Characterization of Confectionery Spreadable Creams Based on Roasted Sunflower Kernels and Cocoa or Carob Powder

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Bulletin UASVM Food Science and Technology 71(1) / 2014
ISSN-L 2344-2344; Print ISSN 2344-2344; Electronic ISSN 2344-5300

Abstract

Spreadable creams are solid-oil suspensions, a mix of fats represents the oil phase, the dispersed phase consisting usually of sugar, cocoa powder, milled and roasted nuts, dried milk and whey. For improving the viscosity of the final product emulsifiers are used, most common being lecithin and mono and diglycerides.

The present paper refers to a spreadable confectionery product group, creamy, proper to be eaten as it is, as well as spread on a bread slice or as a filling for cookies or chocolate cream.

According to this work, the following ingredients were used: roasted sunflower kernels, sugar, palm oil, cocoa or carob powder and lecithin. The obtained product can be consumed also by persons who suffer from allergies, due the fact that sunflower seeds were replacing the peanuts or almond, the ingredients known as allergens and which are usually used in the technological process of obtaining these creams.

The purpose of this study was to characterize the obtaining confectionery spreadable creams based on sunflower kernels, cocoa or carob powder. It was determined the chemical composition of the prototypes obtained, a spreadable cream having no cocoa or carob, one with cocoa and one with carob powder. The antioxidant capacity and total phenolic content of the obtained samples were also assessed.

Keywords: *spreadable cream, sunflower-seed, carob, antioxidant capacity, phenolic compounds*.

INTRODUCTION

Although nearly any food is capable of causing an allergic reaction, peanut allergy is one of the most common food allergies. Food allergy is affecting up to 15 million people in the United States, including 1 in 13 children.

Allergy to peanuts appears to be on the rise in children. According to a study funded by Food Allergy Research & Education, the number of children in the US with peanut allergy tripled between 1997 and 2008. Studies in the United Kingdom and Canada also showed a high prevalence of peanut allergy in schoolchildren (www.foodallergy.org).

Chocolate products are the most important confectionery that is popular especially for children and as a source of energy in addition to its high nutritional value. In chocolate industry, many of ingredients such as cocoa, sugar, cocoa butter, play an important role in product quality.

So, it was created a product that is trying to meet market requirements, in terms of both people with allergies to peanuts and persons allergic to cocoa, the product being free of allergens, but also for those who love chocolate.

Research underway in the palm oil industry has revealed a range of bioactives than can be used as functional components for food product that enhance health. Carotene is one of the most important functional components in palm oil (Tan *et al.*, 2007).

The oil palm fruit was identified as an excellent source of two major phytochemicals, namely vitamin E (tocopherols and tocotrienols) and carotenoids, both of which are fat-soluble. Oil palm vitamin E has been reported to act as a potent biological antioxidant, protecting against oxidative stress and the atherosclerotic process (Sundram *et al.*, 2003; Mukherjee and Mitra, 2009). Recently, oil palm fruits were also identified as a rich source of phenolic compounds (Sambanthamurthi *et al.*, 2011).

Theobroma cacao L. the source of chocolate, is a species native to the rainforests of Central and South America (Bailey *et al.*, 2009).

Cocoa beans, seeds of the tree *Theobroma cacao* L., are the primary raw material used in the manufacture of final products intended directly for consumption such as cocoa powder, chocolate bar and other cocoa derivative products which are highly valued by consumers around the world (Belscak *et al.*, 2009).

Cocoa-products are an important source of phenolic compounds such as proanthocyanidins (PAC) and monomeric flavan-3-ols. The consumption of cocoa with high levels of procyanidins and epicatechins, despite the high contents of saturated fatty acids, has been associated with benefits to human health including increased plasma antioxidant capacity and lower lipid peroxidation, a mechanism of protection in heart disease (Katz *et al.* 2011).

Carob pods are characterized by high sugar content (more than 50%), mainly sucrose (32-38%), glucose (5-6%), fructose (5-7%) and maltose (Binder *et al.*, 1959; MacLeod and Forcen, 1992). Carob is a natural sweetener with a flavor and appearance similar to cacao. Carob is often used as a chocolate or cocoa substitute (Brand, 1984; Nyerges, 1978). Such usage is attributed to the fact that carob has the advantage of being caffeine and theobromine-free whereas chocolate and cocoa contain relatively high amounts of these two antinutrients (Craig and Nguyen, 1984).

