CHEMICAL ENGINEERING TRANSACTIONS

VOL. 75, 2019

A publication of AIDIC
The Italian Association of Chemical Engineering
Online at www.cetjournal.it

Guest Editors: Sauro Pierucci, Laura Piazza

ISBN 978-88-95608-72-3; **ISSN** 2283-9216

DOI: 10.3303/CET1975070

Design and Development of a Novel Dietetic and Sustainable Ice Cream Cookie Sandwich

Alessio Cimini*, Mauro Moresi

Department for Innovation in the Biological, Agrofood and Forestry Systems, University of Tuscia, Viterbo, Italy
a.cimini@unitus.it

In this work, a novel dietetic ice cream cookie, called Ice-Glu®, was designed to provide at least 1 g of oat β-glucan per portion according to EU Regulation no. 1169/2011, and about 1 mg of cholesterol. It consisted of an oatmeal cookie of ~15 g, topped with 65-g ice-cream brick block, made essentially of skimmed milk, vegetable-based whipping cream, β-glucan enriched oat bran and dark-chocolate flakes. Its eco-innovative characteristics derived from ingredients carefully selected, mainly of vegetable origin, with quite a low carbon footprint (i.e., oat, and vegetable fats). Moreover, it incorporated oat bran high in β-glucan (28 % w/w), a byproduct of oat milling currently used as cattle feed. Since Ice-Glu® can be produced in the same processing lines used to make conventional impulse ice cream sandwiches, its operating costs and environmental impact were measured by accounting for just the market prices and global warming potentials of its basic ingredients. In the circumstances, the raw material costs (0.105 €) and carbon footprint (94 g CO_{2e}) per each portion of Ice-Glu® resulted to be about 35 % greater and 20 % smaller than those of the conventional counterpart, respectively. Such an increase in the raw material costs of Ice-Glu® might be offset by its increased health and environmental benefits.

1. Introduction

Ice cream is a product with organoleptic properties greatly appreciated by quite a large spectrum of consumers, especially children and elderly people. In 2016 the global ice cream market size was around US$55 billion (GVR, 2018), while in Italy was about €2 billion (CNA, 2018). There is also a growing request for vegan ice creams, such as sorbets, and coconut-, almond-, soy- and rice-milk ice creams, this market being valued at US$1 billion in 2017 and expected to soar to US$45 billion by 2027. The ice cream market is segmented into impulse, artisanal, and take-home ice creams. Impulse segment held the largest share and included cups, cones, sandwiches, ice cream bars, and sticks. Ice cream structure makes it a very promising carrier for the stabilization and *in vivo* delivery of bioactive compounds (e.g., dietary fibers, natural antioxidants, fruit peels, herbal extracts, ω-3 and ω-6 fatty acids, minerals and trace elements), as well as beneficial microorganisms (Soukoulis et al., 2014). In particular, ice cream enriched with insoluble fiber from oat, wheat, and apple exhibited an enhanced macroviscosity and melting point (Soukoulis et al., 2009), while that enriched with orange peel fiber allowed a 70% fat reduction with slight effect on color, odor, and texture (de Moreas Crizel et al., 2013). Moreover, ice cream might be used as an effective vehicle for energy or nutrient/vitamin delivery in the elderly, especially because six out of every 10 elderly care/hospital patients resulted to be at serious risk of malnutrition (Spence et al., 2019).

Among dietary fibers, oat and barley ones are quite rich in a class of linear non-starch polysaccharides, known as β-D-glucan, that consist of glucose monomers. Several clinical studies have highlighted their benefits, not only on the level of low-density lipoprotein (LDL) blood cholesterol, but also on glycemic and insulinic response, as well as probiotic and immune-stimulating activities. In 2006 the Food and Drug Administration approved the use of healthy claims to highlight their consumption benefits on human health. Moreover, provided that a food product contained at least 1 g of β-glucan, the EU Regulation n. 1169/2011 authorized the use of the following claim: "it was demonstrated that β-glucan lowers blood cholesterol. Hypercholesterolemia represents a hazard factor for coronary disease development".

