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Extension of Cookies Shelf Life by Using Rice Bran Oil

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ABSTRACT

Rice bran oil (RBO) was applied into baked products such as cookies at various levels i.e. 0, 25, 50, 75 and 100% by gradually replacing normal shortening to check its effectiveness in extending the shelf life of product due to its natural antioxidants by using thiobarbituric acid number (TBA number) test with the help of spectrophotometer. Five treatments of RBO and normal shortening (NS) (T1= 100 NS + 0% RBO, T2 = 75% NS + 25% RBO, T3 = 50% NS + 50% RBO, T4 = 25% NS + 75% RBO, and T5 = 0% NS + 100% RBO) were used to prepare cookies and 45 days storage study was conducted. TBA number was calculated after each storage interval. Both treatments and storage showed significant effect on TBA number of cookies. Treatment T_5 (100% RBO) exhibited TBA number 0.03, while T_1 (100% NS) showed 0.05 at 0 day. There was an increase in TBA number during storage of 45 days. Treatment T_5 (100% RBO) showed the minimum increase (0.05) followed by T_4 (0.06) and T_3 (0.08). It is evident from the results that by increasing the percentage of rice bran oil (RBO), the TBA number decreases and the on set of rancidity is delayed.

Key Words: Rice bran oil; Cookies; Storage; Sensory attributes; TBA number

INTRODUCTION

Rice bran oil (RBO) is a miracle product obtained from the outer brown layer of rice. It contains 15 to 20% oil (Marshall & Wadsworth, 1994). RBO is considered as one of the highest quality vegetable oil in terms of its cooking quality, shelf life, fatty acid composition, nutritive value, flavor, taste and cooking economy (Sayre & Saunders, 1990; Rogers *et al.*, 1993; Sharma, 2002). Kirk and Sawyer (1991) investigated that refined oil in good condition has TBA value (an indicator used for the oxidative rancidity level) of 0.02-0.08 where as crude oil or badly stored oils have 0.1-0.2. Kim *et al.* (2000) added 2% RBO to restructured beef roasts and concluded that beef roasts containing RBO had higher oxidative stability ($P<0.05$) during storage at 4^{o}C than did beef roasts without additives (control).

The baking is a developing industry in Pakistan, 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 and cookies, fat is one of the major ingredients. The functional and nutritional properties of RBO has appeared well suited to its usage as shortening in baked goods like cookies. The present study was carried out to evaluate the suitability of RBO in baked products like cookies.

MATERIALS AND METHODS

Raw material including wheat flour, sugar, shortening, eggs and baking powder were procured from local market. Rice bran oil was taken from Institute of Food Science and Technology, University of Agriculture, Faisalabad. Cookies were prepared with some modifications according to the method given in AACC (2000). In the formation of cookies, shortening was used according to ratios as mentioned in Table I. The cookies were stored in polyethylene bags and placed in laboratory shelf at ambient temperature. The cookies were evaluated by a panel of judges from the staff and postgraduate students for taste, color, flavor, texture, crispness and overall acceptability at 0, 15, 30 and 45 days interval of storage according to the procedure described by Meilgaard *et al.* (1991). To assess the development of rancidity in the product, TBA no. of cookies stored at stated intervals was determined fortnightly as described by Kirk and Sawyer (1991). The data obtained for each parameter was subjected to statistical analysis to determine the level of significance according to the methods described by Steel *et al.* (1997).

