EVALUATION OF FATTY ACID COMPOSITION AND OXIDATIVE STABILITY OF BLENDED RICE BRAN AND OLIVE OIL

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ABSTRACT

The purpose of the present study was to develop a healthier and stable blend of rice bran oil and olive oil. Therefore, rice bran oil was blended with olive oil in two ratios i.e. 80:20 and 70:30. These blends were analysed for fatty acid composition, physiochemical properties, oxidative stability, and antioxidant activity. Consequently, RBO+OO (70:30) contained the highest amount of oleic acid (47.6 %). In terms of physicochemical properties, RBO+OO (70:30) showed appropriate smoke point (200°C) and frying temperature (175°C), and had low acid value (0.19 mg KOH/g) as well as low percentage of free fatty acids (0.09%). In terms of oxidative stability, RBO+OO (70:30) showed least percent increase (30.3 %) in peroxide formation after 28 days of incubation period. This blend also contained the highest content of total natural antioxidants (2525.0 mg/kg) except RBO (2968.3 mg/kg) and scavenged the free radicals to the greatest extent (67.7 %).

Key words: Antioxidant activity, Fatty acid composition, Olive oil, Oxidative stability, Physiochemical properties, Rice bran oil.

INTRODUCTION

Edible vegetable oils have gained immense attention due to their palatability in the food system. Lipid oxidation has been recognised as the major problem affecting edible oils, as it is the cause of important deteriorative changes in their chemical, sensory and nutritional properties (Velasco and Dobarganes, 2002). The fatty acid composition of various vegetable oils is important in determining the oxidative stability of the oil. Research studies have found that rate of oxidation of vegetable oils rich in polyunsaturated fatty acids (PUFA) is very high as compared to those with high monounsaturated fatty acids (MUFA) and saturated fatty acids (SFA) (Hooper, et. al. 2006). To improve the oxidative stability of vegetable oils rich in polyunsaturated fatty acids, the most recent approach has been developed to increase oleic acid content of vegetable oil by means of direct blending of oils, genetic modifications and compositional changes via chemical means (Aluyor and Jesu, 2008).

Blending of vegetable oils and fats has emerged as an economical way of modifying the fatty acid composition, physicochemical characteristics of vegetable oils and fats besides enhancement in oxidative stability (Abdel-Razek, et. al. 2011; Yanishlieva and Marinova, 2001; Nor Aini and Sabariah, 2005; Nor Hayati, et. al. 2002). Blending of vegetable oil with rice bran oil (RBO) has been found to improve the stability of the blend during frying and storage (Gopal, et. al. 2005). RBO contains high levels of phytosterols, gamma-oryzanol, tocotrienols as well as tocopherols and it extends the shelf - life of snack foods (Gopal, et. al. 2006). Olive oil has a long shelf-life and can be blended with less stable vegetable oils to improve their stability and longevity. Furthermore, using olive oil can lower blood pressure and decrease the risk of heart disease (Kochhar, 2000; Psaltopoulou, et. al. 2004; McKeon, 2005). Olive oil contains the monounsaturated fatty acid oleic acid, antioxidants such as vitamin E and carotenoids (Coni, et. al. 2000). Hence, the purpose of this study was to develop a healthier and stable blend of rice bran oil and olive oil and also to study the fatty acid composition, physiochemical properties, oxidative stability, and antioxidant activity of this blend.

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MATERIALS AND METHODS
Refined rice bran oil (RBO) and olive oil (OO) were purchased from local market. All the analytical and GC grade chemicals and solvents used were supplied by Himedia (Mumbai, India).

Preparation of blends: A 100 ml mixture of RBO and OO was placed in duplicate in 250-ml beakers and was mixed by using a mechanical stirrer at 180 rpm for 15 min to prepare blends of RBO and OO. Blend was prepared in two ratios i.e., 80:20 and 70:30 (Bhatnagar, et al. 2009). These blends were analysed for physiochemical properties, fatty acid composition, oxidative stability, natural antioxidants and radical scavenging activity.