Paper Received: 22 May 2018; Revised: 27 September 2018; Accepted: 26 January 2019

Please cite this article as: Cimini A., Moresi M., 2019, Design and Development of a Novel Dietetic and Sustainable Ice Cream Cookie Sandwich, Chemical Engineering Transactions, 75, 415-420 DOI:10.3303/CET1975070

Barley and oat flour fractions at different β-glucan levels have been so far used to formulate bread and pasta products (Cavallero et al., 2002; Knuckles et al., 1997) to prevent coronary heart disease and diabetes. Unfortunately, the viscosifying effect of β-glucan may be problematic towards the sensory quality of foods and beverages, even if such an effect enhances the physiological effectiveness of β-glucan. Indeed, high β-glucan concentrations not only cause beer filtration problems (Cimini and Moresi, 2015), but also reduce the drinkability of some beverages (Beristain et al., 2006). As far as we know, the aforementioned minimum amount of β-glucan has not been used to formulate any dietetic ice cream yet. Thus, the goal of this work was to define a novel ice cream cookie sandwich, called Ice-Glu®, as well as to assess its manufacturing processes, environmental impact, operating costs, and sensory properties.

2. Materials and methods

The impulse ice-cream was designed to provide 1 g of oat β-glucan per portion. Thus, it consisted of an oatmeal cookie of about 15 g, topped with 65 g of plain ice-cream with chocolate chips (Fig. 1).
All ingredients used were of food-grade, namely wheat flour (Pastificio Lucio Garofalo Spa,Gragnano, I); whole oat flour (Fior di Loto Montefiore dell'Aso, I); OatWell™ Original Powder at 28 % (w/w) β-glucan (DSM Nutritional Products Ltd, Dalry, UK); table sugar (Eridania Italia Spa, Bologna, I); whole eggs (Ovito, Terni, I); egg white (Le Naturelle, Eurovo, S.Maria di Fabriago, I); non-hydrogenated liquid vegetable fats at 28 (Hoplà Trevalli, Jesi, I) or 55 (Vallè Italia srl, Milan, I) % w/w fat; pasteurized whole milk (Granarolo Spa, Bologna, I); skimmed UHT milk (Granarolo Spa, Bologna, I); skimmed powder milk (Olvega Spa, Reggio Emilia, I); whipping cream at 35 % (w/w) milk fat (Granarolo Spa, Bologna, I); Belbake Baking Powder (Lidl, Neckarsulm, D); and table salt (Italkali Spa, Palermo, I).

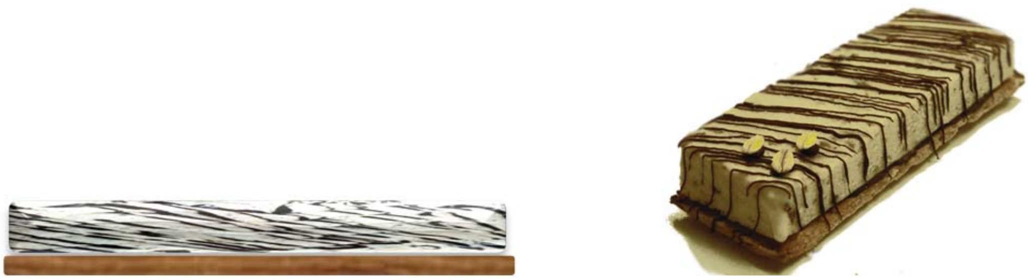

Figure 1: Schematic view and picture of the impulse ice cream cookie providing 1 g of oat β-glucan per portion.

As concerning the cookie, the shortbread dough was prepared using the so-called *creaming-up method*. This technique allows solid fat, like shortening or butter, to be softened into a smooth mass and then alternately blended with the other dry and liquid ingredients. In the circumstances, tiny air bubbles are incorporated in the batter, these acting as a form of leavening agent when the batter is baked. The basic ingredients were sequentially added into the mixing bowl of the Kenwood Chef KVC3100W Stand Mixer and thoroughly mixed using a stainless steel wire whip beater for 2 min at medium velocity. At the end of mixing, the whole oat and wheat flours, β-glucan enriched oat bran, table salt and baking powders were incorporated and mixed using a flat beater at medium velocity. The resulting homogeneous dough was wrapped in a plastic film and let it rest at 4 °C for at least 2 h. Upon sheeting and rolling from three to six times a 0.5-cm thick sheet was obtained. It was cut in stripes, 4.5-cm wide and 11-cm long. These were then cooked in a hot air-circulation oven at 210 °C for about 18 min. Each cookie had an average final mass of 15±1 g.
The ice cream was prepared by adding in sequence skimmed milk powder, sugar, oat flour, and β-glucan enriched oat bran into a bowl and thoroughly mixed. Skim milk and vegetable-based whipping cream were then added. The resulting homogenous solution was pasteurized at 68 °C for 3 min; then, cooled down to ambient temperature using a cold bath and stored at 4 °C overnight. The cream mix was poured into a home ice cream maker (Gaggia mod 60468, Gaggio Montano, I), and churned for 20 to 25 min. Under vigorous stirring the chocolate flake were finally incorporated using neither stabilizers nor emulsifiers. The final mixture was poured into a plastic mold and put into a freezer at -18 °C. After hardening, the ice cream block was cut to form the brick block ice cream portions, each one weighing 65±2 g. Each ice cream brick was positioned over a previously prepared cookie, its upper surface having been previously coated with 1-mm thick layer of molted dark chocolate. The resulting ice cream cookie was packed using a food metallized polyester film bag, and stored in a freezer at -18 °C for no longer than one month. Tables 1 and 2 show the formulation used for each component of the conventional and novel ice cream cookie sandwiches examined in this work.

