J Food Sci Technol (June 2017) 54(7):2126–2134
DOI 10.1007/s13197-017-2652-2

ORIGINAL ARTICLE

Effect of rice bran oil spread on the physical, sensory and fatty acid profile of cake

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Revised: 6 April 2017 / Accepted: 18 April 2017 / Published online: 16 May 2017

Abstract Studies were carried out to replace hydrogenated fat (HF) with rice bran oil (RBO) and two varieties of rice bran oil spread RBOS1 and RBOS2 in the preparation of cake. Physico–chemical properties, sensory properties, scanning electronic microscopic (SEM) study and fatty acid estimation with reference to trans fatty acids of cake made with control and experimental samples were studied. The best acceptable cake among the four i.e., RBOS2 cake was selected for consumer evaluation along with control (HF) cake. Results revealed that there was no significant difference in overall acceptability of cake made with HF and RBOS2. The internal structure and pore structure of RBOS2 cake was finer and smoother than the control cake as per SEM imaging. The pores within the core varied in diameter between 13.9 and 29.6 µm in control cake and between 16.9 and 58.6 µm in RBOS2 cake at 500 × magnification indicating good textural properties compared to HF cake. The fatty acids analysis results showed that the amount of total trans fatty acids (TFA) was 15.46% in HF cake, 3.56% in RBO cake, 4.54% in RBOS1 cake, and 3.78% in RBOS2 cake. The major trans fatty acids observed in all samples were elaidic acid (C18:1 trans-9) and Linolelidic acid (C18:2, trans-6). Elaidic acid was the highest in HF cake (6.64%) and the least in RBO cake (2.62%). Linolelidic acid was the highest in HF cake (8.48%) and the least in RBOS2 cake (0.91%). Trans Vaccenic acid was detected only in HF cake (0.34%). TFA content assumes significance in terms of its ill effects on the health of consumers, only if fat content is also high. Hence, consumption of the HF products might prove to be harmful, if consumed in large amounts and at higher frequencies. Therefore RBOS can be promoted as healthy fat for production of baked products.

Keywords Rice bran oil · Rice bran oil spread · Trans fatty acids · Cake

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Introduction

Rice bran oil is an excellent cooking medium because it is nutritionally superior, contains more micronutrients, longer shelf life, more stable at higher temperature, gives better taste and flavor to food items; frying takes less time, so saves energy and economical due to 15% less absorption of oil during frying. Rice bran oil has garnered attention from consumers in recent years, owing to its high concentrations of health-promoting compounds, ranging from tocopherols and tocotrienols, to phytosterols and γ-oryzanol (Sen et al. 2006). Tocotrienols also act as antioxidants and display anticancer, cholesterol lowering and neuroprotective properties that are distinct from tocopherols (Sen et al. 2007). γ-Oryzanol has been shown previously to act as an antioxidant (Miller and Engel 2006; Juliano et al. 2005) and is also effective at lowering cholesterol (Yokoyama 2004). Rice bran oil specifically has been shown to protect against lipid peroxidation in vitro (Lee et al. 2005). Many of the same molecules in rice bran oil that impart antioxidant activity in biological tissues also inhibit lipid oxidation on the shelf life of rice bran oil leading to relative resistance to oxidative degradation at both ambient and elevated temperatures, thereby giving longer product life to foods made with rice bran oil. While commodity oils have traditionally been used in the manufacture of spreads, rice bran oil itself is now being explored, for use in spreads, as cooking oil and as bakery fat (Eady et al. 2011).

In the baking industry, a number of functions are induced by lipids. They include: tenderization, mouthfeel, structural integrity, lubrication, air incorporation, heat transfer and shelf life extension. Because of their functional properties (e.g. creaming ability), plastic shortenings, which are often made by partial hydrogenation, are commonly used in the baking industry (Reyes-Hernandez et al. 2007; Zhou et al. 2011). However, trans fat generated during the hydrogenation process increases the risk of coronary heart disease (Dhaka et al. 2011). The United States Department of Agriculture (USDA) and the Food and Drug Administration (FDA) recommend consuming less than 10% of calories from saturated fatty acids by replacing them with monounsaturated and polyunsaturated fatty acids, and to reduce trans fat intake as much as possible (U.S. Department of Agriculture and U.S. Department of Health and Human Services 2010). In recent years, the food industry has been making efforts to reduce trans fat by blending oils (high oleic and low linolenic) with fully hardened oils (palm), or by randomizing through interesterification (Wassell and Young 2007; Jeyarani et al. 2009). However, because of its supreme characters such as plasticity, which leads to desired physical qualities of baked products, lipids containing trans fat are still widely used in food industry (Jeyarani et al. 2009). Recently consumers have become more concerned about the health implications of trans fats which are produced in the baked products due to usage of hydrogenated fat at high baking temperatures. Studies have shown that Rice bran oil semisolid fraction (RBOF) can also be incorporated into baked food formulations with improvement in oxidative stability in baked foods.