The basis of selection of this blend was a combination of three factors: (1) India is second largest producer of rice bran oil (2) olive oil contains highest amount of MUFA (oleic acid) (3) lower cost of the blend when compared to individual oil. The selection of two ratios i.e. 80:20 and 70:30 was based on recommendation given by Prevention of Food Adulteration Act (PFA) 1954. According to PFA 4th Amendment Rules 1992, blending of any two vegetable oils (wherein the component oil used in the admixture is not less than 20%) has been permitted.

Fatty acid composition by gas chromatography (GC): Oil samples were analysed for their fatty acid composition by gas chromatography using fatty acid methyl esters (FAME) preparation (Appleqvist, 1968). FAMEs were analysed on a gas chromatograph (Varian CP 3800, USA), equipped with a flame ionization detector (FID) and a fused silica capillary column (50 m x 0.25 mm i.d.), coated with CP-SIL 88 as the stationary phase. The oven temperature was programmed at 200 °C for 13 min. The injector and FID were at 250 °C. A reference standard FAME mix (Supelco Inc.) was analyzed under the same operating conditions to determine the peak identity. The FAMEs were expressed as relative area percentage.

Physicochemical properties: Smoke point and frying temperature were determined according to the AOCS Method Cc 9a-48 (1990). Viscosity of blended oil was recorded with the help of viscometer (Patent no: 688/del/85). Peroxide value, iodine value, saponification value, acid value and free fatty acids of the vegetable oils were determined by using AOAC (2000) methods.

Oxidative stability: Samples were placed in beakers (50- ml) capacity and incubated at 37°C and 55 % RH in a lab incubator to study the oxidative stability of the blends over a period of 4 weeks (28 days). Samples were withdrawn at weekly intervals and analysed for their peroxide value (PV). The PV is a titration measure of all peroxides and lipid oxidation products that will oxidize the potassium iodide under operating conditions. Five grams of the oil sample was poured into a 250 ml flask. Thirty millilitres of glacial acetic acid/chloroform (3:2, v/v) solutions were added and stirred. A stopper was inserted and the flask was shaken for 1 min and left for 5 min in the dark at 15–25 °C. Thirty millilitres of distilled water was added, and the liberated iodine was titrated with 0.01 N Na₂S₂O₃, using starch as indicator. The PV was calculated following the AOCS (2003) method.

Antioxidant activity: To analyze antioxidant activity of blend, natural antioxidants (oryzanol, α-tocopherol equivalent) and radical scavenging activity (RSA) towards DPPH radicals were determined.

Natural antioxidants: The alpha tocopherol equivalent was determined by Emmerie Engel assay modified by Baker and Frank (1988). Three stoppered centrifuge tubes were taken and labelled as standard, sample, and blank. To these labelled tubes, 0.5 ml of DL-α-Tocopherol acetate (standard), 0.5 ml of blended oil (sample) and 0.5 ml of distilled water (blank) were added respectively. In each centrifuge tube, 0.5ml of ethanol and 0.5ml of xylene were added. All the three stoppered centrifuge tubes were mixed and centrifuged for 15min. In other three clean stoppered tubes, 0.5ml of each xylene layer was transferred. To this 0.5ml of dipyriddyl reagent was added and 0.5 ml of this mixture was pipetted into spectrophotometer cuvettes (Systronics UV-VIS-108, Bangalore, India) and the absorbance of sample and standard against the blank was read at 460 nm. To the blank, standard and sample, 0.33 ml of ferric chloride reagent was added and mixed for 30 seconds. After 1.5 minutes of the addition, zero setting was done at 520 nm and absorbance of the sample and standard against the blank was read. The alpha tocopherol equivalent was calculated by using this formula:
Alpha tocopherol equivalent (mg%) = \[\text{alpha tocopherol in standard (mg %) x \{sample OD}_{520} - (0.29 x \text{sample OD}_{460})\} / \text{standard OD}_{520}\]

Oryzanol content of blended oil was determined by a spectrophotometric method (Gopal et al., 2006) by dissolving 0.01 ml of the sample in 10 ml of hexane and reading the absorbance at 314 nm in a 1-cm cell (Systronics UV-VIS-108 spectrophotometer, Bangalore, India). The oryzanol content was calculated by using the formula:
\[(A/W) X (100/358.9)\]

Where A is the absorbance of the sample, W is the weight of the sample in gram/100 ml, 358.9 is specific extinction coefficient for oryzanol.

