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Sensory evaluation of new products obtained with sea buckthorn (*Hippophae rhamnoides* L.) after cold oil extraction

Gabriela Iordăchescu[1], Gabriela Ploscuțanu[1], Gabriela Vlăsceanu[2]

[1]*Faculty of Food Science and Engineering, „Dunarea de Jos" University, 111 Domneasca str.800201, Galati, Romania*

[2]*Hofigal Export Import SA, 2 Intrarea serelor str.042124, Bucharest, Romania*

Abstract

Food producers process the sea buckthorn (*Hippophae rhamnoides L.*) as juice, jam, syrup and wine which is considered a tonic product. The dried fruits may be a good base for development of colour, taste and nutritive enhancement for some food product. So, sea buckthorn dried fruit are recommended for different food products. The purpose of the study is to use the dried sea buckthorn powder and sea buckthorn groats (resulted after cold pressing) in two types of products: frozen and cooked. The products were frozen yogurt, sorbet and bread with variable content on dried sea buckthorn powder and sea buckthorn groats (1 %, 2 % and 3 % respectively). For sensory analysis was used Just About Right Scale. The 2 % for sea buckthorn groats and 3 % for dried sea buckthorn powder were preferred.

Keywords: sea buckthorn, groats, powder, frozen yogurt, sorbet, bread

1. Introduction

In ancient times, sea buckthorn (*Hippophae rhamnoides*) was used in medicinal purposes to treat intestinal worms in horses. This is why the genus name is *Hippophae* which in greek language means *Hippos* – horse and *phao* - I kill. The sea buckthorn is known also as Siberian pineapple, sea berry, sandthorn and swallowthorn [1].

Different parts of sea buckthorn plant have been widely used in traditional medicine in various countries (India, China, Nepal, Pakistan, Myanmar, Russia, Britain, Germany, Finland, Romania, France, etc.) of the world [2].

Many reports are focused on the fruits, leaves [3] and oil extracts [4]. The leaves are rich in flavonoids, tannins and triterpenes and used to make extract, tea, animal feed, cosmetics and pharmaceutical [5]. On the leaves of sea buckthorn and their pharmacological effects are available only a few studies.

The leaves are steamed or pan-fried to inhibit polyphone oxidise, which can affect the quantity and quality of desired bio constituents [6]. The leaves ethyl alcohol extract was reported to possess antioxidant, imunomodulatory and anti-inflamatory [7, 8].

Sea buckthorn berries are recommended and used for slowing the aging process, improving sight and preventing infections. Antioxidant, anti-bacterial immunomodulatory activity, treatment of: gastric ulcers [9], skin disorders [10], radiation induced oxidative damage [11] were reported for the extracts of whole fruit, fruit pulp, pulp oil or seed oil. The seeds and berry oil are used as expectorant, treating asthma, heart disorders and high cholesterol and are supplemental sources of vitamins C, A, E, amino acids, fatty acids.

The composition of fatty acids and carotenoids varied for the different varieties from Romania.

Corresponding author: *e-mail:* gabriela.iordachescu@ugal.ro

The fat content 21,7 % (on dry) of dried fruits is a very good source of essential fatty acids (Omegas 3 and 6) [12]. This recommends the use of dried fruits powder in the food products. The products selected in this work were two frozen products (frozen yogurt and sorbet) and bread. The products were chosen because the raw material can be selected to enhance the nutritive value of the product.

Terpou and Kanellaki (2017) proposed employing sea buckthorn berries as a probiotic encapsulation carrier with great potential in manufacturing application and commercialization of probiotic frozen desserts [13].

The term of frozen desserts commonly cover all kind of desserts that are the meant to be eaten in a frozen condition including ice creams, sherbets, sorbets, frozen yoghurts and nondairy frozen desserts [14].

Frozen dairy products have characteristics of both yogurt and ice cream and could be the persuasive carriers of probiotics. Functions of the frozen yogurt containing viable bifidobacterial cells are recognized and favoured by the people of all ages [15].

