NEW CONCERNS REGARDING THE INNOVATIVE FORMULATION OF SOME PUDDINGS BASED ON GOAT MILK

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Abstract. While consumers are more demanding about some ready-to-eat products, especially for sweets and desserts and they have high quality expectations, the producers are determined to be connected to their special necessities. So, puddings are very popular desserts, which are consumed all over the world in various formulations. The preparation of the samples was based on a classical idea which was innovated by replacing the important constituents of the formulation. Just due to its popularity the pudding reformulation is a challenge in accordance with the consumers'expectations which needs to recognize the specific characteristics of the puddings. First, the base of the pudding was the goat milk with some auxiliary materials as starch, agar, yolk powder, and Agave syrup, with/without coconut oil or Carob powder, vanilla/rum flavor.The four types of puddings (with vanilla, vanilla and coconut oil, Carob powder and Carob powder and coconut oil) were evaluated by physico chemical, microbiological, sensorial and energetic value.

Key words: goat milk, pudding, Agave syrup, coconut oil

INTRODUCTION

The new society needs induce the lack of time for preparing food in the domestic environment, which is due to an increasingly alert and crowded lifestyle. However, consumers expect to find healthy products on the market, whose taste and flavour are similar to those made by themselves at home. Milk is the most complete and nutritious food and it is used to manufacture different kinds of delicious products, which are useful for human health (Sarker et al., 2016). Pudding is one of the classical desserts that meets consumers' expectations and desires, as a healthy and sweet alternative to most of the caloric bombs that are currently available on the market. Even it is a quite simple kind of dish, it is almost difficult to come up with a definition of pudding that includes everything called by that name. Because the term is used for such different products as chocolate pudding, blood sausages (blood puddings), and steak-and-kidney pudding (www. my.escoffier.edu). The puddings taken for study are cream puddings. These puddings are usually made with less starch, it may contain several flavoring ingredients.

Generally, puddings are products that have as their main ingredient cow's milk, thus enriching this dessert with proteins, vitamins and minerals. Both creamy texture and soft flavour are defining sensory characteristics and ingredients like eggs, butter and cocoa powder have a major influence on them (Sun et al., 2006).The creaminess is a texture characteristic which is used to describe peanut butter, soup, and most dairy products (Howe, 1993). It is especially given by the lipid content of the raw and auxiliary materials.

The materials used to innovate the formulation of the classical puddings own special nutritional properties. Goat milk has therapeutic values in medicine and human nutrition, with important advantages over cow or human milk in having higher digestibility of protein and fat, alkalinity and buffering capacity (Park, 2010).

Hen egg is one of the most versatile foods, containing high- quality proteins and lipids, which leads it to be used as thickening, gelling, emulsifying, foaming, colouring, and flavouring aggent (Anton, 2007; Rossi et al., 2010). The final texture in most dairy desserts is determined by the interaction of milk casein with thickening agents such as starch, agar-agar, carrageenan (Chandan, 2009). Corn starch is applied in food industry as a thickening agent in desserts and pudding. Starch is often used in combination with other ingredients such as milk in pudding and custard (Master and Steeneken, 1997). Agave syrup is a type of sugar from Agave plant with low glycemic index. Carob powder is a cocoa powder alternative, which contains no fat.

MATERIALS AND METHODS

The description of the puddings manufacturing technology. The pudding manufacturing technology is based on several specific unit operations like filtration, preheating (40 – 45°C), auxiliary materials addition (egg yolk powder, agar-agar and/or coconut oil, Carob powder), successive mixings (Agave syrup, vanilla/rum essence addition), heating (65 – 70°C) to obtain the starch denaturation and heating at 85 – 90°C to inactivate the microorganisms from the mix, filling and cooling to storage temperature (4-8°C). The obtained samples were encoded as follows VLC (vanilla pudding), VUC (vanilla pudding with coconut oil), RLC (pudding with carob powder) and RUC (pudding with carob powder and coconut oil). All the samples were characterized by some chemical, microbiological and sensory determinations.

The chemical composition of puddings. The chemical composition of puddings was determined using procedures prescribed by the national standards. Dry matter was determined according to SR ISO 3728:2009. Fat content was accomplished by Soxhlet extraction (according to SR EN ISO 7328:2009) and protein content (according to SR ISO/TS 17837:2009) was determined by the Kjeldahl method. Ash was determined according to the SR EN ISO 707-2009. Carbohydrates were estimated by difference. The analyses were performed in triplicate.