Radical scavenging activity (RSA) toward DPPH Radicals: DPPH radical scavenging activity was measured using the method described by Erasto et al. (2007) and Miraliakbari and Shahidi (2008). This assay is based on the determination of the concentration of 2, 2-diphenyl-1-picrylhydrazyl (DPPH) methanolic solution, after adding the antioxidants. DPPH concentration is reduced by the existence of an antioxidant at 515 nm and the absorption gradually disappears with time. A 0.1 mM methanolic solution of DPPH was prepared.

The oil samples (1 ml after tenfold dilution) were placed in test tubes and a 2-ml aliquot of DPPH methanolic solution was added and the mixture was vortexed for 20 s at ambient temperature. Against a blank of pure methanol without DPPH, the decrease in absorption at 515 nm was measured in 1-cm quartz cells after 1, 30, and 60 min of mixing, using a spectrophotometer (Systronics UV-VIS-108, Bangalore, India). RSA toward DPPH radicals was estimated from the differences in absorbance of methanolic DPPH solution with or without sample (control) and the inhibition percent was calculated using the following equation:
\% inhibition = \{(absorbance of control - absorbance of test sample)/absorbance of control\} X 100

Statistical analysis: All the determinations were carried out in triplicate and the results were expressed as mean ± standard error. One way analysis of variance (ANOVA) and their statistical significance (pd"0.05) was ascertained using a computer programme package (CPCS1).

RESULTS AND DISCUSSION

Rice bran oil was blended with olive oil in two ratios i.e., 80:20 and 70:30 and was analysed for its physicochemical properties, fatty acid composition, oxidative stability, and antioxidant activity.

Fatty acid composition: Fatty acid composition of single and blended oils is given in Table 1. The total amount of SFA, MUFA and PUFA present in RBO was 15.4, 38.0 and 46.6 per cent respectively whereas OO contained 15.9 per cent SFA, 68.5 per cent MUFA and 15.6 percent PUFA. RBO+ OO in the ratio of 80:20 contained 21.1 per cent SFA, 42 percent MUFA and 36.9 per cent PUFA whereas percentage of SFA, MUFA and PUFA present in RBO+ OO (70:30) was 19, 47.6 and 33.4 respectively. Oleic acid of RBO+ OO (47.6%) in the ratio of 70:30 was higher than RBO+ OO (42%) in the ratio of 80:20. The percentage of oleic acid in both ratios was higher than RBO (38.0%) and lower than OO (68.5%). Oleic acid had been described to reduce the cardiovascular risk by reducing blood lipids, mainly cholesterol (Coni, et. al. 2000; Turner, et. al. 2005; Lopez-Huertas, 2010; Stephens, et. al. 2010). The amount of linoleic acid in RBO+OO (36.9%) in the ratio of 80:20 was higher than