The frozen yogurt it is a relatively new product which is healthier than ice cream because instead of cream uses yogurt. Named also low-fat or light ice cream can use yogurt with different fat

Sorbet is a complex multiphasic system composed of a dispersion of ice crystal and air bubbles inside a concentrated liquid matrix. The manufacturing process of sorbet is carried out in several unit operations ranging from the ingredients homogenization (liquid mix production) to the hardening of the crystallized product [16].

Sorbet is a frozen product having as main sensorial qualities taste and aroma. Only sugar syrup and sometimes alcohol (which reduces the freezing temperature a consequence obtaining a softer texture) may be added. It is considered a very appropriate desert for vegetarians and lactose/diary intolerant people.

Also the groats which are rich in vegetal proteins and essential oils (omega 3: omega 6 in an optimal ratio 1:4) present a challenge for the use in food products. The purpose of this study is to evaluate the sensorial impact on the consumer of the sea buckthorn powder and the groats in selected products.

2. Materials and methods

The sea buckthorn dried and groats was provided by S.C. Hofigal Impot – Export S.A. The dried sea buckthorn was powdered in a grinding machine (particle size 1 mm), Sea buckthorn powder had an orange colour, distinctive aroma, tart fruity flavour and fibrous texture. The quantity used in each product represented 1%, 2 % and 3%.

The frozen yogurt was prepared using Cedra yogurt made by a mix of cow, sheep and buffalo cow milk and 1% added sugar. This type of yogurt was selected because of its' complex taste and aroma. The sorbet was prepared with mineral water and sugar. The freezing temperature was -18^0C. The bread was prepared in an AFK baking machine with medium regime, and fast baking parameters using wheat flour, water and dried yeast Dr. Oetker.

The samples were coded with G the ones with different percent (1 %, 2 % respectively 3 %) of sea buckthorn groats and SB the ones with different percent (1 %, 2 % respectively 3 %) dried sea buckthorn powder.

The sensory analysis was conducted in the Sensory analysis and consumers' science laboratory from the faculty Food Science and Engineering (Dunarea de Jos University) Galati by a group of 70 panellists, students with varying experience in food science and potential consumers of the products. Water was used between the samples. Just-About-Right Scale was used for analysis [17, 18]. This scale is used in research on food, where consumers in addition to rating their liking of a product, have to evaluate a product on a number of attributes using this scale format:

- Much too strong
- Somewhat too strong
- Just- about- right
- Somewhat too weak
- Much too weak.

It is a bipolar scale with opposite end-anchors and centre point and is useful in comparing different versions of the product. The panel had in addition to rating their liking of the products. They used a 9 points scale (where 1- Dislike extremely, 2- Dislike very much, 3- Dislike moderately, 4- Dislike slightly, 5- Neither like nor dislike, 6- Like slightly, 7- Like moderately, 8- Like very much, 9- Like

extremely). The JAR scale and liking scale were correlated using xls absolute deviation.

ANOVA unifactorial was used for data analysis because the scales are symmetric and have low frequencies in the extremes.

3. Results and discussion

For each product more characteristics were analysed, but the ones which discriminated the samples were the colour and taste.

In Figure 1 are the results for the colour of frozen yogurt. To date, a large body of laboratory research has demonstrated that changing the hue or intensity/saturation of the colour of food and beverage items can exert a sometimes dramatic impact on the expectations, and hence on the subsequent experiences, of consumers [19].