Microbiological analyses. Microbiological analyses were conducted in order to determine: Total Viable Count (TVC) – aerobic mesophiles were enumerated on Plate Count Agar by incubation at 30 ± 1 °C for 72 h. Colonies were counted and results were expressed as cfu/g according to ISO 4833-1:2013. *Enterobacteriaceae* number (ENT) were enumerated on violet red bile glucose (VRBG) medium by incubation at 35 °C for 18 – 24 hours. The method highlights the properties of enterobacteria to ferment glucose with acid production, coloring the colonies in purple due to the pH indicator (neutral red) presence in the culture medium. Colonies were counted and results were expressed as cfu/g according to ISO 21528-2:2004. The Total Viable Count and *Enterobacteriaceae* number were determined immediately after manufacturing (moment 0) and after 7 and 14 days of storage. All determinations were carried out in triplicate for each sample.

Sensory evaluation. The sensory evaluation of the pudding samples was carried out in a standardized test room (ISO, 2007) by 10 untrained panelists in the age range 25 – 40 years. The main criterion for the panelists' choice was "*regular consumption of dairy desserts*". A hedonic test with a 9-point scale (1 represents dislike extremely, while 9 represents like extremely) was used for the evaluation. Before sensorial analysis the samples were left at room temperature (20°C) for 1 h to equilibrate. All pudding samples were blind coded with 3-digit random numbers, presented in containers and then served to the panelists.

Water was offered to rinse the mouth between tasting the pudding samples in order to distinguish clearly the specific flavours. Each pudding sample was evaluated using the following descriptors: appearance (this refer to colour intensity, visual thickness, surface shine, skin formation), odor, taste (this refer to sweet, only milk), flavour (vanilla/rum, creamy), stickiness, adhesiveness, mouthcoating, mouthfeel, and aftertaste.

RESULTS AND DISCUSSIONS

Because of the novelty of these products there is a need of characterization and of testing the consumers' acceptability. Thus this chapter presents chemical analyses, the microbiota variation during the 14 days of storage and the sensorial evaluation of the samples.

Chemical analyses. This subchapter includes the dry matter, fat, protein, ash, carbohydrates content for all the analyzed samples.

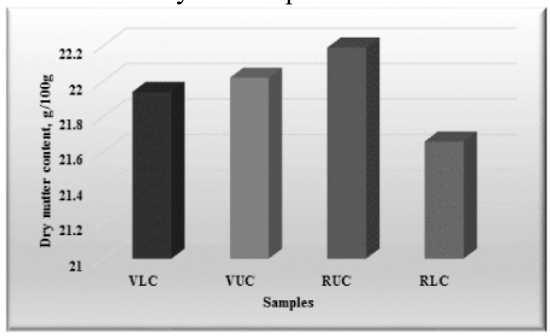

Figure 1. Dry matter content of pudding samples

The dry matter of the pudding samples ranged from 21.66 g/100g for RLC sample to 22.19 g/100g for RUC sample. This slightly increase in dry matter content might be attributed to addition of coconut oil and carob powder.

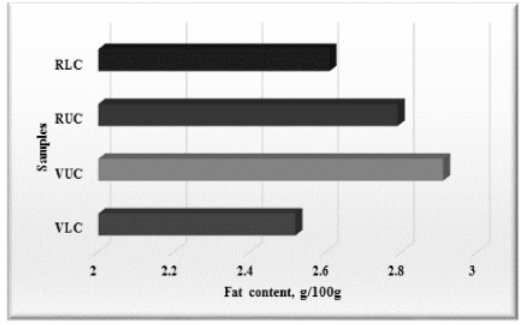

Figure 2. Fat content of pudding samples

The increased fat content in the samples formulated with coconut oil compared with the pudding samples containing only animal fat from milk, ranging between 2.52 g/100g and 2.91 g/100g with the highest value in the VUC sample. This results are comparable with other researches for puddings with different egg levels, the fat content is 3.5 times lower than that reported by Sarker et al., 2016. These results indicate that the samples are low in fat content, which recommends them for a wide range of consumers.

