,8[b]	2327±108[a]	6537±571[b]
10% jam	38,5±0,18[c]	0,95±0,03[a]	6,48±0,01[c]	0,2±0,01[a]	20,5±0,7[b]	1476±270[b]	4120±216[c]
15% jam	38,4±0,55[bc]	0,93±0,02[a]	6,43±0,01[d]	0,3±0,02[b]	20,2±0,3[b]	1343±255[b]	6540±84[b]

Different lower-case letters indicate the statistical difference among the samples ($p<0.05$)

Table 2 shows the viscosity and color measurement result. Viscosity at 20 rpm, 15% caper jam addition to ice cream decreased. Similarly, at 50 rpm, the lowest value was 48574 for %15 jam added ice cream. Addition of caper jam with a concentration of 5%, 10% and 15% caused a significant decrease in viscosity ($p<0.05$) comparing to control sample. Similar results were found by Topdas et al. (2017). Cherry paste addition to ice cream decreased the viscosity values at both 20 rpm and 50 rpm.

The color profile of ice cream is an important sensory parameter for the consumers. Average L*, a*, and b* values of the samples are given in Table 2. In this study, it was found that L*, a*, and b* values of the ice cream samples statistically different from each other ($p <0.05$). L*, a*, and b* values of the samples were found to be in the range of 80.93-83.28, (-1.01)- (-2.1), and 8.42-11.6, respectively. The lowest lightness value was observed in 5% jam added ice cream while control sample was the highest. For the redness, the lowest value was observed for the control sample and the highest value was observed for 5% jam added ice cream. For the yellowness, the lowest value was observed for the control sample while the highest value was observed for 15% jam added ice cream.

Table 2. Viscosity and color parameters of the samples

Sample	Viscocity (rpm)		Color		
	20	50	L	a	b
Control	12004±22[a]	58721±459[a]	83,28±0,3[a]	-1,01±0,06[a]	8,42±0,1[a]
5% jam	11330±55[b]	59325,5±188[b]	82,71±0,3[a]	-2,1±0,03[b]	10,18±0,4[b]
10% jam	10308±77[c]	55697±171[c]	80,93±0,1[b]	-2,08±0,04[b]	11,43±0,1[c]
15% jam	9880±126[d]	48574±160[d]	81,08±0.1[b]	-2,09±0,05[b]	11,6±0,4[c]

Sensory evaluation

The untrained panelists (n=28) that participated to sensory evaluation were asked to evaluate the ice cream samples based on color and appearance, texture, gumminess, flavor, sweetness, and general acceptability. In terms of color and appearance, 15% caper jam added ice cream was the least liked. This might be due to greenish color that consumer did not like. For the texture, panelists did not observe a statistically significant difference. For the gumminess, the most liked sample was 10% caper jam added ice cream. Moreover, the panelists observed 15% jam added ice cream was the least liked as the score was 4.71. Panelists also did not observe statistically significant difference for the sweetness of the samples. For the general acceptability, 15% caper jam added ice cream was the least liked. However, there was no significant difference between the other samples. Panelists also stated that they felt sourness in the jam added ice creams which was as expected since the caper jam has little of sourness.

Table 3. The scores of sensory evaluations (n=28)

Sample	Color and appearance	Texture	Gumminess	Flavor	Sweetness	General acceptability
Control	7,2±0,23[a]	6,36±0,35[a]	6,29±0,1[a]	6,25±0,2[a]	6,82±0,76[a]	6,13+0,08[a]
5% jam	6,43±0,b[b]	5,98±0,38[a]	5,38±0,33[ab]	5,43±0,61[ab]	6,46±0,25[a]	5,54+0,56[ab]
10% jam	6,66±0,33[b]	6,07±0,71[a]	6,96±1,06[a]	5,68±0,51[ab]	6,04±0,15[a]	5,77+0,13[ab]
15% jam	5,8±0,68[b]	5,57±0,76[a]	4,5±0,3[b]	4,71±0,51[b]	6,64±0,4[a]	4,89+0,3[b]

Conclusion

In this study, caper jams addition were evaluated in the ice cream for the chemical, physical, and sensory effects on the ice creams. Various physical and chemical (color, viscosity, dry matter, ash, pH, titratable acidity, first dripping time, and complete melting time) properties of caper jam added ice creams were determined, and sensory evaluation were conducted. Based on the results, statistically significant differences were obtained for control and caper jam added ice creams for all parameters except ash content (%) and titratable acidity (%). Untrained panelists gave lower scores for color and appearance to jam added ice creams, however, for the other parameters there were no statistically significant difference for at least 5% jam added ice cream. Based on the result, caper jam addition to ice cream has a potential to be manufactured in industrial scale.