The specific raw material costs (SC) and carbon footprint (CF) of the conventional and dietetic ice cream cookie sandwiches formulated here were assessed as follows:

$$SC = \sum_i (m_i \, SC_i) \quad (1)$$

$$CF = \sum_i (m_i \, CF_i) \quad (2)$$

where m_i, SC_i and CF_i are the amount, specific cost and carbon footprint of the generic i-th ingredient, respectively, as shown in Tables 1 and 2. Each CF_i represents the amount of carbon dioxide equivalents (CO_{2e}) emitted over a time horizon of 100 years, as detailed by the PAS 2050 standard method (BSI, 2008) and extracted from the Ecoinvent and LCA Food databases of the Life Cycle Analysis (LCA) software Simapro 7.2 v.2 (Prè Consultants, Amersfoort, NL) and technical literature (Harris et al., 2015; Nilsson et al., 2010).

Table 1: Cookie and ice cream formulation for the conventional ice cream cookie sandwich prepared here, together with each ingredient specific cost (SC_i) and carbon footprint (CF_i).

Ingredients for	**Cookie [g portion^{-1}]**	**Ice cream [g portion^{-1}]**	**SC_i [€ kg^{-1}]**	**CF_i [kgCO_{2e} kg^{-1}]**
Wheat flour	6.50	-	0.55	1.03
Butter	3.90	-	3.10	4.50
Sugar	3.24	-	0.78	0.86
Egg	1.14	-	0.62	2.01
Baking powder	0.18	-	18.5	0.28
Salt	0.06	-	0.16	0.20
Whole milk	-	41.54	0.60	1.11
Skimmed milk powder	-	2.47	2.50	8.65
Whipping cream 36% milk fat	-	8.52	1.70	3.60
Sugar	-	12.48	0.78	0.86

Table 2: Cookie and ice cream formulation for the β-glucan enriched ice cream cookie sandwich prepared here, together with each ingredient specific cost (SC_i) and carbon footprint (CF_i).

Ingredients for	**Cookie [g portion^{-1}]**	**Ice cream [g portion^{-1}]**	**SC_i [€ kg^{-1}]**	**CF_i [kgCO_{2e} kg^{-1}]**
Whole oat flour	6.15	7.09	1.20	0.57
β-glucan enriched oat bran	1.08	0.91	10.00	1.13
Margarine	2.12	-	2.30	0.83
Sugar	1.80	-	0.78	0.86
Egg white	3.62	-	0.70	0.62
Baking powder	0.18	-	18.50	0.28
Salt	0.06	-	0.16	0.20
Skim milk	-	37.57	0.50	1.10
Skimmed milk powder	-	2.34	2.50	8.65
Vegetable-based whipping cream	-	8.91	2.30	0.42
Sugar	-	5.79	0.78	0.86
Dark chocolate	-	2.41	3.00	3.45

Sensory evaluation of the conventional and β-glucan enriched ice cream products was performed by a paired preference test in order to assess how much the product was liked. The panelists included in these tests were seven BS students identified as users of the product and not trained. These panelists were asks to indicate how much they liked or disliked the two ice creams based on the attributes of appearance flavor, body, texture, and melt (Stone and Sidel, 2004; Tharp and Young, 2012), as well as the global acceptance, according to a 9-point hedonic scale. Each sample was randomly coded with three-digit numbers.

