POTENTIAL OF EDIBLE FLOWERS TO BE USED IN BISCUITS

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Introduction

The research was on the use of edible flowers in food, looking at the quantities that can be used in biscuits. There are not many flower-flavoured products on the market, which provides a new opportunity for product developers who are thinking about creating a unique product range. The focus was on crumb biscuits containing different percentages of ground dried marigold and dried tea rose petals. As the decoctions of these flowers are consumed for certain health purposes, it could be considered that they could also be considered as functional foods. marigold is known to have anti-inflammatory, antibacterial properties. Tea roses are effective against gout and rheumatism, but are also beneficial for stress relief and mood enhancement.

Materials and methods

Cookies were prepared by follow the formula in Table 1. The cookies were round in shape with diameter of 45 mm and thickness of 6-8 mm and baked in an electric oven at 180 °C for 9 min. Figure 1. represents the samples.

The water activity of the baked biscuits was determined using a Novasina water activity measuring machine. 2 parallel measurements per sample were performed. The colour was measured with a Konica Minolta CR 410 handheld digital colourimeter. It was used to give the lightness factor (L*), the green/red ratio (a*) and the blue/yellow ratio (b*). The colorimetric components of 3-3 replicate samples were investigated. The prepared biscuits were measured using a Brookfield LFRA Texture Analyzer and the data were recorded and evaluated using Texture ProLite software. For each sample, 9 parallel measurements were made. Based on the measured data, a stock profile diagram was prepared and the main stock parameters were determined (e.g. hardness, cohesion, adhesion, etc.). For the determination of total polyphenols, the Folin-Ciocalteu method of Singleton and Rossi (1965) was used, using a HITACHI U-2900 spectrophotometer. The results were expressed as gallic acid/100 g biscuits. During the sensory evaluation, 14 participants (men and women) judged the different biscuits. Each product was given a three-digit code. They had to fill in a series of questions about the products and a scoring table. Statistical evaluation of the data was performed using one-sample analysis of variance to determine the extent to which biscuits containing different concentrations of flowers differed from each other and from the natural variety. In case of significant difference, it was necessary to apply pairwise comparisons in Past4.07b to determine where there was a difference. In addition, for the sensory evaluation, an independence test was performed in Past. Significance was determined by p-value at a significance level (α) of 0.05. If the p-value was less than 0.05 (α), a significant difference was found, whereas, if the p-value was greater, a large difference was found.

Results and discussion

The control biscuits had the highest average water activity (0.413). The flower-enriched products had lower values in all cases. marigold petal biscuits showed the lowest water activity values (0.315, 0.302, 0.395), while those with tea rose showed higher water activity values (0.339, 0.379, 0.407). In terms of colouring components, compared to the natural biscuits, the marigold and tea-salt products became darker in shade as the concentration increased. Analysis of variance confirmed that there were significant differences between the samples, as the obtained p-values were very low. Further investigation of which biscuits differ significantly from each other revealed that all products differed from each other in the sample pairs of control-M1%, control-M2.5%, control-M5%, M1%-M5% and M2.5%-M5%, and in the sample pairs of tea-salted biscuits. It was also observed that as the concentration of added marigold increased, the green/red and blue/yellow ratios increased, i.e. the cakes became more intense yellow.

	Control	M 1%	M 2,5%	M 5%	R 0,5%	R 1%	R 2%
Flower petal	-	1 g	2,5 g	5 g	0,5 g	1 g	2 g
Flour	50 g	50 g	50 g	48,33 g	50 g	50 g	50 g
Margarine	33.33 g	33.33 g	33.33 g	33.33 g	33.33 g	33.33 g	33.33 g
Sugar	16.67 g	16.67 g	16.67 g	16.67 g	16.67 g	16.67 g	16.67 g
Egg yellow	3 g	3 g	3 g	3 g	3 g	3 g	3 g
Salt	0.17 g	0.17 g	0.17 g	0.17 g	0.17 g	0.17 g	0.17 g
Vanilin sugar	1.33 g	1.33 g	1.33 g	1.33 g	1.33 g	1.33 g	1.33 g

Table 1. The recipes of the biscuits

Figure 1. The biscuits (on the left: control, M 1%, M 2,5%, M 5%, on the right: control, R 0,5%, R 1%, R 2%)

