

PRODUCTION OF DRAGÉES FROM EXTRUDED CORN: THE PRODUCT'S EFFECT ON GLUCOSE LEVEL IN BLOOD

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Abstract

To promote healthy eating and educate society, the Department of Food Technology of the Faculty of Technology at Kauno kolegija is developing safe, innovative, high-value functional food products. The dragées have been a recently developed product, made from extruded corn. For the production of chocolate-coated dragées, extruded corn, two-flavoured dark chocolate (containing 4 % and 30 % of sugar) made from a mixture of cocoa mass, cocoa butter and sugar have been used. The evaluation score of the extruded corn dragées coated with a different taste of chocolate in terms of appearance and shape was high. A higher score was given to sweeter taste. It has been observed that when the participants of the research were given to taste dragées covered with chocolate containing 4% of sugar, their glucose level in capillary blood 15 min after a meal increased 0.85 mmol/l, followed by a gradual downward curve. After two hours of the consumption of the product, the capillary blood glucose concentration was the same as before the product's consumption – 5.34 mmol/l. For the assessors, who consumed chocolate coated dragées containing 30% of sugar, glucose increased 30 min after a meal, followed by a gradual downward curve and the capillary blood glucose concentration was 0.15 mmol/l higher prior product's consumption. **Conclusions:** During the sensory evaluation, the assessors positively evaluated the appearance and smell of both products, yet they gave preference to a sweeter taste, although the dragées of a bitter taste and a lower content of sugar had a lower impact on glucose level change.

Key words: extrusion, dragées, glucose, blood, chocolate

Received: 10.01.2019

Reviewed: 27.02.2019

Accepted: 04.03.2019

INTRODUCTION

Food provides essential substances to support body's functions. A number of researches carried out has repeatedly substantiated the link between nutrition and health. Recently, a particular emphasis has been placed on the benefits of carbohydrates present in plants. According to Iglesias R. et al. (2016), the amount of carbohydrates, their type and fibres are one of the most important aspects of nutrition that controls and maintains stable and balanced blood sugar levels. As recommended by the European Food Safety Authority, the intake of carbohydrates should range between 45 and 60 per cent of ration value.

In an attempt to maximize the nutritional value of vegetable raw materials, advanced food processing technologies have been under development e.g. extrusion. The origins of the extrusion process date back to the beginning of the 19th century, but the technological process in the food industry has been widely applied in

the second half of the 20th century. Since the technology of extruded products is universal and highly effective, the application of short-term heat treatment enables to produce high-quality products (Alam M. S et al., 2016). Onwulata C. I. et al. (2010) claim that the extrusion process opens up unlimited possibilities for the creation of new high-fibre foods. During the extrusion process due to high temperature, pressure and shear, granules of cereal starch change, and the sensual and textural properties common to the extruded products occur. The raw materials having undergone such treatment instead of the traditional heat treatment using a short baking-drying process, makes it possible to produce a new type of cereal product that is more easily digestible, has a longer shelf life, and retains a higher nutritional and biological value due to milder heat treatment.

Extrusion is a thermal process during which the product's internal water content, abruptly

evaporated, leads to the breaking-up of the product and simultaneously resulting in a desired shape. Extruded products have a low moisture content (8 – 12 %), resulting in a longer shelf life in comparison to the conventional products. The advantage of these products is that they are easy to digest and have a higher level of protein and energy intake (Alam M. S. et al., 2015).

According to Fuller S. et al. (2015); Asgary S. et al. (2017) nutritional fibres can reduce blood glucose and cholesterol level by slowing down digestion and absorption of carbohydrates. Wirstrom T. et al. (2013) state that consumption of wholegrain products induces a significant reduction of glucose level in blood. The results of a study conducted by Phanindra P. et al. (2018) show that a reduction in blood glucose levels has been observed with prolonged use of extruded products. Meynier A. et al. (2015) found that reducing glycaemic response is crucial for the prevention of metabolic diseases. Scientists are unanimous regarding the classification of carbohydrates according to the glycaemic index. According to Foster K. et al. (2002); Meynier A. et al. (2015) the glycaemic index indicates how fast carbohydrates present in products are digested, absorbed and raises blood glucose levels within two hours after the meal. For healthy individuals, the level of glucose in blood fluctuates from 3.33 to 5.55 mmol/l (Miškinienė M. 2012).