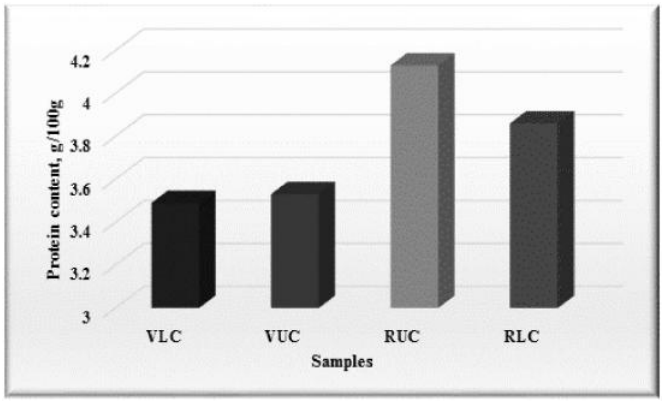

Figure 3. Protein content of pudding samples

The protein content increased from 3.49 g/100g for VLC sample to 4.13 g/100g for RUC sample. This increase in protein content is perhaps dependent on the addition of eggs yolk powder and carob powder. The results are in accordance with the findings of Pracham and Thaiudom, 2016 for jasmine rice puddings (3.54-7.70g/100g).

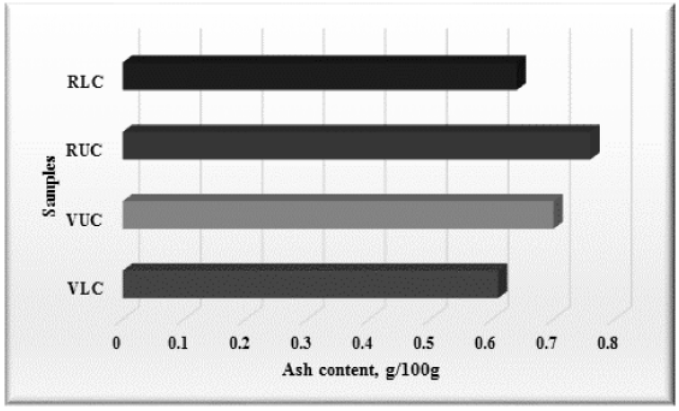

Figure 4. Ash content of pudding samples

The addition of eggs yolk powder, corn starch, carob powder and agave syrup increase the ash level of the puddings.The ash content was higher for pudding with coconut oil and carob powder encoded RUC (0.76 g/100g) compared with the VLC sample (0.61 g/100g), because these auxiliary materials contain minerals. The values are lower than those published on USDA platform (1.40g/100g) (www.usda.gov).

The consumers'demand for natural and functional foods is continuously increasing and it is desirable to use alternatives of sugar as a sweetener in food processing. However, beside the healthy aspects, food products should have an attractive image and a good taste (Sun et al., 2007). Even in the experimental puddings there is no sugar added, the carbohydrates content was determined taking into consideration the other components of the matrix (goat milk, Agave syrup, starch, Carob powder).

Puddings had a carbohydrate content ranging from 14.51 g/100g to 15.32 g/100g, where the highest carbohydrate content (15.32 g/100g) was found in the sample with goat milk, eggs yolk powder and vanilla essence (VLC). Thus,no significant differences are

presented by the carbohydrates content. Similar researches on commercial puddings determined the carbohydrates content at over 21% (Damian, 2012).

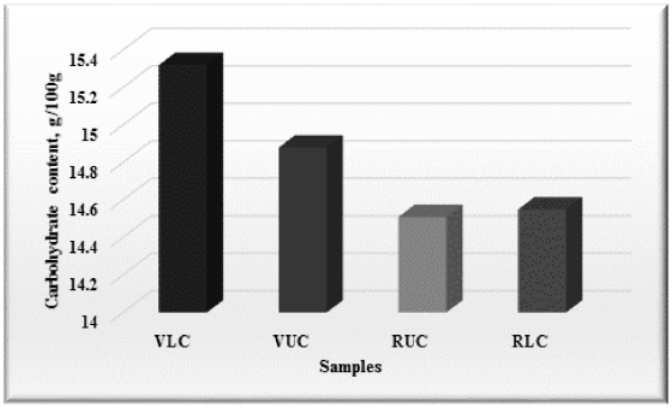

Figure 5. Carbohydrates content of pudding samples

Microbiological determinations. As a way of promoting food and consumer safety, it is vital that the presence of microorganisms in pudding type products is evaluated and motorized. The results obtained from microbiological analysis are presented in Table 1.

Table 1.