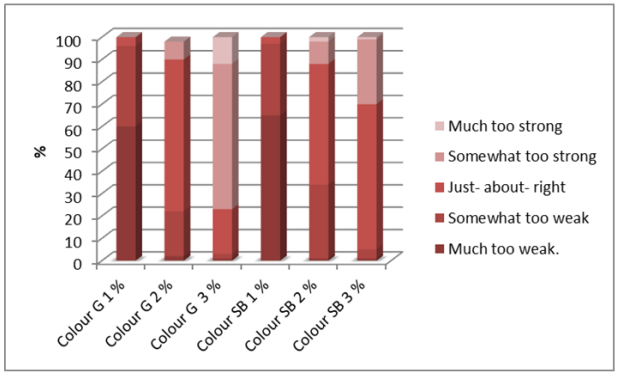

Figure 1. JAR scale for the colour of frozen yogurt with sea buckthorn groats and dried sea buckthorn ($p < 0,05$)

For the JAR scale the optimal concentration for the colour was in the case of sea buckthorn groats 2 %. Dried sea buckthorn powder had a JAR score with values for JAR 54 % for SB 2 %, but 65 % for SB 3 % and small differences between somewhat to weak in the case of SB 2 % (28 % of the panellists) and somewhat too strong in the case of SB 3 % (36 %).

Figure 2 represents the evaluation for the taste of frozen yogurt. The verdict for the taste on JAR scale was favourable to the same concentrations as the colour (groats 2 % respectively sea buckthorn 2 % and 3 %).

The effect of varying levels of sugar (18, 20, 22 %) and fruit (15, 20, 25 %) concentrations on the sensory properties of frozen yogurt were investigated by Guven and Karaca (2002). The results indicated that frozen yogurts with high sugar and fruit concentrations were the type most preferred by the panellists [20].

Astringency and bitterness are important sensory factors for the consumer acceptance of sea buckthorn products [21]. With the hedonic scale (Figure 3) the panellists selected the frozen yogurt 2 % sea buckthorn groats and dried se buckthorn powder 3 %.

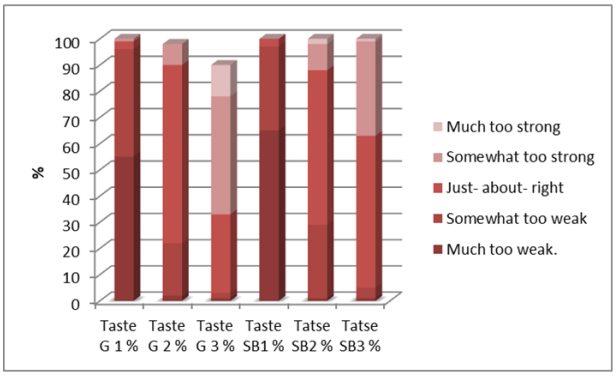

Figure 2. JAR scale for the taste of frozen yogurt with sea buckthorn groats and dried sea buckthorn

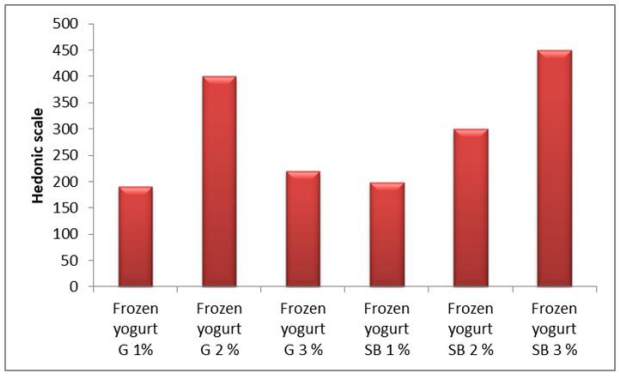

Figure 3. Hedonic scale for the frozen yogurt with sea buckthorn groats and dried sea buckthorn

For the sorbet the same steps were followed and the JAR results for the colour (Figure 4) and taste (Figure 5) demonstrated that the same sea buckthorn groats respectively powder concentrations are considered to be the appropriate ones.