3. Results and Discussion

3.1 Assessment of the theoretical β-glucan and cholesterol contents in a single portion of Ice-Glu®

Ice-Glu® is a novel dietetic and sustainable ice cream cookie sandwich designed to contain at least 1 g of β-glucan per portion and to be environmental friendly and, what is more, beneficial to human health. Its β-glucan content derived from the use of the OatWell™ Original Powder and whole oat flour at 28 and 4 % (w/w) β-glucan, respectively, in both the cookie and ice cream. By limiting the use of fats of animal origin (i.e., milk fat, and whole eggs) and resorting to skim milk and vegetable-based whipping cream at 0.5 and 28 % (w/w) fat, it was possible to minimize the cholesterol content to a theoretical value of 1.3 mg per portion. According to USDA (n.d.), the conventional light or rich vanilla ice-creams contain as much as 27 or 92 mg of cholesterol per each 100-g portion. Table 3 shows the main nutritional assessment for Ice-Glu® to be reported in the label. In this way, it would be possible to inform the consumer that each portion contains more than 1 g of β-glucan as soluble fiber and provides a calorie intake of 792 kJ (or 189 kcal), this representing the 9.5 % of Reference Intake of an average adult calculated on the basis of a daily intake of 8400 kJ according to the EU Regulation 1169/2011. Ice-Glu® was thus a lower-calorie ice cream than the chocolate chip cookie sandwiches available on the market nowadays, since their total fat content and calorie intake range from 6.2 to 15 g and from 224 to 380 kcal per serving size, respectively (<sharehappy.it/Products/ProductDetail.aspx/bid-171665/sid-1315212/pid-171660>, <drumstick.com/nestle/nestle-toll-house-vanilla-chocolate-chip-cookie-sandwich#nutrition>).

Table 3: Ice-Glu® nutritional information.

Nutritional Value		**per portion**	**per 100 g**
Energy	[kcal]	189	233
	[kJ]	792	976
Water	[g]	45.8	57.3
Protein	[g]	4.8	6.0
Carbohydrate	[g]	22.1	27.5
Fat	[g]	5.6	7.0
Fiber, total	[g]	1.7	2.2
soluble fiber	[g]	1.1	1.4

3.2 Carbon footprint assessment

Owing to the difficulty of collecting data on the environmental impact of ice cream production in the industrial scale, and by accounting for the fact that the novel Ice-Glu® product can be prepared in the same processing lines used to produce a conventional impulse ice-cream, its environmental improvement derived from a careful selection of ingredients with low environmental impact, such as non-hydrogenated vegetable liquid vegetable fats and β-glucan enriched oat bran.

By resorting to well-known databases and technical literature, it was possible to assess the carbon footprint of all the ingredients used for the conventional and innovative ice cream cookie sandwiches (Tables 1 and 2), and thus compare their resulting carbon footprint scores. The use of whole oat flour and vegetable fats resulted in a net decrease in the carbon footprint for the oat-rich biscuit (0.69 kg CO_{2e} kg^{-1}) with respect to the traditional shortbread (1.96 kg CO_{2e} kg^{-1}), the carbon footprint of the latter being higher for the use of butter and wheat flour. In conclusion, the GHG emissions associated with the use of the only raw materials amounted to about 10 g of CO_{2e} per each portion of the oatmeal cookies and to 29 g CO_{2e} per a single portion of conventional shortbread, this resulting in a CO_{2e} saving of 65 %. As concerning the dietetic ice cream, the use of a vegetable-based whipping cream and skimmed milk, directed to minimize the cholesterol content, resulted in a net benefit for health and environmental. In fact, the GHG emissions associated to the production of the plain ice cream totaled approximately 1.67 kg CO_{2e} kg^{-1}, while those pertaining to Ice-Glu® were about 1.29 kg CO_{2e} kg^{-1}.

Table 4 compares the carbon footprint scores for a portion of the novel and conventional ice cream cookie sandwiches, both weighing 80 g each. It can be noted a net decrease of 44 g of CO_{2e} per each portion of Ice-Glu®.

Table 4: Carbon footprint (CF) and specific raw material costs (SC) for each portion of the novel (Ice-Glu®) and conventional ice cream cookie sandwiches prepared here together with the masses of each component.