<table>
<thead>
<tr>
<th>Fatty acid (%)</th>
<th>RBO(100%)</th>
<th>OO(100%)</th>
<th>RBO+ OO(80:20)</th>
<th>RBO+ OO(70:30)</th>
<th>CD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palmitic acid (C16:0)</td>
<td>14.5± 0.8</td>
<td>15.3± 0.2</td>
<td>20.6± 0.4</td>
<td>18.7± 1.4</td>
<td>2.34</td>
</tr>
<tr>
<td>Stearic acid (C18:0)</td>
<td>0.9± 0.3</td>
<td>0.6± 0.2</td>
<td>0.5± 0.1</td>
<td>0.3± 0.2</td>
<td>NS</td>
</tr>
<tr>
<td>Oleic acid (C18:1)</td>
<td>38.0± 1.3</td>
<td>68.5± 0.7</td>
<td>42± 0.9</td>
<td>47.6± 1.4</td>
<td>2.45</td>
</tr>
<tr>
<td>Linoleic acid (C18:2)</td>
<td>46.6± 1.0</td>
<td>15.6</td>
<td>36.9± 0.7</td>
<td>33.4± 1.1</td>
<td>2.19</td>
</tr>
<tr>
<td>Linolenic acid (C18:3)</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>-</td>
</tr>
<tr>
<td>Arachidic acid (C20:0)</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>-</td>
</tr>
<tr>
<td>SFA %</td>
<td>15.4± 1.0</td>
<td>15.9± 0.1</td>
<td>21.1± 0.3</td>
<td>19± 1.6</td>
<td>2.8</td>
</tr>
<tr>
<td>MUFA %</td>
<td>38.0± 1.3</td>
<td>68.5± 0.7</td>
<td>42± 0.9</td>
<td>47.6± 1.4</td>
<td>2.5</td>
</tr>
<tr>
<td>PUFA %</td>
<td>46.6± 1.0</td>
<td>15.6± 0.8</td>
<td>36.9± 0.7</td>
<td>33.4± 1.1</td>
<td>2.2</td>
</tr>
<tr>
<td>SFA:MUFA:PUFA</td>
<td>1:2.5:3.0</td>
<td>1:4.3:1</td>
<td>1:2:1.7</td>
<td>1:2.5:1.7</td>
<td>-</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SE, * = Significant 5% , ND- Not detected, NS-Non significant, RBO rice bran oil, OO olive oil
RBO + OO (33.4%) in the ratio of 70:30 but the percentage of linoleic acid in both ratios was lower than RBO (46.6%) and higher than OO (15.6%). Scientific studies demonstrated the potential beneficial effects of PUFA for chronic diseases including cancer, insulin resistance and cardiovascular disease (Ruxton, et. al. 2004; Anderson and David, 2009; Gibson, et. al. 2011). Significant (p<0.05) difference was found in fatty acid composition of all vegetable oils. The World Health Organization (2008) has recommended the fatty acid ratio of vegetable oil to be 1:1.5:1. Results showed that blending improved the fatty acid ratio of RBO + OO i.e. 1:2:1.7 and 1:2.5:1.7 in the ratio of 80:20 and 70:30 respectively.

**Physical properties:** The data on physical properties of single and blended oils is given in Table 2. The smoke point is the temperature at which a fat or oil produces a continuous wisp of smoke when heated. Results showed that smoke point of RBO and OO was 242°C and 238°C respectively whereas RBO + OO showed lower value of smoke point i.e. 200°C in both ratios. But this meets the standard requirement for frying oils which should have a smoke point above 200°C (AOCS, 2003); an indication that these vegetable oils are suitable for frying purposes. Frying temperature of RBO and OO was observed to be 174°C and 169°C respectively whereas this value was higher for RBO + OO (80:20) i.e. 177°C. Frying temperature of RBO + OO in the ratio of 70:30 was 175°C. A significant (p<0.05) difference was observed in frying temperature of vegetable oils but still the frying temperature was within the range (150-190°C) suggested by Choe and Min (2007). With respect to viscosity, OO had higher (42 CST) value followed by RBO + OO (41CST) in the ratio of 80:20, RBO + OO (40 CST) in the ratio of 70:30 and RBO (40 CST).

**Chemical properties:** The data on chemical properties of single and blended oils is given in Table 2. Peroxide value is a useful indicator of the early stages of rancidity occurring under mild condition and it is a measure of the primary lipid oxidation products. So, greater the peroxide value, the more will be the rate of oxidation in the oil (Atinafu and Bedemo, 2011). It was found that RBO had highest peroxide value i.e., 0.62 meq /Kg whereas peroxide value of OO was found to be 0.47 meq /Kg. RBO + OO in the ratio of 80:20 and 70:30 had lower peroxide values i.e., 0.33 and 0.53 meq /Kg respectively as compared to RBO. It could be due to presence of highest amount of MUFA present in OO (68.5%) used for blending which raised the MUFA content of RBO + OO in both ratios (Table 1). Recent studies have reported that MUFA rich vegetable oils are less prone to oxidation (Serjouie, et. al. 2010). Iodine value is an index of the unsaturation, which is the most important analytical characteristic of oil (Otunola, et. al. 2009). Iodine value of RBO + OO in the ratio of 80:20 and 70:30 was recorded to be 115.2 g and 114.6 g respectively which were higher than the iodine value of single oil i.e. 102 g (RBO) and 92 g (OO). The greater the degree of unsaturation (or high IV), the more rapid the oil tends to be oxidized, particularly during deep-fat frying (Alireza, et. al. 2010). Although the highest iodine value was observed in RBO + OO, the protective role of the natural antioxidants induced by the presence of rice bran oil (i.e., oryzanol, alphatocopherol equivalent) resulted in a lower value of peroxide value (Gopal, et. al. 2005).

