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Short Communication

Enhancing Shelf Life of Vegetable Oils Blend by Using *Moringa oleifera* Leaf Extract as Antioxidant

Muhammad Nadeem[a]*, Ansar Ullah[a], Muhammad Idnan[b] and Muhammad Ali[a]
[a]Department of Dairy Technology, University of Veterinary and Animal Sciences, Lahore, Pakistan
[b]Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore, Pakistan

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Abstract. The antioxidant activity of ethanolic *Moringa oleifera* leaf extract for oxidative stabilisation of canola, sunflower and soybean oils was investigated at ambient temperature. The blend was prepared by mixing canola, sunflower and soybean oils in equal proportions. Ethanolic *M. oleifera* leaf extract was incorporated into vegetable oils blend at three different concentrations; 300, 600 and 900 ppm (T_1, T_2 and T_3), compared with a control and the sample added with 100 ppm tertiary butylated hydroxyl quinine (TBHQ) was used as a positive control. Filled in one litre transparent PET bottles, kept at room temperature (35-40 °C) for 3 months and sampled at 0 and 90 days for the assessment of oxidative stability. Peroxide value of three months stored blank, T_3 and TBHQ supplemented samples were 2.25, 0.84 and 0.78 (meqO_2/kg). Induction period of blank, T_3 and TBHQ supplemented vegetable oils blend was 3.46, 7.95 and 8.57 h. Peroxide value of blank, T_3 and TBHQ supplemented vegetable oils blend, after 5 days at 63 °C, was 7.55, 2.81 and 2.59 (meqO_2/kg).

Keywords: *Moringa oleifera*, leaf extract, vegetable oils blend, oxidative stability

Blended oils are naturally characterised with higher proportions of unsaturated fatty acids and susceptible to free radical mechanism. Thermal processing of edible oils almost completely eliminates the natural antioxidants (Fereidoon, 2005). To enhance the shelf life of vegetable oils, most of the edible oil producers are using synthetic antioxidants that cause harmful effects on human health. Tertiary butylated hydroxyl quinine (TBHQ) is regarded as the best antioxidant for the inhibition of oxidative breakdown in vegetable oils. Antioxidant potential of *M. oleifera* leaf extract for the stabilisation of olein based butter has been studied earlier (Nadeem *et al*., 2014). However, the antioxidant potential of *M. oleifera* leaf extract for the stabilisation of vegetable oils blend with high degree of unsaturation at ambient temperature has not been studied so far. Therefore, antioxidant activity of *M. oleifera* leaf extract was studied for the long term preservation of canola, sunflower and soybean oils blend on the basis of some chemical characteristics.

Refined, bleached and deodorised canola, sunflower and soybean oils without any additives were obtained from a reputed edible oil processing company. TBHQ was obtained from Rhodia Pakistan Ltd. *M. oleifera* leaves were collected from a village of district Muzzafar Garrh. The chemicals were HPLC grade and purchased from Sigma Aldrich, USA.

*Author for correspondence; E-mail: nadeem1220@gmail.com

Ethanolic *M. oleifera* leaf extract was prepared according to the method of Anwar *et al*. (2007). Canola, sunflower and soybean oils were blended in equal concentration (33.33%). *M. oleifera* leaf extract was incorporated into vegetable oils blend at three different concentrations; 300, 600 and 900 ppm (T_1, T_2 and T_3), compared with a control (blank; with no addition of extract) and the sample added with 100 ppm TBHQ was used as a positive control. Filled in one litre transparent PET bottles were kept at room temperature (35-40 °C) for 3 months. Sampling frequencies for the chemical analysis were 0 and 90 days of storage period.

Total phenolic content of *M. oleifera* leaf extract was determined in terms of gallic acid by following the method of Anwar *et al*. (2007). Schaal oven test (63 °C for 5 days), peroxide (Cd 8-53) and anisidine (Cd 18-90) values were determined according to the standard methods of AOCS (1995). Conjugated dienes and trienes were determined according to the standard methods of IUPAC (1987). Determination frequencies for peroxide value, anisidine value, conjugated dienes and conjugated trienes were 0 and 90 days. Induction period was determined by oxidising the 2.5 g samples in the reaction vessels by steady stream of oxygen at 120 °C by using Metrohm Rancimat Model-679 (Metrohm, 1993).

Statistical analysis. Each sample was analysed thrice and each treatment was replicated three times, one way

and two way analysis of variance techniques were used to find out the effect of storage and treatments (Steel *et al*., 1997). The significant variation ($P<0.05$) among the treatments was made by using Duncan's Multiple Range Test (DMR).