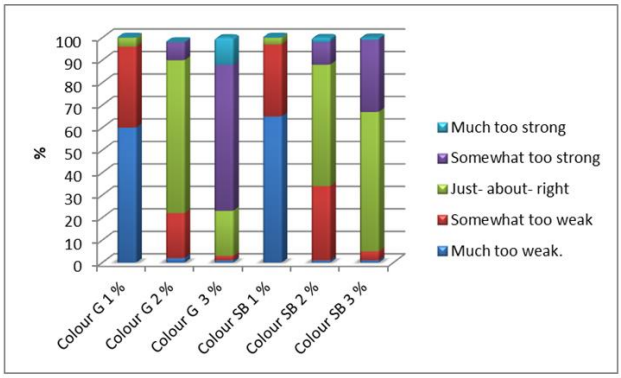

Figure 4. JAR scale for the colour of sorbet with sea buckthorn groats and dried sea buckthorn

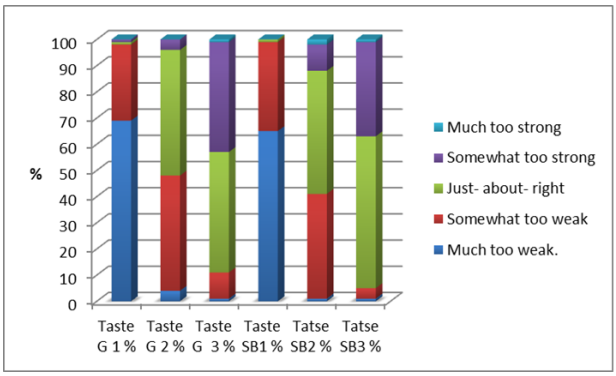

Figure 5. JAR scale for the taste of sorbet with sea buckthorn groats and dried sea buckthorn

Fruits cultivar or origin does not influence sensory characteristics of sorbets in a significant way [22]. Yacon root powder (*Smallanthus sonchifolius* Poepp. and Endl.) had a potential to be an ingredient of fruit sorbets. Color is probably the first characteristic of a food evaluated by a consumer. It was observed, that color of strawberry and cherry sorbets with the addition of yacon root powder obtained high scores, according to panelists evaluation.

Additionally, the taste of strawberry sorbets containing yacon root powder gained the highest scores. The lowest marks of this attribute were obtained for cherry sorbets containing yacon root powder. Was observed that taste of sorbet made from fresh orange and yacon root powder was not good accepted by panelists [23].

The hedonic test (Figure 6) sustained the same concentrations 2 % for sea buckthorn groats and 3 % for the dried sea buckthorn powder even in the case of sorbet the texture was foamier and the taste was ruling sweet comparatively with frozen yogurt which had the sour as basic.

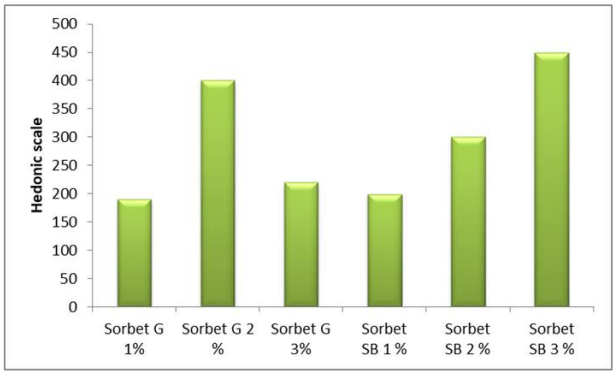

Figure 6. Liking scale for the sorbet with sea buckthorn groats and dried sea buckthorn

Corelating the overall impression (colour and taste) on JAR scale evaluation with 9 points liking scale, in the case of frozen products (Figure 7a frozen yogurt, Figure 7 b sorbet). In this case the optimal concentrations on liking scale were the same with the ones on JAR scale.