Flavonoids present in cacao can improve insulin resistance by improving endothelial function, altering glucose metabolism and reducing oxidative stress (Shah S. R. et al., 2017).

To promote healthy eating and educate society, the Department of Food Technology of the Faculty of Technology at Kauno kolegija/UASc is developing safe, innovative, high-value functional food products. The dragées have been a recently developed product, made from extruded corn. For the production of chocolate-coated dragées, extruded corn, two-flavoured dark chocolate (containing 4 % and 30 % of sugar) made from

a mixture of cocoa mass, cocoa butter and sugar have been used.

Problem of the research: Chocolate-coated dragées, a new product has been developed at the Food Technology Department of Kauno kolegija/UASc, but the attractiveness of the product to the consumer has not been identified. Furthermore, the effect of the product on blood glucose level is not clear.

Object of the research: to identify the attractiveness of the dragées made from extruded corn and dark chocolate of low and high in sugar content (4 % and 30 %) and the effect of the product on glucose level in the capillary blood.

METHODOLOGY OF THE RESEARCH

The production of dragées consisted of the following stages such as: chocolate tempering, pre-coating/gumming of the extruded corn and polishing. To temper dark chocolate a sharp temperature reduction from 45 °C to 28 °C and increase of the operating temperature up to 31 – 32 °C have been applied. Pre-coating was the second stage of dragées production. Chocolate was slowly poured onto the extruded corn into the coating machine and the corn was covered with several layers of chocolate to make the surface smooth and the core to be completely covered. The third stage of the dragées production was polishing. During polishing process, semi-finished products were coated twice with wax fat consisting of wax, paraffin, and vegetable oil. At this stage, the dragées were friction polished. The polishing of dragées was done twice for better gloss of the surface (Aebi M., 2011).

Sensory analysis was performed using the method of sensory descriptive analysis. The research was repeated three times with a group of 21 trained students-assessors given 20 grams of dragées of two different flavours. The assessors were trained according to LST ISO 8586-1 standard. Samples of the chocolate coated dragées for the sensory analysis were presented in disposable plates marked with codes. Unsweetened, weak, warm black tea was served to restore the evaluators' taste receptors. At the beginning of the research, a

list of concepts with descriptions was provided to the assessors to ensure that the same concepts should not be interpreted differently. The following characteristics of the product were evaluated: appearance, shape, smell and taste. A 5-point scale was used for the sensory evaluation, in which the attractiveness of the product was ranked from very bad to very good (1 – very bad, 3 – neither bad nor good, 5 – very good).

A study of glucose levels in capillary blood involved 31 non-diabetic volunteers aged 18 to 84 years. Participants of the research were asked arrive at 8 a.m. in the morning on an

RESULTS OF THE RESEARCH

The evaluation score of the extruded corn dragées coated with a different taste of chocolate in terms of appearance and shape was high. The results obtained regarding taste of the chocolate coated dragées varied due to consumption habits. A higher score was given to sweeter taste (dragées coated with chocolate of 30 % sugar), a lower score was given for a bitter taste (dragées coated with chocolate of 4 % sugar). The intensity of the smell was assessed in the same way, since the chocolate composition was identical except for the sugar content (Fig. 1). Usually, the intensity of the smell is determined by the type of cocoa beans used for chocolate and the proportions of the raw materials used for the chocolate mixture.

empty stomach (not having eaten breakfast or drunk water), without having consumed alcohol a day before, avoiding heavy physical exercises and sweet dishes. Glucose concentration in capillary blood was measured using Bayer's ContourPlus glucometer, single-use automatic lancets for puncture of the finger skin in accordance with aseptic rules. After determination of glucose concentration in capillary blood, the participant was given 40 g of the product. Subsequently, glucose concentration in capillary blood was measured 5 more times (after 15 min, 30 min, 60 min, 90 min and 120 min).