The tea rose biscuits, on the other hand, became more purple in colour at higher concentrations. The hardness data show that, compared to the natural sample, the added marigold made the dough of the biscuits harder (M1%, M2.5%). The biscuits marked M5% had more margarine added when the dough was made, without which the dough could not be kneaded into one. This extra fat added may cause the biscuits to be softer than the natural sample. Interestingly, the hardness of the tea salt biscuits decreased as the concentration of added flower petals in them increased, making the dough softer. This may be due to the fact that the dried petals were ground down to very fine granules and the tea rose contains essential oil. The oil, which is not present in the marigold, may have caused this degree of softness in the dough structure. And based on the results of the two-sample paired t-test, it was statistically supported that the hardness of the biscuits increased during 2 weeks of storage, probably due to the composition of the product, especially the amount and texture of the fat, and the decrease in fat content (Romani et al., 2016).

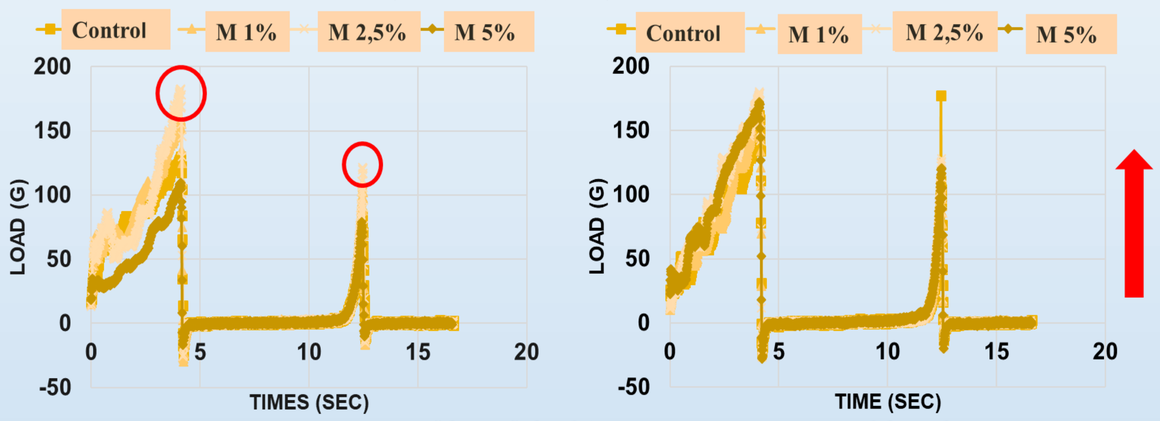

Figure 2. Texture profiles of the biscuits contain marigold at the 1. day, and after 2 weeks storage

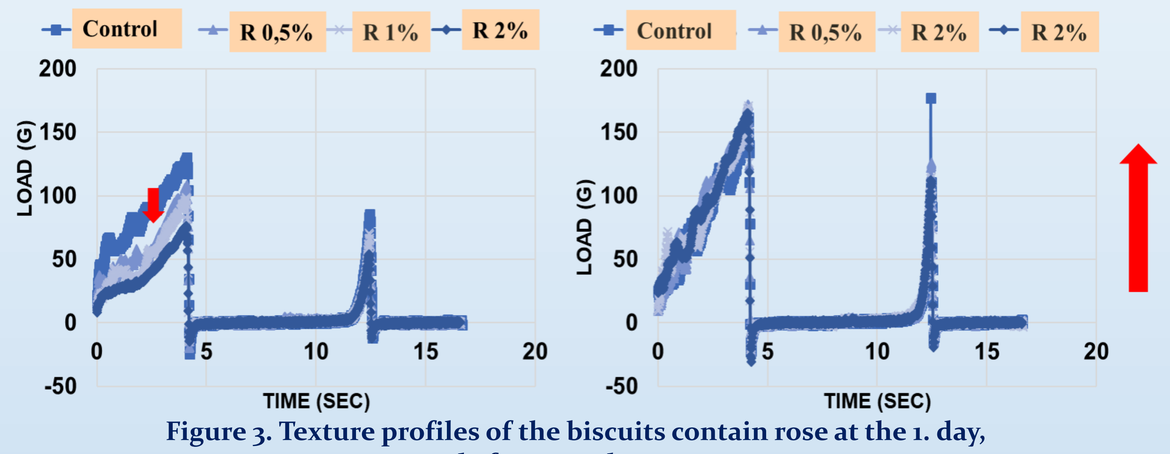

Figure 3. Texture profiles of the biscuits contain rose at the 1. day, and after 2 weeks storage