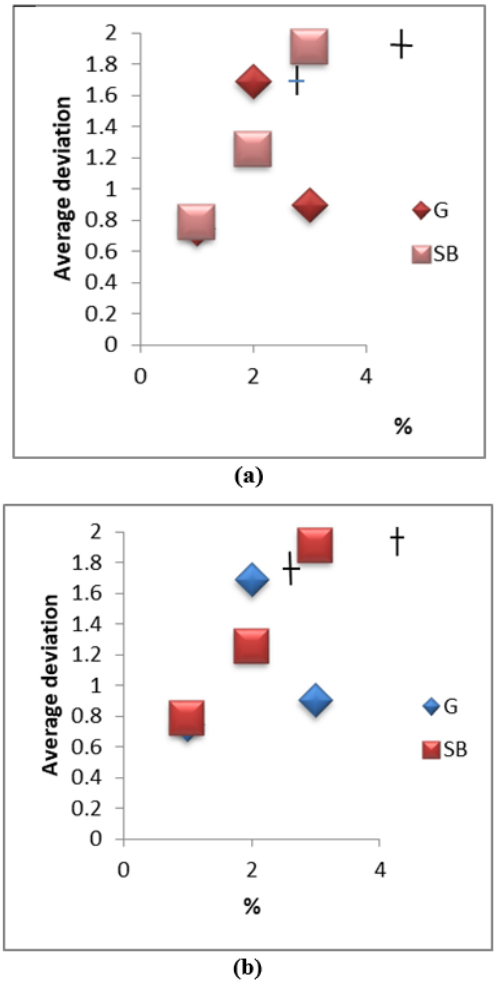

Figure 7. The correlation JAR scale for taste and colour and 9 points hedonic scale for frozen yogurt (a) and sorbet (a)

The 2 % sea buckthorn groat and 3 % for dried sea buckthorn powder were the optimum concentrations in terms of acceptance in the case of frozen products.

Due to the high temperature (~ 170^{0}C) needed for baking, the bread had some colour changes which were not accepted by the panelists. More of the options for the JAR scale were in the area somewhat too strong or somewhat too weak (Figure 8). Similar observations were found by Nilova and Malyutenkova (2018) for dried powder sea buckthorn seeds incorporated bread [24].

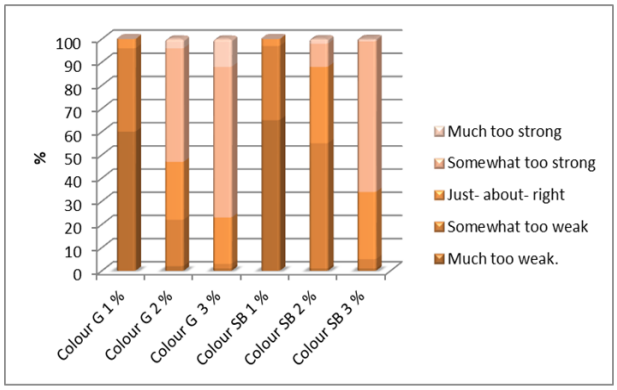

Figure 8. The JAR scale for the colour of bread with sea buckthorn groats and dried sea buckthorn powder

Colour of bread crust is an important sensory attribute, which can enhance acceptability. Browning of bread crust is an origin of Millard reactions during baking in the presence of amino acids, reducing sugars, temperature, time of baking and moisture levels of the fermented dough [25].

4. Conclusions

The sea buckthorn can contribute by its composition to the nutritive value of food. The sea buckthorn groats (result after cold pressing), may be used to enhance the sensorial properties in terms of colour and taste.

Was used the JAR scale which asks the respondent to consider how products differ from ideal combined with a hedonic 9 points scale.

The optimal concentration for the frozen products (frozen yogurt and sorbet) was 2 % for the sea buckthorn groats and 3 % for the dried sea buckthorn powder. The frozen yogurt had the sour taste as main taste and the sorbet the sweet taste as main taste.

From a sensorial point of view, the bread is not enhanced as colour, and the taste is not modified at all, the high temperature being responsible for this. But nutritional studies, taking into account the content of vegetal proteins and essential oils (omega 3: omega 6 in an optimal ratio 1:4) of groats have to be done in the future.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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