Baking is a developing industry in India, which is growing in size. Foods that are convenient, with good taste, reasonably priced and carry a favorable nutritional image are in great demand. Among bakery products especially cakes, fat is one of the major ingredients. The present study was carried out to evaluate the suitability of rice bran oil and 2 varieties of rice bran oil spread (RBOS1 and RBOS2) in baked products like cakes.

Materials and methods

Procurement of raw material and preparation of cakes

Raw materials such as hydrogenated fat, refined wheat flour, sugar, baking powder were procured from the local market. Two types of rice bran oil spread viz. RBOS1 and RBOS2 were developed and standardized using edible gelators (hydrocolloids) at the Indian Institute of Rice Research (Formerly Directorate of Rice Research Centre) for the product development of cake. RBOS1 was a hard variant of RBO spread with 5% edible gelator whereas; RBOS2 was a soft variant of the RBO spread with 2% edible gelator. Cakes (HF cake which served as control, RBO cake, RBOS1 cake and RBOS2 cake) were made following the standard creaming method (Gisslen 2008). The dry ingredients (refined wheat flour, baking powder and salt) were mixed together, while sugar and shortening were mixed separately followed by addition of eggs and vanilla extract. Approximately 450 g of batter was transferred to a 12 cm × 22 cm aluminum loaf pan and placed immediately into a preheated deck oven (Model CN60; General Electric Company) for 40 min at 185°C. Inverted sheet trays were used to create an air gap and prevent bottom crusts from burning.

Physical quality characteristics of cake

The moisture content of the cake samples was determined by the method of AOAC (2005). A representative sample of the finished cake (approximately 1 cm^3) was cut from the center of the loaf and weighed to determine its density (g/cm^3).

Sensory evaluation

The sensory assessments were conducted in a purpose-built, six-booth sensory evaluation laboratory. A panel of 30 members consisted of staff and graduate students of the Department of Foods and Nutrition, Post Graduate and Research Centre, Professor Jayashankar Telangana State Agricultural University (PJTSAU) and Indian Institute of Rice Research (IIRR), Rajendranagar Hyderabad. The panelists had no knowledge of the project objectives. Cake samples (prepared with HF, RBO, RBOS1 and RBOS2) were coded using random three-digit numbers and served with the order of presentation counter-balanced. Panelists were provided with a glass of water and instructed to rinse and swallow water between samples. They were given written instructions and asked to evaluate the products for acceptability based on its color, texture, taste, sponginess, flavour and overall acceptability using nine point hedonic scale (0 = Dislike extremely to 9 = Like extremely).

Consumer evaluation

Results of sensory evaluation showed that cake made with RBOS2 scored the highest (8.13 ± 0.52 out of 9) overall acceptability, which was subsequently selected for the consumer evaluation. A total of 100 subjects were selected randomly for the consumer evaluation, which was conducted at the Department of Foods and Nutrition, PJTSAU and IIRR at Hyderabad by using a consumer acceptability questionnaire consisting of two sections describing the demographic profile of the respondents and the hedonic scoring for the cakes (control—HF cake and experimental—RBOS2 cake). The cake samples were coded with random three-digit numbers and served to the consumers. A 5-point hedonic scale (5 = Like very much to 1 = Dislike very much) was used to determine the consumer acceptance rating for sensory parameters—color, odour, texture, taste and overall acceptability.