Data from the microbiological analyses of pudding samples

Pudding samples	Parameter	Units	Time (days)	
			0	14
VLC	Enumeration of Total Viable Count	cfu·g^{-1}	1.9·10^2	4.5·10^2
VUC			2.7·10^2	1·10^3
RUC			Ne = 5	1.6·10^2
RLC			1.6·10^2	1.6·10^2
VLC	Enumeration of *Enterobacteriaceae*	cfu·g^{-1}	< 10	< 10
VUC			< 10	< 10
RUC			< 10	< 10
RLC			< 10	< 10

Ne – Estimated Number

After production the values of total viable count (TVC) of the pudding samples ranged from Ne = 5 (RUC) to 2.7·10^2 cfu/g (VUC). The *Enterobacteriaceae* number (ENT) were < 10 for all analyzed samples. During storage time, no significant differences between pudding samples were observed for TVC. At the end of the storage period, the values of total viable count ranging between 1.6·10^2 cfu/g and 1·10^3 cfu/g with the highest value in the VUC sample. The ENT number was < 10 over the entire storage period for all pudding samples. These results are in agreement with the Microbiological Guidelines for Ready-to-eat Food revised in May 2007 by Centre for Food Safety.Similar results were obtained for cocoa pudding by Irkin and Guldas in 2011.

The results of sensory evaluation of the puddings is shown in Figure 6.

It can be observed that the addition of auxiliary materials resulted in several significant changes in the sensory evaluation parameters of pudding samples. The pudding sample with carob powder and coconut oil (RUC) has the lowest scores for taste and

appearance. The mean scores for taste ranged from 5 (RUC) to 6.4 (VLC) and the appearance scores ranged from 7.1 (RUC) to 8 (RLC). It is important to notice that there were not significant differences between samples in odour, flavor and sticky evaluation.

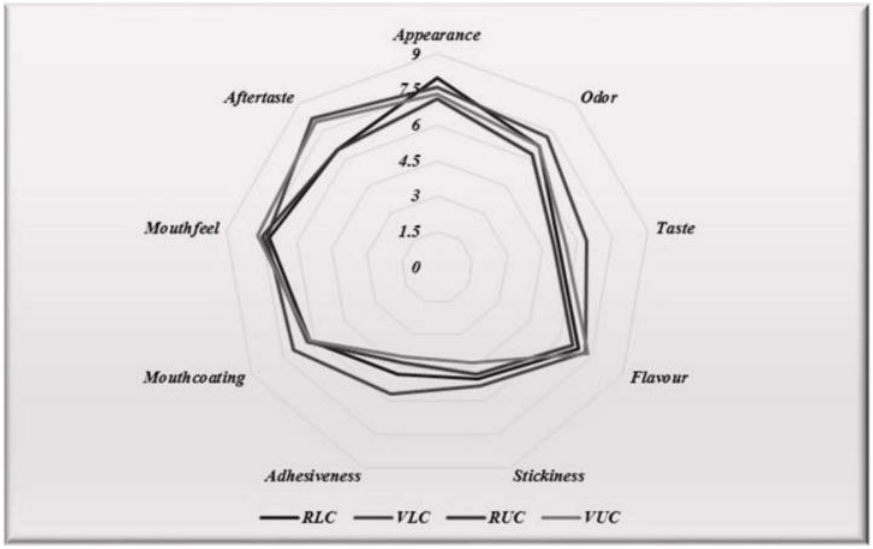

Figure 6. Sensory evaluation of pudding sample

Mouthcoating and mouthfeel values have an insignificant variance for all the pudding samples. The highest value for mouthcoating has been established for VLC sample (7) and the lowest value for mouthfeel for the RLC sample (7.2). Aftertaste seems to be influenced by the presence of auxiliary materials, while the highest values (8.2 and 8) were registered for samples encoded VUC and VLC. From sensory quality point of view, pudding samples containing carob powder and coconut oil were the most appreciated by consumers.

CONCLUSIONS

The consumers' concerns about healthy food and the demand for sugar reduced food increases the interest of this paper. This research face the challenge to obtain sugar free desserts with comparablecharacteristics to those on the market. Even the replacing of some classic components may be of actual interest, it is important to evaluate its effect on sensory properties, because the consumers could reject the product. The results have demonstrated that the replacement of the cocoa powder with Carobpowder and the coconut addition changed the taste and the appearance of the sample. But, they do not affected the thickness and creamy flavor, properties which are specific to this kind of product.

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