Polyphenols are largely ingested through fruits, vegetables and plant-based drinks such as tea, juices and coffee. A large number of publications have been published on the consumption of polyphenols, supporting their ability to prevent and treat serious chronic diseases (cardiovascular problems, diabetes) (Zamora-Ros et al. 2014; Rabassa et al., 2015). The polyphenol content of biscuits measured at week 0 increased in direct proportion to the increase in added flower petal concentrations. During 2 weeks of storage, the polyphenol content of all samples decreased (Figure 4). According to a 2019 publication by Del Bo' and colleagues, daily polyphenol intake varies significantly around the world, due to climatic, socio-cultural and dietary differences. In Japan, polyphenols are consumed at a rate of 1500 mg/day, in the United States 800 mg, in France and Poland 1000 mg/day, while in Italy the average daily polyphenol intake is only 650 mg/day. The highest intake is in Denmark (1786 mg/day) and the lowest in Greece (584 mg/day). Average daily polyphenol intake in non-Mediterranean European countries is 1284 mg (Zamora-Ros et al. 2014; Rabassa et al., 2015). Based on this, the daily intake of polyphenols was calculated from consuming 100 g biscuit (Table 2).

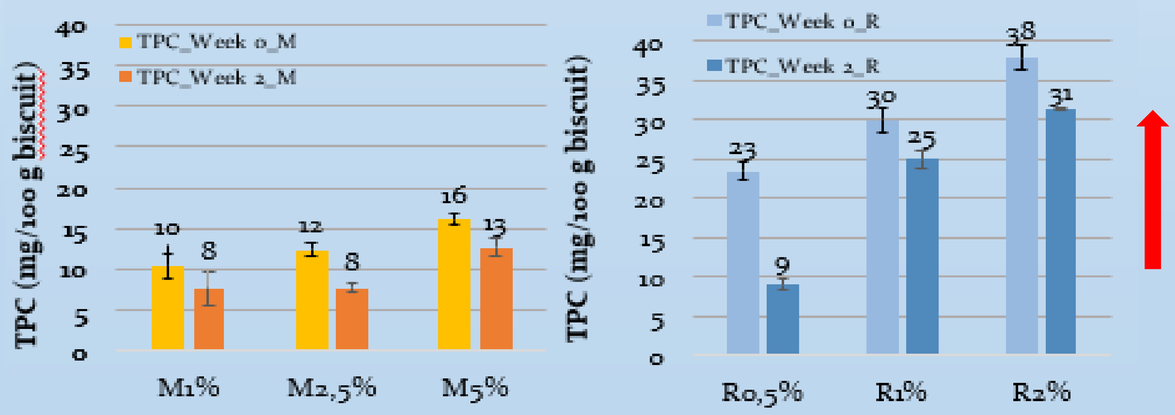

Figure 4. Polyphenol content of the biscuits at the 1. day (week 0), and after 2 weeks storage

Sample	TPC mg/100g biscuit	TPC (%) content from consuming 100g biscuit
M1%	10	0.81
M2.5%	12	0.97
M5%	16	1.26
R0.5%	23	1.82
R1%	30	2.34
R2%	38	2.95

Table 2. Polyphenol daily intake from consuming 100 g biscuit

Conclusion

The addition of dried, ground flower petals gave different results for tea rose (softened biscuits) and marigold (hardened biscuits). Significant differences were also observed within the two varieties and in the results of two weeks of storage. Based on the results, the biscuit that was judged to be the best was R2% and it is worth making future changes to the flavour, such as replacing the margarine with butter and coating with white chocolate. A box containing 12 biscuits made of recycled paper was designed to package the products (Figure 5).The addition of edible flower petals proved to be a promising new alternative to increase the polyphenol content and the enjoyment value of the linseed-based biscuits, modifying their stock and contributing to the daily polyphenol requirement.

Figure 5. White chocolate coated biscuits and the designed package

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