Carob contains about 18% cellulose and hemicellulose. The mineral composition (in mg per 100g of pulp) is: K=1100, Ca=307, Mg=42, Na=13, Cu=0.23, Fe=104, Mn=0.4, Zn=0.59 (www.sigmaaldrich.com).

Sunflower seeds may be consumed directly as seeds, roasted with or without the hull, using the varieties with the lower content in the oil (approximately 30%) thicker in shell, a poor adhesion to its kernel. Components that are involved in the composition of chemical sunflower (fat, protein, cellulose, ash) are depending on variety and growing conditions.

Sunflower seeds contain around 20% protein, a high level of potassium (710 mg/100g) and magnesium (390mg/ 100g) and particularly is rich in polyunsaturated fatty acids (approximately 31%, as compared with other seeds and oleaginous fruit: soybeans (3.5%), groundnut (13.1%), linseed (22.4%), sesame seed (25.5%) and sunflower seeds (28.2%) (Skrbic and Filipcev, 2008).

Sunflower seeds contain a significant quantity of vitamin E - 37.8 mg/100g, unlike linseeds, sesame and soya bean, which contain less than 3 mg/ 100g, while peanut is estimated to contain 10.1 mg/100g of vitamin E (Skrbic and Filipcev, 2008).

MATERIALS AND METHODS

Roasted sunflower kernel production

Roasted sunflower seeds were obtained from a mix of industrial sunflower seeds, from the harvest of 2012. After quantitative and qualitative reception of sunflower seeds, before being passed into the dehulling machine, the final cleaning of the seeds was achieved by a vibro-vacuum cleaner.

Products resulting from the dehulling machine were separated in a plansifter resulting the sunflower kernels, unhulled and partially dehulled seeds, hulls and kernel dust. Unhulled and partially dehulled seeds were resent to the dehulling machine, while the hulls and kernel dust were recovered as by-products.

The roasted sunflower kernel was obtained in a continuous equipment at 120°C and then cooled under the current of air (40 – 45°C).

Carob-Sunflower spreadable cream prototypes production

Prototypes (*Tab. 1*) were obtained in batches of four kilograms on the Pilot plant of the Department of Food Engineering, Faculty of Food Science and Technology, USAMV Cluj-Napoca. The roasted sunflower kernel was grinded at pilot plant scale, using a ball mill model WAFA 20, Mazzetti Renato, Italy. Working time for obtaining the spreadable creams samples was two hours, the rotor speed being kept constant.

General chemical composition

Protein, fat, ash and moisture content of different samples was determined according to AOAC (2002) procedures.

The protein was determinated by the Kjeldahl method and shall consist of the total nitrogen determination which, multiplied with the coefficient of the transformation of nitrogen in protein, give the quantity of protein.

Fat was determinated by extraction with organic solvents in the Soxhlet apparatus. Ash was determinated by ashing at 550°C-600°C until white ash.

Moisture was determinated by drying a quantity of the sample at 103 ± 2°C until a constant weight (Muste and Mureşan, 2011).

Total polyphenol content

Extraction of samples

In order to obtain extracts for total polyphenols determination, ~1 g of the sample from each spread cream prototype was extracted in a mortar, with acidified methanol (MeOH:HCl 0.01 %). The extract was separated and re-extracted up to become colorless. The filtrates obtained were combined in a total extract and solvent evaporated (35°C). The dry residue was re-dissolved in a specific quantity of methanol according to requirements (Bunea *et al.*, 2011).

Determination of the total polyphenols

Stock solution of sample extracts (25 µl each) were dissolved in methanol and further dilution were performed to obtain readings within the standard curve made with gallic acid (*Fig. 1*) (R^2=0.999). The extracts were oxidized by the Folin-Ciocâlteu reagent (120 µl) and the neutralization was made with Na_2CO_3 (340 µl), after 5 minutes. The absorbance was measured at 750 nm after 90 minutes, in the dark, at room temperature. The results were expressed as milligram of gallic acid per 100 grams.