Estimation of total fat, fatty acids and trans fatty acids

Total fat was analysed by Gerhardt soxtherm fat analyser by the method described by AOAC (2003.06, 19th Edition). Fatty acids were analysed by AOAC (2001). The isolated fat was trans-esterified using 0.5 M methonolic KOH to form fatty acid methyl esters (FAME). Fatty acids were estimated by GC, 7890B of Agilent Technologies with 7693 Auto sampler, equipped with flame ionization detector and split injector. Injector temperature was at 260°C and samples were injected (1 µl) with split ratio of 10:1 by the auto sampler. Carrier gas (Nitrogen) flow rate was 30 ml/min. Column used was Agilent—DB-FFAP, a nitroterephthalic-acid-modified polyethylene glycol (PEG) of high polarity for the analysis of volatile fatty acids, with a length of 30 m × 250 µm, 0.25 mm diameter, 0.25 µm film thickness. The temperature program was at set with the initial temperature of 100°C, hold time, 5 min, rising at an increasing rate to 240°C at the rate of 4°C/min and held for 5 min. Total run time was 45 min. Nitrogen was used as carrier gas at a column flow rate of 1.0 ml/min. Detector temperature was at 280°C. EZ Total Chrome software was used for running the GC and calculation of fatty acid composition. FID Hydrogen gas flow rate was 30 ml/min. Zero air flow was 300 ml/min and make up flow was 25 ml/min. The fatty acid content was measured based on area normalization.

Standards used were 47885-*U* Supelco® 37 Component FAME Mix, 10 mg/ml in methylene chloride. For individual trans-fatty acids standards, Supelco trans-9-Eliadic methyl ester, 10 mg/ml in heptane, trans-9, 12-Octadecadienoic (linoleliadic) methyl ester and trans-11-Vaccenic methyl ester, were used. After injecting the 37-FAME standard, individual trans-fatty acid methyl ester standards were also injected and the retention times were compared under standard conditions described above to ascertain that the individual standard peaks were coinciding exactly with the peaks in the combined standard. Samples were processed and injected as for standards. Sample fatty acid composition was compared with standard fatty acid composition and percentages calculated by normalization of peak areas.

Microstructure study of cake using scanning electron microscope (SEM) imaging

The control (HF) and most accepted (RBOS2) cake samples were viewed and photographed on a Scanning Electron Microscope (JOEL model JSM 6360LV) operating with magnification from 100 × to 1000 × , to study the porosity and internal appearance of cake which related to expandable (texture and leavening) characteristics of the cake. For microscope study, cake samples were mounted over the stubs with double-sided conductivity tape and applied a thin layer of gold over the samples using an automated sputter coater for about 3 min (Bozzola and Russell 1998).

Results and discussion

Fat is an important ingredient in baking products and it plays many roles in providing desirable textural properties of baking products (Mamat and Hill 2014). The results of physical analysis (moisture and density) of cake had significant differences ($P < 0.01$) between the type of fat used in preparation of cake. Cake moisture was the highest in HF cake (16.04 ± 0.36) and the least in RBOS 1 cake (8.92 ± 0.43). Esteller et al. (2004) reported that, as moisture is transferred from the cake to the atmosphere, the product gets more compact texture which leads to higher hardness and lower cohesiveness. The results of our study were not in consistent with the above finding as the moisture content in RBOS1 cake though was lesser had a good texture compared to HF cake. The density was higher in RBO (0.40 ± 0.01) cake followed by RBOS2 (0.39 ± 0.01) cake. The volume of cake is affected by the gas expansion that occurs during mixing (Gómez et al. 2010) and also due to the kind of fat replacers used (Psimouli and Oreopoulou 2013). RBOS2 could decrease the surface tension of gas/liquid system thereby increasing the foam formulation, resulting in trapped air bubbles in batter, which expanded by heat during baking to provide both framework and structure of the cake.