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Author Contribution
Engin Gundogdu: Conceptualization, Supervision, Writing–Original draft; Ahmed Menevseoglu: Validation, Visualization; Hilal Colakoglu Yeniay: Formal analysis; Fatma Hezer: Formal analysis.

Conflict of Interest
The authors declare that there is no conflict of interest.

References
Abd Rabo, F., and Dewidar, O. (2017). Broken rice for production of functional ice cream. Ismailia Journal of Dairy Science & Technology, 5(1), 21-27.

Akalın, A., & Erişir, D. (2008). Effects of inulin and oligofructose on the rheological characteristics and probiotic culture survival in low-fat probiotic ice cream. Journal of food science, 73(4), M184-M188.Altun, İ. (2012). Peynir Altı Suyunda Üretilen Ekzopolisakkaritlerin Stabilizatör Olarak Kullanımının Dondurmanın Bazı Özelliklerine Etkileri, Doktora Tezi, Yüzüncü Yıl Üniversitesi Gıda Mühendisliği Anabilim Dalı. Van, 147s.

Altuğ, T. (1993). Duyusal Test Teknikleri. Ege Üniversitesi Mühendislik Fakültesi Ders Kitapları Yayınları No: 28, İzmir ,56 s.

Cakmakci, S., Topdaş, E. F., Çakır, Y., Kalın, P., (2016). Functionality of Kumquat (Fortunella margarita) in The Production of Fruity Ice Cream, The Science of Food and Agriculture, 96(5), 1451-1458

Bodyfelt, F.W., Tobias, J., Trous, G.M. (1988). The Sensory Evaluation of Dairy Products. Van Nostrand Reinhold, 598, New York.

Çil, Y.M. (2006). Oltu (Erzurum) Yöresinde Yetişen Kapari (Capparis ovata var. herbacea) Tomurcuklarının Bileşimi ve Salamuraya İşlenmesi, Yüksek Lisans Tezi, Atatürk Üniversitesi Gıda Mühendisliği Anabilim Dalı. Erzurum, 79s.

Dursun, E. and Dursun, I. (2005). Some Physical Properties of Caper Seed. Biosystems Engineering, 92 (2), 237 – 245. doi.org/10.1016/j.biosystemseng.2005.06.003

El-Samahy, S., Gaballah, A., Embaby, H., Hamed, Y., Khalil, R. (2015). A novel low fat ice cream based on the use of preparation of cactus pear (Opuntia dillenii) pulp. Egyptian Journal of Dairy Science, 43(1), 91-104

Ersöz, N.B. (2012). Pirinç Sütü ile Düşük Kalorili Dondurma Üretimi, Yüksek Lisans Tezi, Erciyes Üniversitesi Gıda Mühendisliği Anabilim Dalı, Kayseri, 220s.

Farahat, A., El-Batawy, O., Alla, E. (2011). Preparation of functional ice cream fortified with date pulp. Egyptian Journal of Dairy Science, 39(2), 285-291

Güven, M. and Karaca, O. (2002) The effects of varying sugar content and fruit concentration on the physical properties of vanilla and fruit ice-cream-type frozen yogurts. International Journal of Dairy Technology 55(1) 27-31

Hiranrangsee, L., Kumaree, K. K., Sadiq, M. B., & Anal, A. K. (2016). Extraction of anthocyanins from pericarp and lipids from seeds of mangosteen (Garcinia mangostana L.) by Ultrasound-assisted extraction (UAE) and evaluation of pericarp extract enriched functional ice-cream. Journal of food science and technology, 53(10), 3806-3813.