Table 1. The protocol used to obtain spreadable creams based on roasted sunflower kernel and carob or cocoa powder

Samples	Sunflower %	Carob %	Cocoa %	Sugar %	Palm oil %	Lecithin %
Control sample (1)	40.5	-	-	49	10	0.5
Carob prototype (2)	40.5	8	-	41	10	0.5
Cocoa prototype (3)	40.5	-	8	41	10	0.5

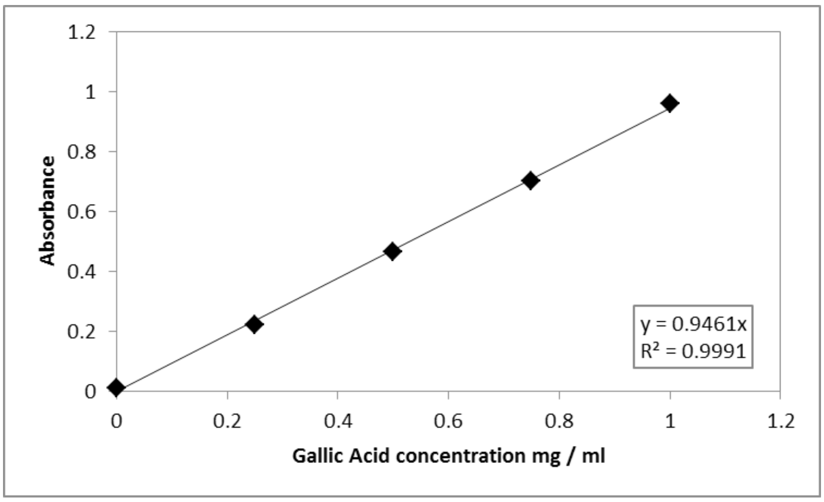

Fig. 1. Standard curve calibration for Gallic acid

Antioxidant capacity determination

The antioxidant capacity was determinated through the evaluation of free radical-scavenging effect on 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical.

This determination was based on the proposed method of Odriozola-Serrano *et al.* (2008). 10 µl of methanolic sample extract was mixed with 3.9 ml DPPH (0.025g/l) and 90 µl of distilled water. The mixture has been stirred properly and kept in the dark for 30 min. The absorbance of samples was measured at 515 nm (UV-VIS 1700 Shimazdu) against a blank consisting of methanol. The results were expressed as percentage decrease with respect to the absorption value of a reference DPPH solution.

RESULTS AND DISCUSSIONS

Protein content of spreadable creams

Protein content (*Fig. 2*) of the cocoa prototype (12.48%) has been greater than for other prototypes, the one based on sunflower and carob (11.41%) and the control one (10.56%). This can be explained by the fact that sunflower kernel has a protein content of 20-25% and determines roughly the protein content of the creams, while the addition of carob or cocoa causes an increase of the protein content.

Fat content of spreadable creams

The control sample had the highest content of fat, registering 33.98% (*Fig. 3*). However, the other two samples, carob and cocoa prototypes

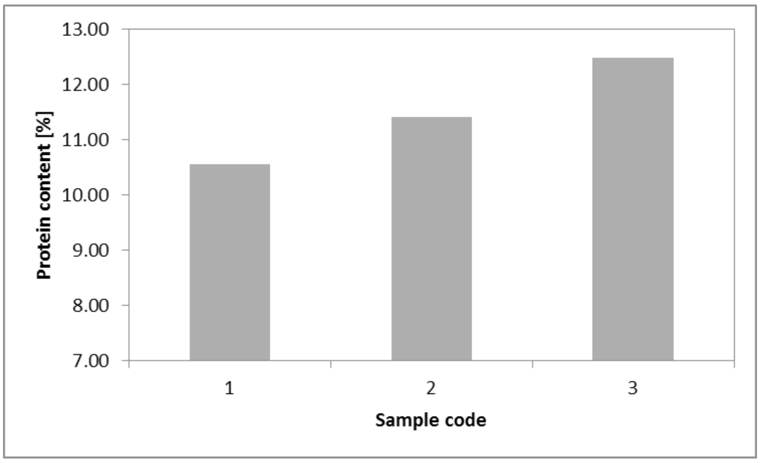

Fig. 2. The protein content of confectionery spreadable creams prototypes (1 - control; 2 – carob prototype; 3 – cocoa prototype)

