Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.3083

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (6):** 346-351 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Fatty Acid Profile, Proximate Composition and Consumer Acceptability of Cream Based Fat Spread Incorporated with Olive Oil and Rice Bran Oil

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Received: 1.06.2017 | Revised: 3.07.2017 | Accepted: 7.07.2017

ABSTRACT

Cream based spread is a fat spread with cream as major source of fat. Along with cream, vegetable oils have been used to enhance the spreadability and improve the fatty acid profile of the spread. Fatty acid profile analysis of the spread revealed that incorporation of olive oil and rice bran oil in the spread along with milk fat improved the fatty acid profile of the product with approximately 20 per cent decrease in the saturated fatty acid, about 14 and 10 per cent increase in MUFAs and PUFAs respectively when compared with milk fat. The cost of production of the spread was calculated to be Rs 19.81/100 g spread. The pilot scale consumer acceptability study showed that the product was well accepted.

Key words: *spread, fatty acid profile, Consumer acceptability, Proximate composition*

INTRODUCTION

The demand for butter as table spread is declining due to its high cost, poor spreadability, high content of saturated fatty acids and cholesterol. This has led to development of other spreads which include a variety of spreadable semi-solid products such as fat spread, cheese spread, peanut butter etc. Apart from fat spreads fruit based spreads such as jams, jellies, marmalades etc. are also gaining popularity. These products have good organoleptic quality but lacks in adequate nutrition. They contain mainlycarbohydrate and fruit pulp but lacks in protein, fat and minerals[15]. Present consumer demand therefore, is for table spread that is nutritionally balanced, possesses mild flavour, suits Indian palate and food habits and at the same time is economical. Considerable efforts have been made in India for development of fat spreads of dairy and non-dairy ingredients such as vegetable fat and skim milk powder and cheese[10,11], *paneer* and *Chhana* based spreads[12], cheese and buttermilk, cheese and *chakka* based spreads[7].Due to the advantages of providing a rich mouthfeel and a characteristic flavour along with the upcoming concept of product diversification, cream has been exploited for the development of fat spread[2].

Cite this article: Bhardwaj, R., Balasubramanyam, B.V. and Mishra, D., Fatty Acid Profile, Proximate Composition and Consumer Acceptability of Cream Based Fat Spread Incorporated with Olive Oil and Rice Bran Oil, *Int. J. Pure App. Biosci.* **5(6):** 346-351 (2017). doi: http://dx.doi.org/10.18782/2320-7051.3083

Being an animal fat, there are certain constrains associated with use of cream as a source of fat in the fat spreads, *viz*., poor spreadability at refrigeration temperature due to high amount of saturated fatty acids present and high cost. Attempts have been made in the direction of composition modification for production of spread. One of such innovations is partial substitution of cream by vegetable oil/s to improve its spreadability at low temperature and decrease the amount of saturated fat in the product[6]. There is increasing evidence of the health benefits of olive oil and rice bran oil consumption in the diet. Blending of rice bran oil and olive oil results in a stable blend in terms of chemical parameters *viz*., free fatty acids, peroxide value and TBA value[5]. There is a strong inverse association between olive oil consumption and the risk of a first non-fatal myocardial infaraction[4]. A rice bran oil rich diet reduces serum total cholesterol (25%) and LDL (Low Density Lipoprotein) cholesterol (30%)[16]. The γ-oryzanol in rice bran oil helps to decrease cholesterol level[14]. Olive oil and rice bran oil can help in increasing the MUFAs and PUFAs in the spread thus improving the fatty acid profile as well as spreadability of the product at refrigeration temperature.

Considering the popularity of fat spreads, the project was taken up to develop a low fat cream based spread by partial replacement of cream with olive oil and rice bran oil to study the fatty acid profile, proximate composition and consumer acceptability of the developed product.

MATERIALS AND METHODS

Cream and raw skim milk were obtained from the Experimental Dairy of the Southern Regional Station of ICAR- National Dairy Research Institute, Bengaluru. The average fat content of the cream was 61.5 percent which was standardized to 50 percent fat using skim milk before it was used in the experiments. Olive oil of Siega brand was purchased from Reliance Market, Bengaluru, India. Rice bran oil of Fortune brand was procured from Star Bazar, Bengaluru, India. Spray dried skim milk powder of Nandini brand (Karnataka Milk Federation, Bengaluru) was obtained from Nandini Milk Parlour and used in the experimental trials. Table salt of Tata brand was procured from local market. Xanthan gum supplied by Sisco Research Laboratories Pvt. Ltd. (SRL), Mumbai, India, was used as stabilizer.Analytical grade chemicals from reputed Pharma Companies were used for chemical analysis. Fatty acids standard was purchased from Supelco Scientific with total 37 fatty acids present in it by the name SUPELCO-37. Gas chromatographic system Model 7890A GC (Agilent) with Flame Ionization Detector (FID) and DB-WAX, 30m×0.25mm column was used for fatty acid profile analysis of the spread. Moisture content of spread was determined by gravimetric method[8]. Fat in spread was determined by Mojonnier – gravimetric method as per the method[8]. The percent protein in spread was determined by standard Micro Kjeldahl method described in AOAC[1]. Ash content in spread was determined as per the method described in AOAC[1]. Total carbohydrates in the product were calculated by difference as described: % Carbohydrate = 100- (% Moisture+% Fat+%Protein+%Ash). Fatty acid profile of the spread was analysed by the method of O'fallon[9] (2007).