Hwang, J. Y., Shyu, Y. S., Hsu, C. K. (2009). Grape wine lees improves the rheological and adds antioxidant properties to ice cream. LWT-Food Sci Technol, 42, 312 – 318. DOI: 10.1016/j.lwt.2008.03.008

Kara, A. (2012). Türkiye'de Yetişen Kapari (Capparısssp.) Bitkisinde Genetik Çeşitliliğin Moleküler İşaretleyicilerle Karakterizasyonu, Yüksek Lisans Tezi, Hitit Üniversitesi Biyoloji Anabilim Dalı. Çorum, 110s.

Karaman, N. (2011). Salep ve Bazı Stabilizatörlerin Maraş Dondurmasının Çeşitli Nitelikleri Üzerine Etkilerinin Belirlenmesi, Yüksek Lisans Tezi, Kahramanmaraş Sütçü İmam Üniversitesi Gıda Mühendisliği Anabilim Dalı. Kahramanmaraş, 94s.

Kayış, P.G. (2008). Organik ve Konvansiyonel Kapari Çeşitlerinin Farklı Salamura Ortamlarındaki Besin Değerleri, Yüksek Lisans Tezi, Afyon Kocatepe Üniversitesi Gıda Mühendisliği Anabilim Dalı. Afyonkarahisar, 69s.

Kavaz-Yüksel, A. (2015). The Effects Of Blackthorn (Prunus Spınosal) Addition On Certain Quality Characterıstıcs Ofıce Cream. Journal of Food Quality, 38, 413-421.

Kurt, A., Çakmakçı, S., Çağlar, A. (2007). Süt ve Mamülleri Muayene ve Analiz Metotları Rehberi, Atatürk Üniversitesi Ziraat Fakültesi Yayınları, Erzurum, 238s

Kuscu, A. and Yildirim, N. (2018). Acılığı Giderilmiş Kapariden (Capparis Spp.) Geleneksel ve Vakum Yöntemleriyle Üretilen Reçellerin Kalite Özelliklerinin Karşılaştırılması. Süleyman Demirel University Journal of Natural and Applied Sciences, 22(2), 881-886. DOI: 10.19113/sdufbed.55487

Sakurai, K., Kokubo, S., Hakamata, K., Tomita, M., Yoshida, S. (1996). Effect of production conditions on ice cream melting resistance and hardness. Milchwissenschaft, 51, 451-454.

Sun-Waterhouse, D., Edmonds, L., Wadhwa, S. S., Wibisono, R. (2013). Producing ice cream using a substantial amount of juice from kiwifruit with green, gold or red flesh. Food Research International, 50(2), 647-656.

Tayiroğlu, B. (2020). Kapari ürünlerinin fonksiyonel özellikler ve biyoalınabilirlik açısından değerlendirilmesi. Uludağ Üniversitesi Fen Bilimleri Enstitüsü, yüksek lisans tezi, Bursa

Tlili, N., Elfalleh, W.,Saadaoui, E., Khaldi, A., Triki, S., Nasri, N. (2011). The caper (Capparis L.): Ethnopharmacology, phytochemical and pharmacological properties. Fitoterapia, 82 (2), 93–101. doi.org/10.1016/j.fitote.2010.09.006

Tlili, N., Khaldi, A., Triki, S., Munné-Bosch, S. (2010). Phenolic compounds and vitamin antioxidants of caper (Capparis spinosa). Plant foods for human nutrition, 65(3), 260-265

Topdas, E.F., Cakmakci, S., Cakiroglu K. (2017). The Antioxidant Activity, Vitamin C Contents, Physical, Chemical and Sensory Properties of Ice Cream Supplemented with Cornelian Cherry (Cornus mas L.) Paste. Kafkas Univ Vet Fak Derg., 23 (5), 691-697. DOI: 10.9775/kvfd.2016.17298

Türkmen, N., & Gürsoy, A. (2017). Functional ice cream. Akademik Gida, 15(4), 386-395.

Jimenez-Flores, R., Klipfel, N., Tobias, J. (1993). Ice Cream and Frozen Desserts, Vch Publishers, 57-159.

Wu, B., Freire, D. O., & Hartel, R. W. (2019). The Effect of Overrun, Fat Destabilization, and Ice Cream Mix Viscosity on Entire Meltdown Behavior. Journal of food science, 84(9), 2562-2571.