Product	**Component**	**Mass [g]**	**CF [g CO_{2e}]**	**SC [€]**
Ice-Glu®	Ice cream	65	84	
	Shortbread	15	10	
	Total	80	**94**	**0.105**
Conventional ice cream	Ice cream	65	109	
	Shortbread	15	29	
	Total	80	**138**	**0.078**

As far as the egg is concerned, the CF data were referred to the whole product, while for the production of our oatmeal biscuit the only egg white was used to minimize the cholesterol content. Moreover, the carbon footprint of the milk- and vegetable-based whipping creams was estimated by accounting for the climate change impact of the margarine and butter products in some EU countries (Nilsson et al., 2010) as referred to a unitary fat content. The carbon footprint of chocolate coincided with Cadbury estimates, which did not account for GHG emissions from deforestation (Harris et al., 2015). The carbon footprint β-glucan enriched oat bran was roughly assumed as the double of that of whole oat flour to account for the higher mechanical energy needed to fractionate the whole four and the lower mass recovery yield for the enriched oat bran.

3.3 Specific raw material cost assessment

To compare the production costs of the novel Ice-Glu® product to those of a conventional ice cream cookie, only the raw material costs were accounted for on the assumption that the investment-related, maintenance, energy, and labour costs did not differ. Tables 1 and 2 lists the market prices of all ingredients used, as extracted from online food commodity prices. Based on the only ingredient costs, a portion of the reference shortbread or oatmeal cookie would cost about 0.022 or 0.03 €, respectively, owing to the greater costs for whole oat flour and β-glucan enriched oat bran. As concerning the ice cream component, the raw material costs for the conventional and novel products amounted to ~0.056 and 0.075 € per portion because the costly oat bran was used to formulate the β-glucan rich ice cream. Altogether, the raw material costs of Ice-Glu® were 35 % higher than those needed to produce a conventional ice cream cookie (Table 4). Despite the β-glucan rich ingredients made the novel product of concern cost about 0.027 € per portion, such incremental cost for Ice-Glu® might be acceptable for the general consumer owing to its health and eco-sustainable claims. The contribution of the raw materials may range from 43 to 55 % of the overall production costs of ice creams (Konstantas et al., 2019).

3.4 Sensory analysis results

Ice cream is a complex colloidal system combining an emulsion and a foam. Air cells, fat globules, as well as fat and ice crystals, are entrapped in an unfrozen continuous liquid phase composed of sugars, proteins, salts, polysaccharides and water. Their interactions determine the organoleptic properties of ice cream. Sugar provides sweet taste, improves thickness and bulkiness, but at higher mass fractions than 42 % (w/w) may confer a soggy structure to ice cream. Fat contributes to the ice cream body, texture, palatability, flavor intensity, emulsion formation and maintenance of melting point. Over 12 % (w/w) fat content ice cream meltdown is faster and flavor intensity decreases. Ice cream hardness reduces as ice crystal size reduces in consequence of high overrun values. Fiber addition causes the binding of free water and viscosity enhances. Thus, it is quite critical to balance ice cream ingredients to obtain a product with the most appropriate structure, texture and body (Syed et al., 2018).

Table 5 shows the main results of the sensory analysis (Tharp and Young, 2012) tests carried out. Despite the appearance of both ice creams was not statistically different at the confidence level of 95%, the other attributes of the reference samples received higher grades than those of Ice-Glu®. The global acceptance (GA) score of both ice creams was positive being over 6.1. Actually, GA for the conventional ice cream was very good (7.7±0.9). On the contrary, GA for Ice-Glu® was just equal to 6.3±1.2, mainly because the panelists perceived an unusual hint of cereals and a sandy texture, both deriving from the addition of the β-glucan enriched oat flour.

Anyway, such a preliminary paired preference test should be redefined to describe better the specific attributes of such ice creams that differed not only in formulation, but also in production technology.

Table 5: Average grades for the sensory attributes (appearance, flavor, body, texture, and melt), as well as global acceptance (GA), of the conventional (R) and β-glucan enriched (Ice-Glu®) ice cream cookie sandwiches prepared here, as assigned by the panelists.

Ice cream sample	Appearance	Flavor	Body	Texture	Melt	GA
R	7.4 ± 1.2^a	7.7 ± 1.0^a	7.9 ± 1.1^a	7.8 ± 1.0^a	7.4 ± 1.1^a	7.7 ± 0.9^a
Ice-Glu®	6.9 ± 1.2^a	5.0 ± 1.2^b	5.1 ± 1.1^b	4.9 ± 1.1^b	5.3 ± 1.7^b	6.3 ± 1.2^b

- Mean values followed by different lowercase letters in the same column are statistically different (p<0.05).

4. Conclusions

In accordance with the EU Regulation n° 1169/2011, this novel Ice-Glu® product might be marketed using the following nutritional claims:

- “low cholesterol content”;

- Availability of 1 g of oat β-glucan per portion. “It was demonstrated that oat β-glucan lowers blood cholesterol. Hypercholesterolemia represents a hazard factor for coronary disease”.