Acid value is a measure of the free fatty acids in oil. Acceptable levels for all oil samples should be below 0.6 mg KOH/g (measured in potassium hydroxide per gram) (AOCS, 2003). Acid value of...
RBO + OO in the ratio of 80:20 and 70:30 was recorded to be 0.28 and 0.19 mg KOH/g respectively which were lower than the acid value of single oil i.e. 0.42 mg KOH/g (RBO) and 0.32 mg KOH/g (OO). Free fatty acids occur in fats as a result of enzymatic hydrolysis by lipases, metal ions acting as free radicals or at an elevation of temperature (Gulla and Waghray, 2011). The percentage of free fatty acids was lowest in RBO + OO (70:30) i.e. 0.09 whereas in the ratio of 80:20 the percentage of free fatty acids was 0.14. The percentage of free fatty acids in both ratios was lower than percentage of free fatty acids present in single oil. Saponification value is an indication of the molecular weights of triglycerides in oil (Muhammad, et al. 2011). The highest saponification value was found in RBO + OO (70:30) i.e. 188.5 mg KOH/g. The saponification value of RBO + OO (80:20) was 177.3 mg KOH/g. There was significant difference (p < 0.05) among the vegetable oils in terms of chemical properties.

**Oxidative stability:** Oxidative stability of oil can be improved by modification of fatty acid composition and addition of antioxidants to the oil (Moussata and Akoh, 1998). The oxidative stability of single and blended oils is given in Table 2. Significant (p<0.05) difference was found in peroxide value of all vegetable oils after 28 days. It was observed that peroxide formation in RBO and OO increased by 52.2 and 40.8 per cent respectively whereas RBO + OO in the ratio of 80:20 and 70:30 showed increase in peroxide formation by 36.3 and 30.3 per cent respectively after 28 days Table 3. So, blends in both ratios showed least percent increase in peroxide formation as compared to single oils. The low peroxide formation in RBO + OO could be due to presence of high amount of MUFA (oleic acid) as shown in Table 1. Vegetable oils with high amounts of oleic acid are slower in developing oxidative rancidity during shelf life or oxidative decomposition during frying than those oils that contain high amounts of polyunsaturated fatty acids (Abdulkarim and Ghazali, 2012). Highest per cent increase in peroxide formation in RBO could be due to presence of PUFA as given in Table 1. Recent studies reported that oxidative stability was inversely proportional to PUFA content of vegetable oil (Bhatnagar, et al. 2009).

**Antioxidant activity:** The term “total natural antioxidants” collectively refers to total alpha tocopherol equivalent and oryzanol content in vegetable oils. Results showed that the amount of total natural antioxidants present in RBO, OO, RBO + OO (80:20) and RBO + OO (70:30) was 2968.3, 305.0, 2496.6 and 2525.0 mg/kg respectively (Table 4). By comparing single and blended oil, it was found that RBO + OO in the ratio of 70:30 had highest (67.7%) RSA towards DPPH radicals (Figure 1). Highest RSA of RBO + OO (70:30) could be due to the presence of oleic acid. Research studies have reported that oleic acid is more stable towards oxidation during storage and cooking (Bastida and Sanchez-Muniz, 2001). Besides, natural antioxidants i.e. oryzanol (2294.0 mg/Kg) and alpha tocopherol equivalent (249.5 mg/Kg) were also present in RBO + OO (70:30). In vegetable oils alpha-tocopherol inhibits the effects