RESULTS AND DISCUSSION

The optimized cream based spread constituted 20.65% milk fat, 14.35% olive oil, 5% RBO, 10% SMP, 1.25% salt and 0.2% xanthan gum

Proximate composition of the optimized cream based fat spread

The proximate physic-chemical analysis of the cream based spread, prepared by using optimized formulation, was carried out to measure the moisture, fat, total protein, ash and total carbohydrate content of the products (Table 1). The moisture content of the sample

was found 48.32 per cent. Total fat content in the spread samples was kept fixed at 40 per cent but when analyzed it was found that the fat content in the spread sample was 39.81 per cent. It may either be due to slight variation during weighing of the ingredients for spread preparation or due to some fat loss during analysis. Total protein in the sample was 4.31per cent. Total ash in the spread sample was 2.19. Carbohydrates in the sample were measured by subtracting the four parameters from 100 and were obtained 5.36 per cent.The optimized spread was observed to have 0.134 per cent FFA. No peroxides were observed in fresh spread. pH value of the sample was recorded to be 5.3. the phenolic compounds were absent in the optimized control spread sample indicating that the ingredients used for spread preparation did not contribute to TPC in the spread. The antioxidant activity was measured to be 12.23 %RSA in the control spread which might be contributed by olive oil and rice bran oil.

Fatty acid profile of the developed spread

Keeping in mind the health concerns of today's aware consumers, the low fat cream based spread was developed by partially replacing the milk fat (cream) with olive oil and rice bran oil to reduce the saturated fatty acids in the product, maintain the MUFAs and enhance the PUFAs in the finished product. To analyze the fatty acid profile of the developed spread, the fatty acid profile analysis was carried out using GC and the findings are presented in Table 2.The results clearly show that incorporation of the vegetable oils resulted in roughly 20 per cent decrease in the saturated fatty acid content in the total fat when compared with the milk fat. The MUFAs and PUFAs were found to increase by about 14 and 10 per cent respectively. The n-6 fatty acids were 8.5 per cent higher in the cream based fat spread in comparison to milk fat while the n-3 fatty acids were found negligible in the milk fat which was observed 0.64g/100 g fat per cent in the finished spread. Seckin *et al*[13]., also carried out fatty acid composition analysis of some Turkish dairy products.

Estimation of cost of production of cream based fat spread

Any newly developed product needs to be economically viable for its adoption on commercial scale. Cream based spread developed during the present investigation can be taken up either by setting up a new production unit or as product diversification in dairy plant homogenizing milk for standardization. In order to sustain in commercially competitive market, a newly developed product needs to be attractive both in terms of palate properties and price. The costing presented in Table 3 shows that the cost of the developed spread with improved fatty acid profile cost Rs 20/100g of spread.The cost worked out to be less than the cost of butter with better functional attributes such as good spreadability, healthier fatty acid profile and natural preservatives.

Consumer acceptability study of cream based fat spread

The optimized spread containing pomegranate peel extract was prepared, filled in 100g cups, stored at refrigeration temperature (5±2˚C) and then next day served to potential consumers for consumer acceptability study. A performa was given to the consumers which described the product and its intended use along with a questionnaire asking the likings of the cream based spread incorporated with pomegranate peel extract that was to be filled by them. The findings are presented in figure 1(a-d). The results indicate that the developed product was highly accepted among the consumers. Bower *et al*[3]., also developed spread with proven health benefits and conducted consumer acceptability study and found that gender, age, health concern and nutritional knowledge had mostly interactive effects on purchase intent, with females, older subjects and those with high health concern having higher purchase intent for the proven health benefit label.

Table 1: Proximate composition of the optimized cream based spread

Parameter	(%)
Moisture (%)	48.32±0.10
Fat(%)	39.81±0.11
Protein (%)	4.31±0.04
Ash (%)	2.19±0.01
Carbohydrates (%)	5.36±0.25
%FFA	0.134
PV(meq KOH/1000 fat)	-
pH	5.3
Total Phenols (mg GAE/g)	-
Antioxidant activity (%RSA)	12.23

Table 2: Fatty acid profile of the optimized spread and milk fat

Fatty acids (%)	Milk fat (%)	Optimized spread (g/100g of fat)
C4	3.3	1.68
C6	1.6	0.81
C8	1.3	0.66
C10	3.0	1.53
C12	3.1	1.58
C14	9.5	4.89
C16	26.5	22.03
C18	14.6	8.54
C20	-	0.16
C22	-	0.05
C16:1	2.3	1.85
C18:1	29.8	44.70
C20:1	-	0.25
C18:2(n-6)	2.5	11.39.
C18:3 (n-3)	-	0.64
SFAs	62.9	41.93
MUFAs	32.1	46.8
PUFAs	2.5	12.03
n-6	2.5	11.39
n-3	-	0.64