Moreover, it should fit the current willingness of the general consumer towards healthy and eco-friendly foods, this being a prerequisite for remodeling his/her daily diet and habit to a more sustainable life style.

The β-glucan present in this novel ice cream entirely derives from whole oat flour and bran, these giving this ice cream cookie not only a natural taste, but also healthy properties in virtue of the low cholesterol, high alimentary fiber, and β-glucan contents. Finally, such a healthy ice cream cookie sandwich might also be advertised as a real eco-friendly alternative to the current products for its lower calorie uptake by 20-50 % and lower carbon footprint by 32 %.

References

Beristain C.I., Cruz-Sosa F., Lobato-Calleros C., Pedroza-Islas R., Rodríguez-Huezo M.E., Verde-Calvo R., 2006, Application of soluble dietary fibers in beverages, Revista Mexicana de Ingenieria Quimica, 5, 81-95.

BSI, 2008, Publicly Available Specification (PAS 2050) for the assessment of the life cycle greenhouse gas emission of goods and services, British Standards Institution, London.

Cavallero A., Empilli S., Brighenti F., Stanca A.M., 2002, High (1→3,1→4)-β-glucan barley fractions in bread making and their effects on human glycemic response, Journal of Cereal Science, 36(1), 59-66.

Cimini A., Moresi M., 2015, Pale lager clarification using novel ceramic hollow-fiber membranes and CO_2 backflush program, Food and Bioprocess Technology, 8 (11), 2212-2224.

CNA, 2018, Italia superpotenza del gelato <cna.it/notizie/indagine-cna-un-mercato-di-2-miliardi-di-euro-e-lavoro-40-mila-addetti> accessed 04.04.2019.

de Moraes Crizel T., Jablonski A., de Oliveira Rios A., Rech R., Flˆores S.H., 2013, Dietary fiber from orange byproducts as a potential fat replacer. LWT-Food Science and Technology, 53, 9-14.

GVR (Grand View Research), 2018, Ice cream market share, trends, growth, research report 2018-2025 <grandviewresearch.com/industry-analysis/ice-cream-market> accessed 10.01.2019.

Harris N., Payne O., Mann S.A., 2015, How much rainforest is in that chocolate bar?, World Resources Institute <wri.org/blog/2015/08/how-much-rainforest-chocolate-bar> accessed 04.04.2019.

Knuckles B.E., Hudson C.A., Chiu M.M., Sayre R.N., 1997, Effect of beta-glucan barley fractions in high-fiber bread and pasta, Cereal Foods World, 42(2), 94-99.

Konstantas A., Stamford L., Azapagic A., 2019, Economic sustainability of food supply chains: Life cycle costs and value added in the confectionary and frozen desserts sectors, Science of the Total Environment, 670, 902-914.

Nilsson K, Flysjö A., Davis J., Sim S., Unger N., Bell S.,2010, Comparative life cycle assessment of margarine and butter consumed in the UK, Germany and France, The International Journal of Life Cycle Assessment, 15, 916-926.

Syed Q.A., Anwar S., Shukat R., Zahoor T., 2018, Effects of different ingredients on texture of ice cream, Journal of Nutritional Health & Food Engineering, 8(6), 422-435.

Soukoulis C., Fisk I.D., Bohn T., 2014, Ice cream as a vehicle for incorporating health-promoting ingredients: Conceptualization and overview of quality and storage stability, Comprehensive Reviews in Food Science and Food Safety, 13, 627-655.

Soukoulis C., Lebesi D., Tzia C., 2009, Enrichment of ice cream with dietary fibre: effects on rheological properties, ice crystallisation and glass transition phenomena, Food Chemistry, 115: 665-671.

Spence C., Navarra J., Youssef J., 2019, Using ice-cream as an effective vehicle for energy/nutrient delivery in the elderly, International Journal of Gastronomy and Food Science, 16: 1-6 (Article 100140)

Stone H., Sidel J.L., 2004, Sensory Evaluation Practices, 3rd ed., San Diego, CA, USA, Elsevier Academic Press.

Tharp B.W., Young L.S., 2012, Tharp & Young on ice cream: An encyclopedic guide to ice cream science and technology, Lancaster, PA, USA, DEStech Publications, Inc., p. 273.

USDA (United States Department of Agriculture), n.d., USDA Food Composition Databases, <ndb.nal.usda.gov/ndb/> accessed 04.04.2019.