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DEVELOPMENT OF HIGH PROTEIN CONTAINING BAKERY FILLING

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ABSTRACT

Development of nutrient-dense foods is one of the most important goals of today's food industry. High protein content of foods helps to provide energy and aminoacids for human body.

In our study protein enriched filling was developed for doughnuts. The main ingredients of the product were pudding powder and egg white product (TOTu, ToTu milk, ToTu cream, and ToTu cream extra).

The texture of samples was analyzed by Anton Paar Mcr 92 rheometer and the quality of products was evaluated by sensorial tests. Microbiological decontamination of HHP was investigated (500 MPa, 5 min).

Our results show that high protein content did not influence the sensorial quality of filling, as long the microbiota of the products is highly improved by HHP treatment. Rheological properties is highly influenced by the concentration of egg proteins.

The overall quality will be better, if egg white products are used for the product.

Keywords: High protein food, egg products, bakery products

INTRODUCTION

Egg white is a key ingredient in many food products as it combines high nutritional quality (SEUSS-BAUM, NAU, AND GUÉRIN-DUBIARD 2011) with excellent functional properties (de Souza and Fernández 2013). Lactase deficiency may lead to gastrointestinal symptoms after milk ingestion, known as lactose intolerance. Studies showed that lactose intolerant individuals avoid milk consumption, but they eat other dairy (PAWŁOWSKA ET AL. 2016). Lactose intolerance is a pathophysiological situation that occurs due to insufficiency of the "lactase" enzyme present in the jejunum. Ingestion of lactose containing products leads to alteration in intestinal digestion and colonic fermentation, leading to diarrhoea and other clinical discomforts (SURI ET AL. 2019).

The high content of essential amino acids in egg white proteins and the high bioavailability of these proteins are of great benefit to human nutrition. However, the effects of industrial processing such as dry heating on the nutritional quality of egg white proteins have been poorly documented. Some studies considered the effect of dry heating on the in vitro digestibility of proteins as it is a prerequisite to nutritional quality (SCHMIDT ET AL. 2007), but the effects of minimal processing technologies are not investigated in case of egg white. Studies are viable about the digestibility assays confirmed previous findings that exposure of egg white to high temperatures increased digestibility markedly. However, it seems that the effects of pH and salt concentrations were found to be minimal (LASSÉ ET AL. 2015).

In the egg product industry, microbiological safety of liquid products is mainly guaranteed by pasteurisation. The USDA requires that liquid whole egg is at least heated at 60 °C for no less than 3.5 min, but in the United Kingdom the recommendations are to pasteurize at least at 64 °C for 2.5 min (ROSSI ET AL. 2010). In France, there is no statutory heat

treatment; only microbiological results are determined by regulations. To achieve this, the treatments classically used to pasteurize whole egg vary from 65 to 68 °C for 2–5 min in order to ensure 5 to 6 decimal reductions of vegetative microorganisms and especially *Salmonella Enteritidis* and *Listeria monocytogenes* (BARON, JAN, AND JEANTET 2010). Pasteurisation temperatures used in the egg industry are limited by the sensitivity of egg proteins to heat treatment. Thus, pasteurisation for 2–10 min from 60 to 68 °C modifies whole egg electrophoretic pattern by especially decreasing ovotransferrin, livetin, ovalbumin, apovitellenin, lysozyme and/or ovomucin band intensity (BARTLETT & HAWKE 1995; ROSSI ET AL. 2010; LECHEVALIER ET AL. 2017).
Liquid egg white (LEW) and egg white-based products are usually regarded as functional foods for their excellent source of high-quality proteins, trace minerals, and for the ability of their components to coagulate, and to form foams when whipped. E.g. egg white proteins play important role in foam formulation of cake batters, like sponge cake (ALAVI ET AL. 2020). High Hydrostatic Pressure (HHP) is one of the most promising minimal processing technologies in the food industry, but only a few scientific studies are existing about HHP treatment and its effects on egg products (TÓTH ET AL. 2017).
On the other hand, egg white products are free from gluten, lactose and containing almost zero carbohydrates, these characteristics led to an increasing market of consumers, like people living on a paleolite, or low carb diet, or living with an allergic disease, or sensitivity against lactose, milk protein or gluten.
The goal of our experiment is to develop a special vanilla taste filling from egg white products, which has an increased protein content.