The results of sensory evaluation of cake made with hydrogenated fat (HF), rice bran oil (RBO), rice bran oil spread1 (RBOS1) and rice bran oil spread2 (RBOS2) variety are summarized in the Table 1. Maillard reaction occurs during baking process by reducing sugars. Low molecular weight fructans are hydrolyzed to fructose during baking process which can create darker color in cake

Table 1 Sensory scores of cakes prepared using HF, RBO, RBOS1 and RBOS2

Sensory parameters	HF	RBO	RBOS1	RBOS2	F value	SE value	CD value
Colour	7.80 ± 0.78	7.87 ± 0.74	7.67 ± 0.82	8.00 ± 0.66	0.96^{Ns}	0.14	0.40
Texture	7.00 ± 0.76^{b}	7.80 ± 1.01^{a}	7.20 ± 0.78^{b}	7.73 ± 0.60^{a}	6.53**	0.15	0.44
Sponginess	7.47 ± 1.06^{ab}	7.67 ± 0.90^{a}	7.20 ± 0.94^{b}	7.80 ± 0.76^{a}	2.15*	0.18	0.51
Taste	7.60 ± 1.12	7.93 ± 0.96	7.53 ± 0.74	8.00 ± 0.66	1.64^{Ns}	0.18	0.52
Flavor	7.40 ± 0.74	7.53 ± 1.13	7.60 ± 0.91	7.67 ± 0.62	0.51^{NS}	0.16	0.46
Overall acceptability	7.73 ± 0.80^{ab}	7.93 ± 0.96^{a}	7.47 ± 0.64^{b}	8.13 ± 0.52^{a}	3.90*	0.14	0.41

crumbs (Wilderjans et al. 2013). However, the results of colour of cake made with HF (7.80 ± 0.78), RBO (7.87 ± 0.74), RBOS1 (7.67 ± 0.82) and RBOS 2 (8.00 ± 0.66) had no significant difference. Similarly there was no significant difference in flavor of the cakes made with HF (7.40 ± 0.74), RBO (7.53 ± 1.13), RBOS1 (7.60 ± 0.91) and RBOS2 (7.67 ± 0.62). The cakes made with HF (7.60 ± 1.12), RBO (7.93 ± 0.96), RBOS1 (7.53 ± 0.74) and RBOS2 (8.00 ± 0.66) did not vary significantly in taste, indicating that the RBOS1 and RBOS2 did not alter the taste of cake during processing as compared to HF or RBO.

The texture of cake made with HF (7.00 ± 0.76) and RBOS1 (7.20 ± 0.78) cake; RBO (7.80 ± 1.01) and RBOS2 (7.73 ± 0.60) cake did not vary significantly. However there was a significant ($P < 0.05$) difference observed in the texture of cake made with HF (7.00 ± 0.76) and RBOS2 (7.73 ± 0.60). Cake made with RBOS2 was rated high on 9 point hedonic scale as compared to RBOS1 cake which was rated as the lowest. Overall acceptability of the cake made with RBOS2 was rated high (8.13 ± 0.52) as compared to other cakes indicating that, RBOS2 can be utilized for cake preparation over other fat sources used in the study. Texture properties of bakery products have been always of great importance since firmness of the cake defines its quality. Important quality parameters of cakes like texture, color, taste, have an important effect on structure and the taste of cakes (Wilderjans et al. 2013). Among all the cakes, RBOS2 cake was rated significantly higher on a nine point hedonic score card, indicating that though the colour, flavor, taste did not differ much among the fat sources used, but texture, sponginess and over all acceptability were superior when made with RBOS2. Components that are mainly used in cake baking process are flour, water, sugar, milk, fat and salt, leavening agent, flavors and additives. The quality and quantity of these components are important and influence the properties of the final product as well as the stability of quality during storage. Wide range of cakes with different properties can be produced due to quality and quantity changes of these ingredients (Matos et al. 2014).

Cake is baked product relished by consumers and available worldwide which is served as dessert in various forms at different occasions (Schirmer et al. 2012). Hence consumer acceptability is an important aspect which decides the consumption of cake. A total of 100 subjects, including 23 males and 77 females were randomly selected for the consumer acceptability study from the age group of 18–60 years based on their interest in participating in the study, using a consumer acceptability questionnaire consisting of two sections describing the demographic profile and hedonic scoring for the cake.

The results of demographic profile of the respondents of consumer evaluation study revealed that 40% of the respondents consume rice bran oil daily. 2% were aware about rice bran oil spread, whereas 40% were unaware about health benefits of rice bran oil spread. Among the respondents, all 100% of respondents had never tasted rice bran oil spread at all. Results from the study indicated that 94% of the respondents were willing to buy rice bran oil spread, whereas 6% were not willing to buy. The reason for 94% of respondent's willingness to buy the rice bran oil spread was due to the health benefits of rice bran oil spread. There are studies which suggest that acceptability for products is related to consumer attitude and knowledge about the health claims of the product (Drake and Gerard 2003; Ramcharitar et al. 2005).