Table I. Different treatments used in study

Treatments	Normal Shortening (%)	RBO (%)
T_1	100	-
T_2	75	25
T_3	50	50
T_4	25	75
T_5	-	100

RESULTS AND DISCUSSION

Sensory evaluation of cookies. Analysis of variance revealed that cookies differed significantly regarding various sensory attributes like color, taste, flavor, crispness, texture and overall acceptability, due to treatments and storage as shown in Table II and III. Treatments had significant effect on color of cookies (Table. III). T_3 got maximum score (7.77) while T_5 obtained the lowest score (6.32). T_3 was preferred by the

judges because it gave the desired color to the cookies which distinguished it from the others. Judges placed T_3 (7.30) at the first position and T_5 (6.25) at the last position, when averaged over all means for flavor of cookies. T_4 (7.05) was also favored by the judges. Taste of cookies showed highly significant differences among the treatments. Judges ranked T_3 (7.77) at the first position and T_5 (6.20) at the last position. The quality score in response to crispness of the cookies depicted that T_3 got maximum score (7.20) while T_5 obtained the lowest score (6.25). The results concerning with the score for texture of cookies disclosed a highly significant difference among treatments. T_3 got the maximum score 7.15 while T_5 was at the bottom obtaining 6.47 score. Overall acceptability was determined based on quality scores obtained from the evaluation of color, taste, flavor, texture and crispness of the cookies. T_3 got the maximum score 7.44 while T_5 was at the bottom obtaining 6.33 score.

Storage had significant effect on color of cookies (Table IV). The maximum score 7.30 was obtained at 0 day by all the cookies which was significantly decreased as the storage increased. The minimum score of 6.54 was obtained at 45 days storage. The deterioration in color of biscuits might be due to the absorption of moisture from the atmosphere and oxidation of fats. These results are in close agreement with the findings of Ahmad (1993), Pasha (2001) and Iftikhar (2002). Flavor of cookies decreased from 6.50 -7.32 during 0- 45 days storage. The loss in flavor might be attributed to absorption of water that resulted in fat oxidation. As regarding taste of cookies, maximum score was obtained by fresh cookies (0 day) which was gradually decreased with storage days. The range between 0 day and 45 days was 6.62 - 7.36. Elahi (1997) also found a decrease in mean score for taste from 6.62-5.81 after 90 days storage in biscuits prepared from composite flour. The quality score in response to crispness of the cookies depicted that maximum score 7.08 was obtained all the fresh cookies (0 day) which was decreased significantly as the storage increased. The minimum score of 6.28 was obtained at 45 days. The range between 0 day and 45 days was 6.28 -7.08. Wade (1988) stated that the biscuits last their crispness during storage due to moisture absorption. Texture of cookies gradually decreased from 6.26-7.08 during 0-45 days storage. As a whole, the maximum score for overall acceptability was obtained by fresh cookies (0 day) which gradually decreased with storage days. The range between 0 day and 45 days was 6.45-7.24. In earlier studies, a gradual decrease in overall acceptability of biscuits during storage was reported by Elahi (1997) who attributed it to moisture absorption, increase in peroxide value and free fatty acid contents in biscuits.

Thiobarbituric acid (TBA) number. The oxidative rancidity level is an important indicator for the quality of stored food. Furia (1968) reported a commercial test

Table II. Analysis of variance for various sensory attributes and TBA number of cookies

Source	df	Color	Taste	Flavor	Crispness	Texture	Overall acceptability	TBA no.
Storage (S)	3	32.33**	37.57**	23.73**	12.40**	88.32**	46.13**	29.11**
Treatment (T)	4	72.44**	85.06**	26.33**	9.00**	46.93**	51.76**	24.30**
S x T	12	1.92 ^{NS}	1.22 ^{NS}	1.91 ^{NS}	1.73 ^{NS}	1.47 ^{NS}	0.69 ^{NS}	1.61 ^{NS}
Error	40							
Total	59							

Table III. Effect of different treatments on various sensory attributes and TBA number of cookies

Treatments	Color	Taste	Flavor	Crispness	Texture	Overall acceptability	TBA no.
T_1	6.80 c	7.10 b	6.95 b	6.50 b	6.47 c	6.76 c	0.08 a
T_2	6.40 d	6.82 c	6.55 c	6.40 b	6.55 c	6.55 d	0.06 b
T_3	7.77 a	7.77 a	7.30 a	7.20 a	7.15 a	7.44 a	0.05 c
T_4	7.20 b	7.20 b	7.05 b	6.95 a	6.92 b	7.04 b	0.04 cd
T_5	6.32 d	6.20 d	6.25 d	6.25 b	6.47 c	6.33 e	0.03 d