Total phenolic content of *M. oleifera* leaf extract was 6.9±0.14% gallic acid on dry basis; almost similar to the earlier findings (Nadeem *et al*., 2013a; Anwar *et al*., 2007). Peroxide value slowly and steadily increased during the storage period of 90 days. The rise in peroxide value was dependent upon the presence and concentration of *M. oleifera* leaf extract. The inhibition of lipid peroxidation at all the determination frequencies was in the order of $T_3 > T_2 > T_1 >$ blank (Table 1). The antioxidant activity of T_3 and 100 ppm TBHQ were at par with each other. The inhibition of peroxides and concentration of *M. oleifera* leaf extract were strongly correlated (Fig. 1, $R^2=0.9844$). The strong inhibition of autoxidation process can be attributed to the higher extents of wide range of phenolic compounds in leaves of *M. oleifera*. Supplementation of sunflower oil and butter oil with *M. oleifera* leaf extract strongly inhibited the autoxidation (Nadeem *et al*., 2013a; Anwar *et al*., 2007). Anisidine value indicates the secondary stages of autoxidation, which are characterised by the formation of aldehydes, ketonses, alcohols and odoriferous compounds (Table 1). Formation of secondary oxidation products were considerably inhibited by the addition of *M. olefiera* leaf extract, even then the storage temperature and concentration of unsaturated fatty acids were on higher side. The recommended temperature for the storage of butter fat is -18 °C, supplementation of butter with *M. oleifera* leaf extract enabled the storage of butter at refrigeration temperature (Nadeem *et al*., 2013b). Oxidation products in the form of conjugated dienes and trienes went increasing during 3 months storage period at varying rate, the yield of oxidation products in three months stored vegetable oils blend was in the order of $T_3 > T_2 > T_1 >$ blank. Supplementation of canola oil with wheat bran extract efficiently inhibited the generation of oxidation products (Chatha *et al*., 2011). Induction period and Schaal oven test were used to assess the antioxidant potential of antioxidants. Induction period of blank, T_3 and TBHQ supplemented vegetable oils blend was 3.46, 7.95 and 8.57 h. Peroxide value of blank, T_3 and TBHQ supplemented vegetable oils blend, after 5 days at 63 °C, was 7.55, 2.81 and 2.59 ($M_{eq}O_2$/kg) (Fig. 2-3). The strong antioxidant activity of sesame cake extract for the stabilisation of olein based butter has been reported in the literature (Nadeem *et al*., 2014; 2013a). *M. oleifera* leaf extract therefore, can be used for the long term storage of vegetable oils blend at ambient temperature.

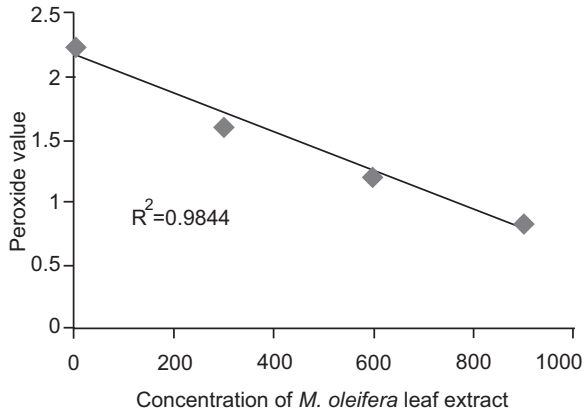

Fig. 1. Correlation between dose of extract and induction period.

Table 1. Effect of *Moringa oleifera* leaf extract on storage stability of vegetable oils blend

Parameters	Storage days	TBHQ	T_1	T_2	T_3	Blank
Peroxide value ($M_{eq}O_2$/kg)	0	0.25±0.02a	0.25±0.02a	0.25±0.02a	0.25±0.02a	0.25±0.02a
	90	0.78±0.04d	1.62±0.11b	1.24±0.05c	0.84±0.08d	2.25±0.06a
Anisidine value	0	4.59±0.19a	4.59±0.19a	4.59±0.19a	4.59±0.19a	4.59±0.19a
	90	8.89±0.25d	16.97±0.33b	11.79±0.18c	9.13±0.42d	24.37±0.91a
Conjugated dienes	0	0.16±0.01a	0.16±0.01a	0.16±0.01a	0.16±0.01a	0.16±0.01a
	90	0.74±0.12d	1.85±0.22b	1.14±0.05c	0.92±0.08d	2.58±0.11a
Conjugated trienes	0	0.05±0.01a	0.05±0.01a	0.05±0.01a	0.05±0.01a	0.05±0.01a
	90	0.35±0.04a	0.82±0.06b	0.59±0.04c	0.44±0.04a	1.29±0.14a

Values are mean ± SD, n = 3. Values followed by the same letter in rows are not significantly different ($p<0.05$).

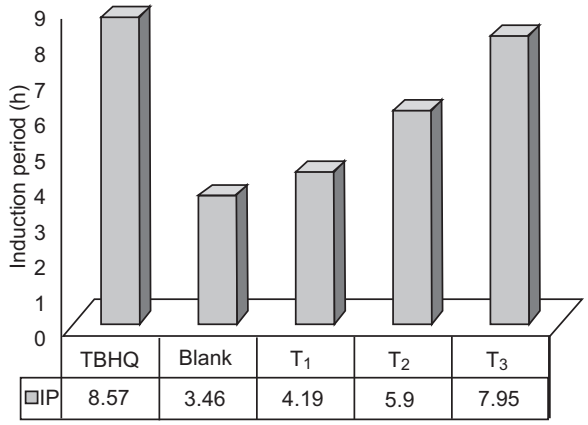

Fig. 2. Induction period.

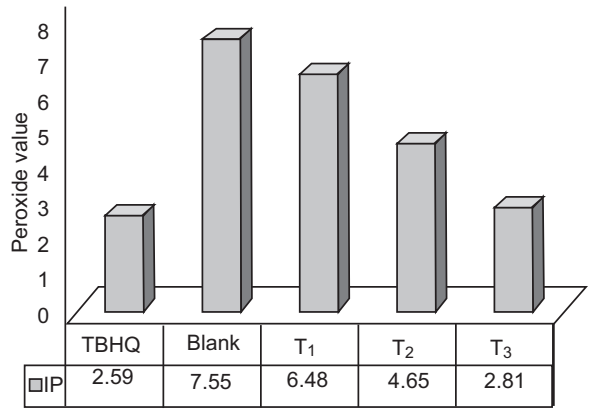

Fig. 3. Peroxide value in Schaal oven test ($M_{eq}O_2$/kg).

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