The results of sensory scores of cake from consumer evaluation study is summarized in Table 2. The results indicated that no significant difference was found between the hedonic ratings of the sensory attributes of control (HF) cake and experimental (RBOS2) cake. The cake made with RBOS2 was well accepted by the respondents (n = 100) selected for consumer acceptability study. The sensory properties of the RBOS2 cake did not vary significantly when compared to HF cake. Bakery products constitute one of the most consumed foods in the world. Among them, cakes are popular and are associated in the consumer's

Table 2 Sensory scores of cakes made using HF and RBOS2

Samples	HF cake (n = 100)	RBOS2 cake (n = 100)	F value (n = 100)	SE value
Colour	4.37 ± 0.52	4.48 ± 0.59	1.77^{NS}	0.06
Texture	4.34 ± 1.06	4.17 ± 0.60	1.81^{NS}	0.09
Sponginess	4.58 ± 0.51	4.49 ± 0.84	4.19^{NS}	0.07
Taste	4.23 ± 0.75	4.10 ± 0.81	1.53^{NS}	0.07
Flavor	4.14 ± 0.98	4.07 ± 0.76	0.27^{NS}	0.09
Overall acceptability	4.42 ± 0.60	4.28 ± 0.52	9.04^{NS}	0.06

mind with a delicious sponge product with desired organoleptic characteristics (Garcia et al. 2013).

Figure 1a–f presents the micro structure of control cake prepared with hydrogenated fat and cake prepared with RBOS2 which was most acceptable in the sensory evaluation under Scanning Electron Microscopy with 100 × , 500 × and 1000 × magnifications. The pores within the core varied in diameter between 7.40–18.0 µm and 14.6–59.8 µm at 1000 × magnification in control and RBOS2 cakes respectively. The internal structure and pore structure of RBOS2 cake was finer and smoother than the control cake. The pores within the core varied in diameter between 13.9 and 29.6 µm in control cake and between 16.9 and 58.6 µm in RBOS2 cake at 500 × magnification. Larger amounts of interior heating in baking results in increased moisture vapor generation inside the food which creates high pressure gradient. Higher pressure gradient occurring inside the cakes during heating can cause looser and more porous structures in cakes (Turabi et al. 2010).

It was stated by McClements (2007) that pore diameter range of 100 µm–100 mm represents macro-scale pore structure, which is related to appearance of the samples. In our study, the pore diameter range at 100 × was between 84.9 and 349 µm in the control cake, where as it was between 146 and 440 µm in RBOS2 cake indicating presence of macro pore size in both the cakes. However, the macro pore size of the RBOS2 cake was much better than the control cake as indicated by the results of sensory evaluation as well as SEM imaging, indicating that RBOS2 as an ingredient instead of hydrogenated fat can contribute to better texture and loaf volume in the cake. The micro structure of RBOS2 presents distinct distinguishable open pore structures as a continuous matrix, which is built up by starch and protein. Similar microstructure observation in the gluten-free rice and low-protein starch breads has been reported by Hung et al. (2007).

Fatty acid and trans fat content of cake

Total fat content in the cake samples analyzed was in the order: RBOS1 (17.15 g/100 g) > HF (17.09 g/100 g) > RBO (15.08 g/100 g) > RBOS2 (14.95 g/100 g). The results of fatty acid analysis (chromatograms) of HF cake, RBO cake, RBOS1 and RBOS2 cakes are given in Fig. 2. The saturated, unsaturated and transfatty acid content of HF cake, RBO cake, RBOS1 and RBOS2 are given in Table 3. The SFA content of the cakes ranged from 24.08% in RBO cake to 44.55% in HF cake. The total amount of unsaturated fat in cake samples ranged from 39.99% in HF cake to 72.36% in RBO cake followed by RBOS2 cake (72.35%) and RBOS1 cake (70.64%). Oleic acid (C18:1) was present in range of 39.99 (HF cake) to 42.60% (RBO cake). Linoleic acid (C18:2) was not present in HF cake but was present in RBO (29.29%), RBOS1 (29.18%) and RBOS2 (29.97%) cakes. α linolenic acid (C18:3) was not present in HF cake, but was present in RBO (0.47%), RBOS1 (0.45%) and RBOS2 (0.72%) cakes. The amount of total TFA was 15.46% in HF cake, 3.56% in RBO cake, 4.54% in RBOS1 cake, 3.78% in RBOS2 cake. Total *trans* fat content was higher in HF cake (15.46%) as compared to experimental samples RBO, RBOS1 and RBOS2. Hydrogenated fat which is commonly used for production of various baked products could be harmful due to presence of higher amount of saturated fats as well as trans fats (Mozaffarian and Clarke 2009).