MATERIAL AND METHOD

Sample preparing

Material used for the development

Cortina

Cortina is a special pudding in powdered form which is used in pastry industry and has excellent sensorial quality. It contains sugar, modified starch, flavours and colour additives. The major advantages of Cortina are the fast and cold solubility and an excellent viscosity during filling procedure. Concentration of Cortina is usually 0,300 – 0,470 kg/L water, depending on desired texture.
Nutritional labelling is summarized in Table 1. containing the different concentrations of Cortina saluted in water.

Table 1: Nutritional labelling of Cortina, with the different concentrations of Cortina soluted in water

Nutrients	dimension	in dry Cortina	0.300 kg/ 1 L water dissolved	0.400 kg/ 1 L water dissolved	0.470 kg/ 1 L water dissolved
energy	KJ/100 g	1662	383.5	474.9	531.4
	Kcal/100 g	392.2	90.5	112.1	125.4
fat	g/100 g	4	0.9	1.1	1.3
unsaturated fatty acids	g/100 g	3	0.7	0.9	1.0
carbohydrates	g/100 g	85	19.6	24.3	27.2
sugar	g/100 g	60	13.8	17.1	19.2
dietary fiber	g/100 g	<0.1	<0.1	<0.1	<0.1
protein	g/100 g	4	0.9	1.1	1.3

Salt	g/100 g	1.4	0.3	0.4	0.4
Water	g/100 g	4	0.9	1.1	1.3
trans-fatty acids:	g/100 g	<0.1	<0.1	<0.1	<0.1
bred unit:	BE/100 g	7.1	1.6	2	2.3

ToTu products

ToTu products are made from egg white due to an enzymatic reaction. They contain only egg white. The different ToTu products have different textures and taste. The original goal of the ToTu products was to offer a lactose- and milk protein-free dairy analogue for people living with allergic reactions against milk ingredients.

- ToTu is a cottage-cheese analogue. The texture is cloddish, similar to traditional Hungarian cottage cheese. ToTu is rich in protein but has lower energy content compared with cottage cheese.
- ToTu cream is has a texture similar to sauercream. The texture is spoonable, viscosity of ToTu cream is higher compared with fermented dairy products (like yogurt, kefir).
- ToTu cream extra has a texture like buttercream, or cheese cream. The product is spreadable.
- ToTu milk is liquid as cow milk. The sensorial attributes are similar to normal milk. Techno functional and sensorial properties like viscosity are similar to normal or lactose-free milk.

Protein enrichment of pastry fillings

Pilot experiments (surveys and focus groups) pointed out, that the most important attributes of foods are sensorial characteristics, like taste and odor for Hungarian consumers. This point of view led us to develop the fillings according to sensorial tests.

First texture and taste were examined with a sensorial panel. Two different fillings were chosen for the next step of examination. The ingredients of the two types of fillings were:

- 150 mL ToTu milk, 45 g Cortina powder and 0,1 m/m vanilla flavour (powder)
- 100 mL ToTu milk, 40 g Cortina (powder), 20 g ToTu cream (creamy consistency) and 0,1 m/m vanilla flavour (powder)

12 panellists were taking part in the experiment they had to evaluate the samples between 1 and 5. The best evaluation was 5. Examined attributes were colour, spoonability, door, out flavour, texture, taste (overall), vanilla flavour, sweet taste, out-taste, overall quality. Finally they had to make a ranking of two developed and original (without any ToTu product) samples.