T1= 100 NS + 0% RBO, T2 = 75% NS + 25% RBO, T3 = 50% NS + 50% RBO, T4 = 25% NS + 75% RBO, and T5 = 0% NS + 100% RBO

Table IV. Effect of storage (days) on various sensory attributes and TBA number of cookies

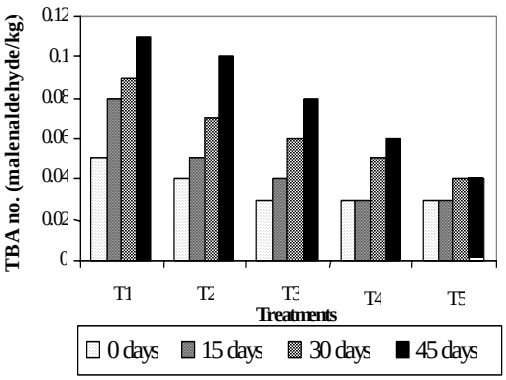
Days	Color	Taste	Flavor	Crispness	Texture	Overall acceptability	TBA no.
0	7.30 a	7.36 a	7.32 a	7.08 a	7.08 a	7.24 a	0.04 d
15	7.10 b	7.24 a	6.80 b	6.96 a	6.96 b	7.01 b	0.05 c
30	6.66 c	6.86 b	6.66 c	6.32 b	6.56 c	6.59 c	0.06 b
45	6.54 c	6.62 c	6.50 c	6.28 b	6.26 d	6.45 c	0.08 a

T1= 100 NS + 0% RBO, T2 = 75% NS + 25% RBO, T3 = 50% NS + 50% RBO, T4 = 25% NS + 75% RBO, and T5 = 0% NS + 100% RBO

based on the reaction of 2-thiobarbituric acid with the oxidation products of fats and oils to form a red color for the determination of oxidative rancidity level. In another test for this purpose, Edward (1985) used thiobarbituric acid combined with glacial acetic acid to develop a color in extract of meat and meat products that will establish thiobarbituric acid number (TBA number), defined as melonaldehyde, which could determine the oxidative rancidity level.

To assess the development of rancidity in the product, the thiobarbituric acid value (TBA no.) was calculated after each storage interval. Analysis of variance (Table II) showed that both treatments and storage have significant effect on TBA no. of cookies. Average TBA values were 0.08, 0.06, 0.05, 0.04 and 0.03 for T_1, T_2, T_3, T_4 and T_5, respectively (Table III). Treatment T_5 exhibited TBA no. 0.03, while T_1 showed 0.05 at 0 day. There was an increase in TBA no. during storage (Table IV). T_5 showed the minimum increase (0.05) followed by T_4 (0.06) and T_3 (0.08). It is evident from the results that by increasing the percentage of rice bran oil (RBO), the TBA number decreases and the on set of rancidity is delayed as shown in Fig 1. It is certainly due to the tocopherols, tocotrienols, and oryzanols in RBO that act as natural antioxidants (Lloyd *et al.,* 2000). Rogers *et al.* (1993) also reported the levels of these nutritionally significant components (tocopherols, tocotrienols and oryzanols) in rice bran oil. RBO based products have extended shelf life since RBO is extremely stable against the onset of rancidity and oxidative deterioration. During storage, there was increase in TBA value but the treatment T_1 (without RBO) showed maximum increase. Treatments containing RBO also show some increase in TBA value but it was within limits.

Fig. 1. TBA numbers of cookies



CONCLUSION

It is evident from the result that by increasing the percentage of rice bran oil (RBO), the TBA number decreases and the on set of rancidity is delayed. Moreover the present study suggests that T_3 (50%RBO + 50%NS) can produce superior quality cookies to prove effectiveness of RBO as bakery shortening.

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