### TABLE 3: Peroxide values (meq/Kg) of vegetable oils for oxidative stability at weekly interval

<table>
<thead>
<tr>
<th>Sample</th>
<th>0</th>
<th>7 days</th>
<th>14 days</th>
<th>21 days</th>
<th>28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBO (100%)</td>
<td>0.62±0.07</td>
<td>0.72±0.07</td>
<td>0.98±0.10</td>
<td>1.55±1.85</td>
<td>3.24±0.22</td>
</tr>
<tr>
<td>OO (100%)</td>
<td>0.47±0.03</td>
<td>0.52±0.03</td>
<td>0.63±0.07</td>
<td>0.93±0.32</td>
<td>1.57±0.03</td>
</tr>
<tr>
<td>RBO+OO (80:20)</td>
<td>0.33±0.03</td>
<td>0.36±0.02</td>
<td>0.47±0.42</td>
<td>0.65±0.51</td>
<td>1.02±0.33</td>
</tr>
<tr>
<td>RBO+OO (70:30)</td>
<td>0.39±0.04</td>
<td>0.57±0.03</td>
<td>0.71±0.48</td>
<td>0.92±0.04</td>
<td>1.32±0.44</td>
</tr>
<tr>
<td>CD*</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>0.81</td>
<td>2.45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample</th>
<th>7 days</th>
<th>14 days</th>
<th>21 days</th>
<th>28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBO (100%)</td>
<td>13.9</td>
<td>26.5</td>
<td>36.8</td>
<td>52.2</td>
</tr>
<tr>
<td>OO (100%)</td>
<td>9.6</td>
<td>17.5</td>
<td>32.3</td>
<td>40.8</td>
</tr>
<tr>
<td>RBO+OO (80:20)</td>
<td>7.4</td>
<td>23.4</td>
<td>27.7</td>
<td>36.3</td>
</tr>
<tr>
<td>RBO+OO (70:30)</td>
<td>5.9</td>
<td>20.2</td>
<td>22.8</td>
<td>30.3</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SE,* = Significant 5% , NS-Non significant, RBO rice bran oil, OO olive oil
TABLE 4: Total natural antioxidants and DPPH radical scavenging activity of vegetable oils

<table>
<thead>
<tr>
<th>Sample</th>
<th>Oryzanol (mg/kg)</th>
<th>Alpha tocopherol equivalent (mg/kg)</th>
<th>Total natural antioxidants (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBO (100%)</td>
<td>2803.0±1.8</td>
<td>165.3±1.1</td>
<td>2968.3±1.9</td>
</tr>
<tr>
<td>OO (100%)</td>
<td>ND</td>
<td>305.0±1.1</td>
<td>305.0±1.1</td>
</tr>
<tr>
<td>RBO+OO (80:20)</td>
<td>2294.0±1.4</td>
<td>202.5±0.0</td>
<td>2496.6±1.5</td>
</tr>
<tr>
<td>RBO+OO (70:30)</td>
<td>2275.5±1.6</td>
<td>249.5±0.4</td>
<td>2525.0±1.2</td>
</tr>
<tr>
<td>CD%</td>
<td>NS</td>
<td>NS</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SE, * = Significant 5%, NS-Non significant, RBO= rice bran oil, OO = olive oil

FIGURE 1: DPPH radical scavenging activity of vegetable oils. CD value between time intervals (0, 30, 60 minutes) - 0.22 (p<0.05), CD value between vegetable oils- 0.43 (≤0.05)

of singlet oxygen during sensitized photoxidation (Min and Boff, 2002). Scientific studies reported that higher the alpha tocopherol and oryzanol content, the higher the DPPH scavenging activity would be (Malik, et. al. 2011; Vorarat, et. al. 2010). A significant (≤0.05) difference was found in RSA of all vegetable oils.

CONCLUSION

By comparing single oils with blended oils, it was found that OO used for blending raised the MUFA (47.6%) content of RBO+OO in the ratio of 70:30. In terms of physicochemical properties RBO + OO (70:30) showed appropriate smoke point (200°C) and frying temperature (175°C), and had low acid value (0.19 mg KOH/g) as well as low percentage of free fatty acids (0.09%). Also, in terms of oxidative stability and antioxidant activity, RBO+OO (70:30) showed least percent increase (30.3 %) in peroxide formation after 28 days of incubation period and had highest content of total natural antioxidants (2525.0 mg/kg) except RBO(2968.3 mg/kg) and highest radical scavenging activity (67.7 %). Hence, the present study revealed that blending of unconventional oil (RBO) with traditional oil (OO) in the ratio of 70:30 to obtain stable and healthier blended oil can be done as it also reduces the demand and cost of traditional oils.
REFERENCES