Rheological methods

Rheological properties determine the technological steps in a food processing. Rheological properties were measured with an Anton Paar MCR 92 rheometer. The method was an amplitude sweeping between 0 and 100%. From every samples G' and G" curves were measured, and yield point and flow point were calculated. *Figure 1.* demonstrates the different values measured and calculated by using the method. Knowing these data technological steps and characteristic can be concluded.

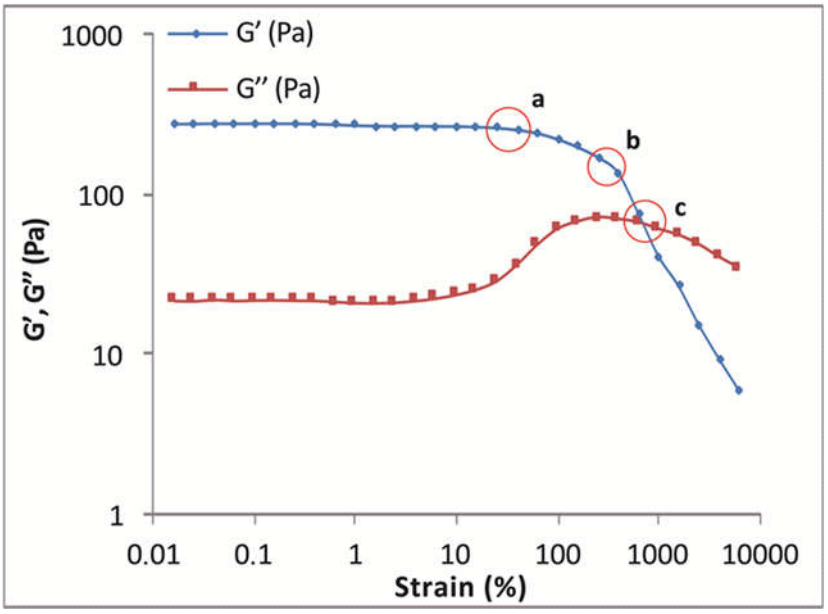

Figure 1: Parameters of amplitude sweeps method

RESULTS

Table 2 summarizes the nutritional labelling of developed fillings comparing with ToTu milk and with Cortina. The results highlight that protein content of pastry fillings were higly increased by adding ToTu products.

Table 2: Nutritional labelling of ToTu milk, Cortina soluted in water, and Cortina soluted in ToTu milk

Nutrients	Dimension	Sample in ToTu milk soluted with Totu milk	Sample in ToTu milk soluted	0,300 kg/ in 1 L water soluted
energy	KJ/100 g	383.5	97	458.2
	Kcal/100 g	90.5	23	108.2
fat	g/100 g	0.9	0	0.9
unsaturated fatty acids	g/100 g	0.7	0	0.7
carbohydrates	g/100 g	19.6	0.1	19.7
sugar	g/100 g	13.8	0.1	13.9
dietary fiber	g/100 g	<0.1	<0.1	<0.1
protein	g/100 g	0.9	5.6	5.2
Salt	g/100 g	0.3	0.1	0.3
Water	g/100 g	0.9		
trans-fatty acids:	g/100 g	<0.1	<0.1	<0.1
bred unit:	BE/100 g	1.6		2.1

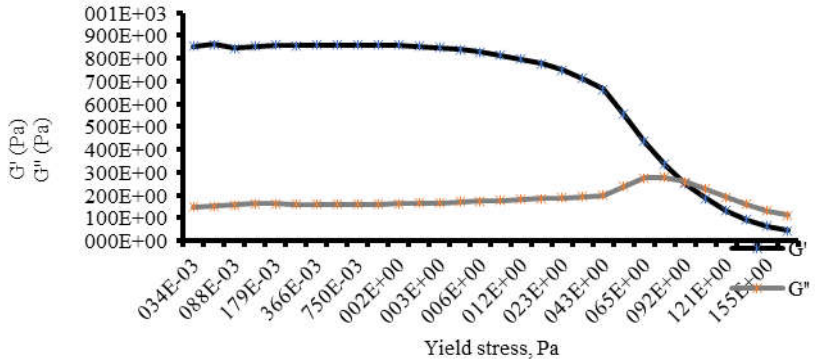

Figure 2: Rheogram of Cortina (300 g /L)