The major *trans* fatty acid observed in all samples was elaidic acid (C18:1 trans-9) and Linolelidic acid (C18:2, trans-6). Elaidic acid was the highest in HF cake (6.64%) and least in RBO cake (2.62%). Linolelidic acid was the highest in HF cake (8.48%) and least in RBOS2 cake (0.91%). The current growing body of evidence from controlled trials and observational studies indicates that TFA consumption like elaidic acid, from partially hydrogenated oils adversely affects multiple cardiovascular risk factors and contributes significantly to increased risk of CHD events (Mozaffarian et al. 2009). Vaccenic acid was detected only in HF cake (0.34%). Vaccenic acid is a TFA which is known to be produced in the rumen of epigastric animals naturally during the partial biohydrogenation of linoleic acid (Lock and Bauman 2004) and it acts as a precursor for the endogenous synthesis of cis9, trans11-conjugated linoleic acid (CLA) via the action of the n9 desaturase enzyme in both humans and animals (Mozaffarian and Willett 2007). The TFA content assumes significance in terms of their

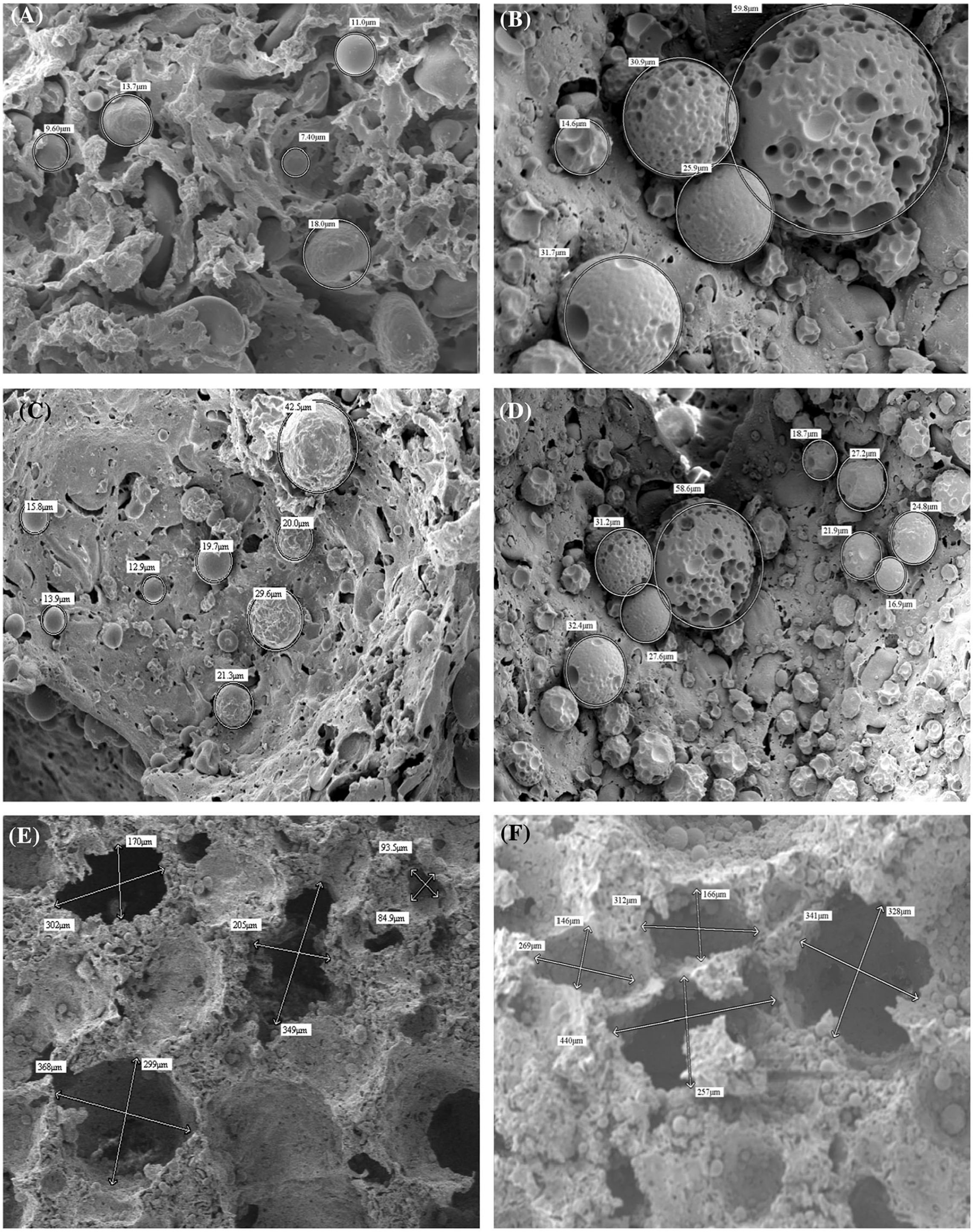

Fig. 1 SEM images of control (HF) cake and RBOS2 cake. **a** SEM image of control (HF) cake measured at 1000×. **b** SEM image of RBOS2 cake measured at 1000×. **c** SEM image of control (HF) cake measured at 500×. **d** SEM image of RBOS2 cake measured at 500×. **e** SEM image of control (HF) cake measured at 100×. **f** SEM image of RBOS2 cake measured at 100×

ill effects on the health of consumers, only if fat content is also high. Hence, consumption of the HF products might prove to be harmful if consumed in large amounts and at higher frequencies as compared to RBOS1 or RBOS2 cakes.

Conclusion

Industrial TFA consumption is believed to increase cardiovascular risk in multiple ways. A variety of alternatives to hydrogenated fats include different combinations of