It has been observed that when the participants of the research were given to taste dragées covered with chocolate containing 4 % of sugar, their glucose level in capillary blood 15 min after a meal increased 0.85 mmol/l, followed by a gradual downward curve. After two hours of the consumption of the product, the capillary blood glucose concentration was the same as before the product's consumption – 5.34 mmol/l. For the assessors, who consumed chocolate coated dragées containing 30 % of sugar, glucose increased 30 min after a meal, followed by a gradual downward curve and the capillary blood glucose concentration was 0.15 mmol/l higher prior product's consumption (Figure 2).

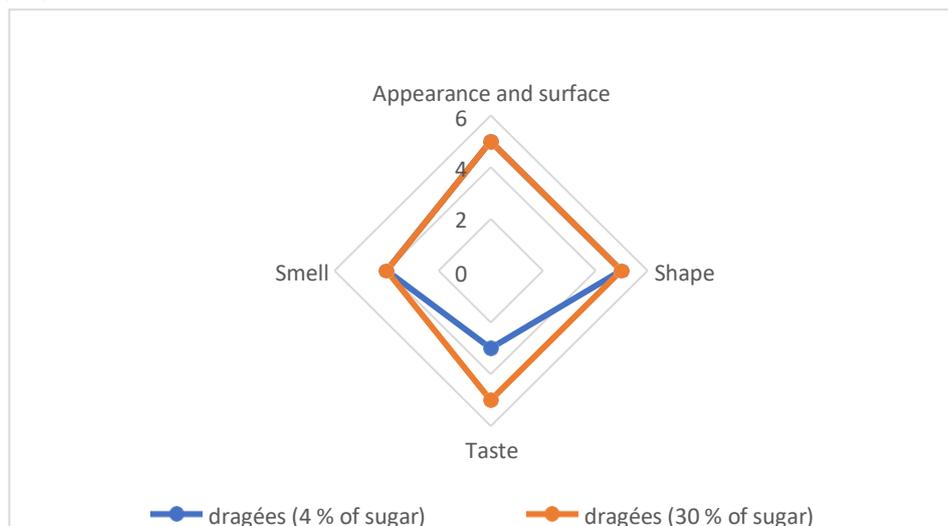


Figure1. Sensory evaluation of dragées (N 21)

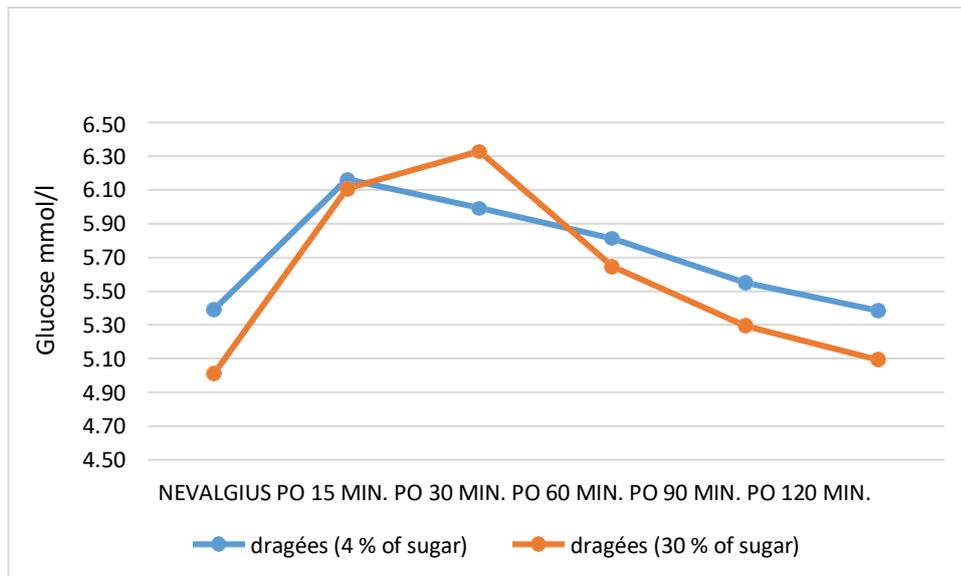


Figure 2. Type of chocolate and glucose level in blood (N31)

CONCLUSIONS

During the sensory evaluation, the assessors positively evaluated the appearance and smell of both products, yet they gave preference to a sweeter taste, although the dragées of a bitter taste and a lower content of sugar had a lower impact on glucose level change.

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