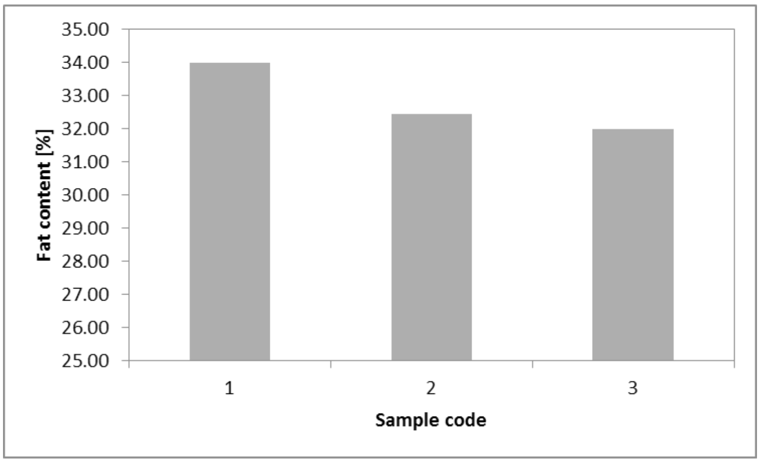

Fig. 3. The fat content of confectionery spreadable creams prototypes (1 - control; 2 – carob prototype; 3 – cocoa prototype)

had also similar values (32.42% and 31.98%). The prototypes analyzed in current work show values of fat content characteristics for similar confectionery products (e.g., chocolate fat content is between 28.5 and 35%).

Ash and moisture content of spreadable creams

The ash content of the spreadable creams based on roasted sunflower kernel and carob or cocoa powder was between 1.38 and 2% (*Fig. 4*). It can be seen a trend of increasing the ash content as the carob or cocoa powder was added.

Regarding the moisture content of analyzed spreadable creams, there were registered values of 0.28% for control, 0.69% for carob prototype and 0.41% for cocoa prototype, showing thus a high stability with minimum risk of microbiological growth.

Total polyphenol content and antioxidant capacity of spreadable creams

The results obtained for total polyphenol content and antioxidant capacity of spreadable creams based on roasted sunflower seed and carob or cocoa are presented in *Table 2.*

The cocoa prototype had registered the highest content of polyphenols as well as the highest value for antioxidant capacity. However, the carob prototype performed well, as it registered a close polyphenol content and antioxidant capacity to cocoa prototype. As expected, the control sample had the smallest values of both total polyphenol content and antioxidant capacity.

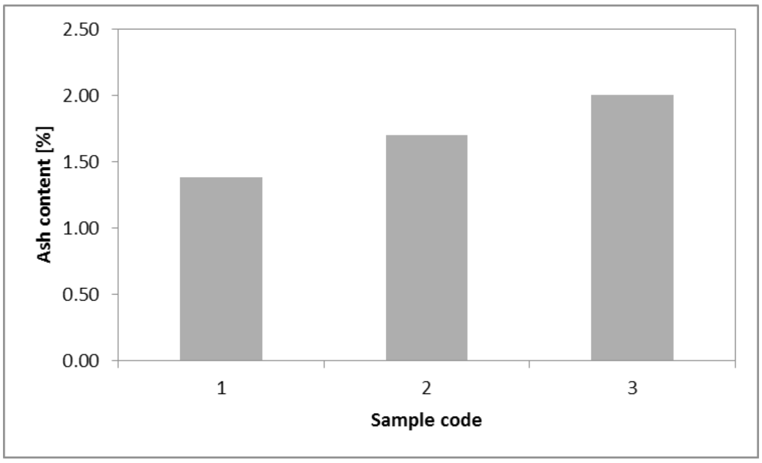

Fig. 4. The ash content of confectionery spreadable creams prototypes (1 - control; 2 – carob prototype; 3 – cocoa prototype)

Table 2. The total polyphenol content and antioxidant capacity of spreadable cream

Sample	Total polyphenol content [mg GAE/ 100g]	Antioxidant capacity [%]
Control sample (1)	749.80	44.74
Carob prototype (2)	844	52.20
Cocoa prototype (3)	929	55.55

CONCLUSION

This is a first study that focuses on the chemical characterization of the spreadable creams obtained from roasted sunflower kernels and carob or cocoa powder. The three analyzed samples showed values between 10.56 - 12.48% for protein, 31.98 - 33.98% for fat, 1.38 - 2% for ash and 0.28 - 0.69% for moisture. The results of the study showed that cocoa prototype contains high level of antioxidants and polyphenols, while the prototype with carob contains medium level of antioxidants and polyphenols.

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