Figure 2. shows the rheogram of filling made with Cortina, compairing with Figure 10 and 11has to be considered, that G' increased by adding ToTu cream and milk, mut the highest impact has ToTu milk on G'. In contrast, G" slightly decreased by adding ToTu products.

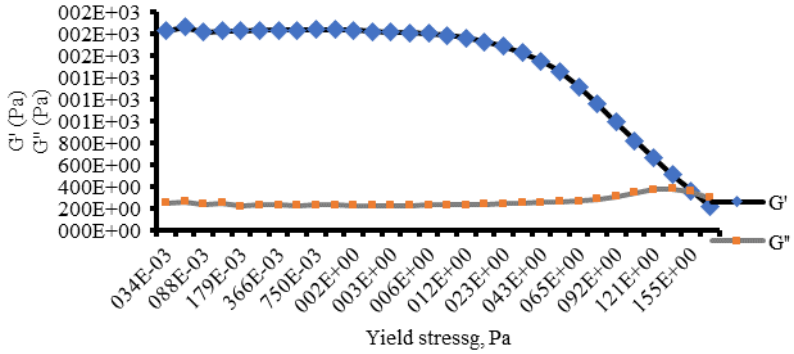

Figure 3: Rheogram of developed filling made with ToTu cream and ToTu milk

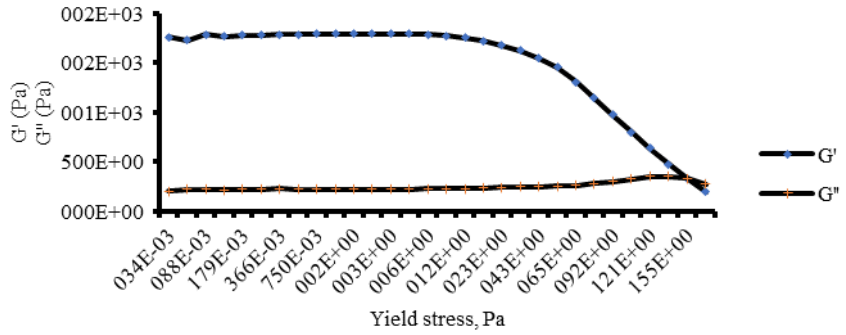

Figure 4: Rheogram of developed filling made with ToTu milk

Rheological properties of developed fillings are summarized in Figure 12. The best sensorial evaluation was fitted to the developed filling with ToTu milk, as long as this sample was the first in ranking of the three different evaluated samples.

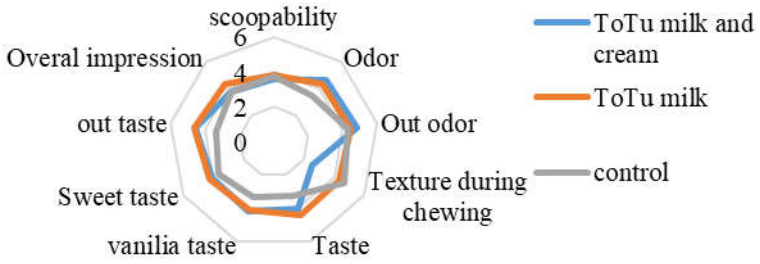

Figure 5: Results of sensorial tests

CONCLUSIONS

The protein-rich foods are getting today a more and more important role in special diets. In our experiment a protein enriched filling for different bakery and confectionery industry products, especially doughnuts were developed. According to our results, the techno-functional properties of the new products are similar, to the original, as long sensorial attributes are equal to original and in nutritional aspects the new, developed filling are better.

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