Table 3: Costing of optimized cream based fat spread

Ingredient	Quantity/100 Kg	Cost (for 100 kg spread) (Rs.)
Cream (50% fat)	41.300 Kg @ Rs400/Kg fat	8260
Olive oil	14.350 Kg @ Rs 300/Kg	4305
Rice Bran Oil	5.00 Kg @ Rs 92/Kg	460
Skim Milk Powder	10.00 Kg @ Rs 235/Kg	2350
Salt	1.25 Kg @ Rs 20/Kg	25
Xanthan gum	0.20 Kg @ Rs 2625/Kg	625
Total		16025
Processing cost @ 15% of ingredient cost		2405
Total cost for 100Kg spread		18430
Packing cost (Rs 15/Kg)		1500
Cost per of 100g spread		19.93 Rounded off to 20.00

Figure 1a: Preference for the spread

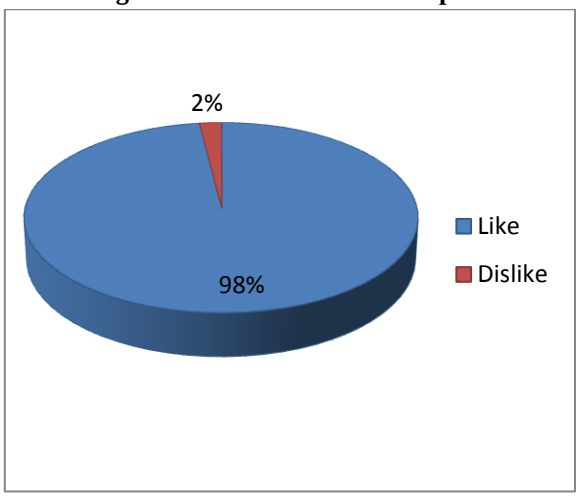


Figure 1b: Degree of liking

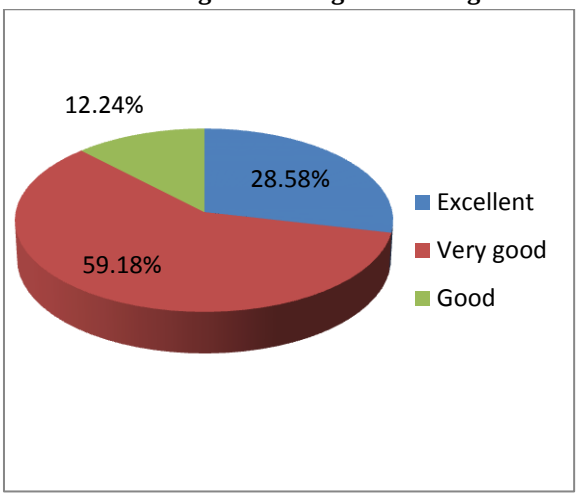


Fig.1c: Spreadability of the product

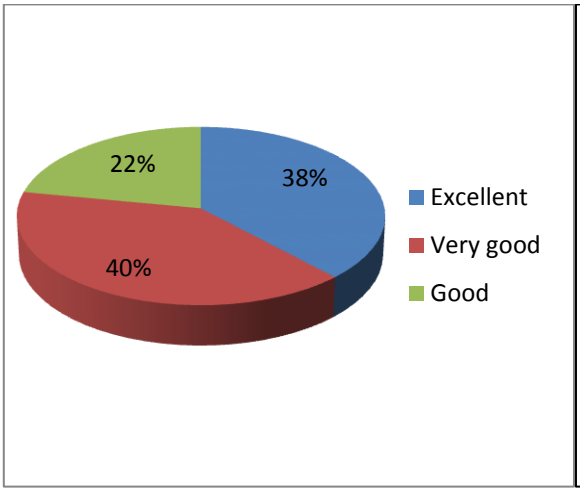
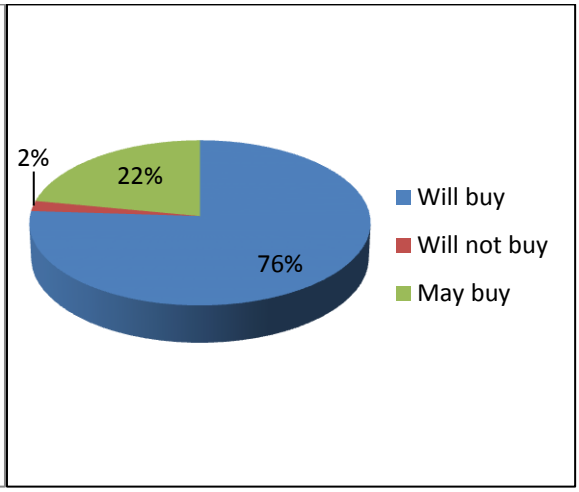


Fig. 1d: Will the consumer buy the spread



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