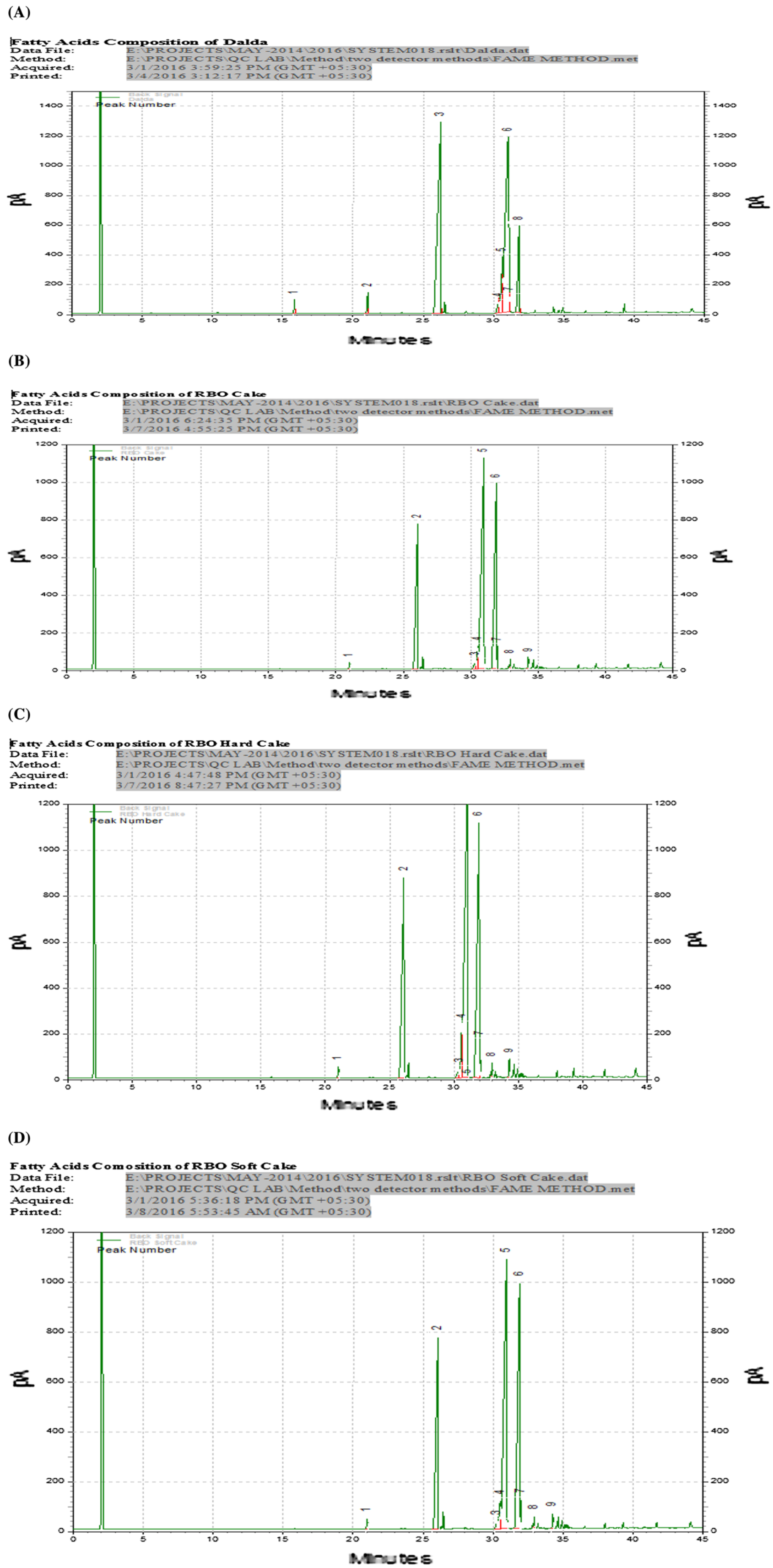

Fig. 2 Chromatograms of control (HF) cake and experimental cakes (RBO, RBOS1 and RBOS2 cakes) **b** Chromatogram of RBO cake **c** Chromatogram of RBOS1 cake **d** Chromatogram of RBOS2 cake

Table 3 Total fat, saturated, unsaturated and trans fatty acid content of cake (%)

Sample	Total fat (g/100 g)	Saturated fatty acids (SFA)						Unsaturated fatty acids (UFA)				Trans fatty acids (TFA)			
		Lauric acid (C12:0)	Myristic acid (C14:0)	Palmitic acid (C16:0)	Stearic acid (C18:0)	Arachidic acid (C20:0)	Total SFA	Oleic acid (C18:1)	Linoleic acid (C18:2)	α-Linolenic acid (C18:3)	Total UFA	Elaidic acid (C18:1,n9 trans)	Linolelidic acid (18:2,n6Trans)	Vaccenic acid (C18:1,n11T)	Total TFA (%)
HF cake	17.09	0.71	1.19	41.64	1.01	–	44.55	39.99	–	–	39.99	6.64	8.48	0.34	15.46
RBO cake	15.08	–	0.39	22.07	0.89	0.73	24.08	42.60	29.29	0.47	72.36	2.62	0.94	–	3.56
RBOS1 cake	17.15	–	0.43	22.89	0.72	0.78	24.82	41.01	29.18	0.45	70.64	3.59	0.95	–	4.54
RBOS2 cake	14.95	–	0.43	22.57	0.44	0.72	24.16	41.66	29.97	0.72	72.35	2.87	0.91	–	3.78

SFA, PUFA and MUFA. RBOS2 is a plant source oil derived from a mix of rice bran oil and edible hydrocolloids, which is healthier compared to hydrogenated fats or other fats as seen from the results of the study. The results indicate that RBOS2 can be used as a potential fat for preparation and production of baked products like cakes with desired quality characteristics such as moistness, sponginess, flavor, texture and overall acceptability. The trans fats were very less in RBOS2 product as compared to other sources of fats used in the study. As there is considerable interest in zero and low-trans fats among food manufacturers, current use of such products is increasing. Hence, RBOS2 can be promoted as healthy fat for production of baked products. Food manufacturers should use alternative fats such as RBOS2 in production and preparation of baked products as baked products made with RBOS2 can limit trans fat consumption.

Compliance with ethical standards

Conflict of interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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