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Chromatographic profile of fatty acids and sugars in cupcakes functionalized with an extract rich in rosmarinic acid

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Currently, the food industry is interested in replacing artificial additives by natural ingredients. Some plant extracts have emerged as possible alternatives to artificial preservatives, namely antioxidants. In fact, dairy, meat and bakery products have been developed, incorporating extracts of aromatic plants, spices or fruits, which have antioxidant properties. In this work, the preserving effectiveness of an extract rich in rosmarinic acid was tested in cupcakes and compared to an artificial additive (potassium sorbate, E202). The extract was obtained from *Melissa officinalis* L. (lemon balm) by applying an ultrasound technique using a mixture of ethanol/water as the extraction solvent. After confirming its antioxidant properties (free radical scavenging effect $EC_{50} = 79 \pm 2 \mu\text{g/mL}$; reducing power $EC_{50} = 49 \pm 1 \mu\text{g/mL}$), antimicrobial (against 8 bacteria and 8 food contaminating fungi), and absence of toxicity (in cell lines), it was incorporated in cupcakes, and analysed immediately after incorporation and after 3 and 5 days of storage at room temperature and protected from light. All samples were analysed chromatographically in terms of fatty acids (GC-FID) and free sugars (HPLC-RI). Regarding fatty acids, a total of 21 molecules were identified, with predominance of saturated fatty acids in all cupcakes samples. Individually, palmitic acid and oleic acid were detected in the highest percentages. Among free sugars, sucrose (the major form) and glucose were identified in all samples. The results demonstrate that the addition of the extract rich in rosmarinic acid caused no changes in fatty acids and sugars' profiles, having the potential to be used in pastry products, meeting the current consumers demand.

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Hromatografski profil masnih kiselina i šećera u kolačima funkcionalizovanim ekstraktom bogatim rozmarinskom kiselinom

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Industrija hrane trenutno je veoma zainteresovana postojanjem mogućnosti zamene veštačkih aditiva prirodnim sastojcima. Izvesni biljni ekstrakti pojavili su se kao moguće alternative veštačkim konzervansima, pre svega antioksidanti. Štaviše, razvijaju se mlečni proizvodi, meso i proizvodi iz pekarske industrije koji u sebi sadrže ekstrakte aromatičnih biljaka, začina ili voća, a koji istovremeno pokazuju antioksidativna svojstva. U ovom radu ispitivana je efikasnost očuvanja ekstrakta bogatog rozmarinskom kiselinom u kolačima, koja je potom upoređena sa veštačkim aditivom (kalijum sorbat, E202). Ekstrakt je dobijen od biljke *Melissa officinalis* L. (matičnjak) primenom ultrazvučne tehnike koristeći smešu etanola/vode kao rastvarača za ekstrakciju. Nakon utvrđivanja antioksidativnih (efekat uklanjanja slobodnih radikala $EC_{50} = 79 \pm 2 \mu\text{g/mL}$; smanjenje jačine $EC_{50} = 49 \pm 1 \mu\text{g/mL}$) i antimikrobnih svojstava (protiv 8 bakterija i 8 gljiva koje zagađuju hranu), kao i utvrđivanja odsustva toksičnosti (u ćelijskim linijama), ekstrakt bogat rozmarinskom kiselinom dodat je u kolače i analiziran odmah nakon dodavanja, kao i nakon 3 i 5 dana skladištenja na sobnoj temperaturi i na mestu zaštićenom od svetlosti. Svi uzorci su analizirani hromatografski u smislu masnih kiselina (GC-FID) i slobodnih šećera (HPLC-RI). Kada su u pitanju masne kiseline, identifikovan je ukupno 21 molekul, sa najvećim procentom zasićenih masnih kiselina u svim uzorcima kolača. Pojedinačno, palmitinska kiselina i oleinska kiselina su detektovane u najvećem procentu. Od slobodnih šećera, saharoza (glavni oblik) i glukoza identifikovane su u svim uzorcima. Rezultati pokazuju da dodavanje ekstrakta bogatog rozmarinskom kiselinom nije prouzrokovalo promene u profilima masnih kiselina i šećera. Time je uočen potencijal korišćenja ovog ekstrakta u pecivima i pekarskoj industriji, imajući u vidu da uspešno zadovoljava trenutno potražnju među potrošačima.

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