

IDENTIFICATION AND ESTIMATION OF THE
ANTIOXIDANT ACTIVITY OF PHENOLIC COMPOUNDS IN
SIX MEDICINAL OILS

By

R.T. Kotuwegedara



TO THE FACULTY OF GRADUATE STUDIES

In the fulfillment of the requirement for the award of the degree of

Master of Philosophy in Chemistry

Of the University of Kelaniya

Sri Lanka

ගණක අංකය	579
මගී අංකය	

April - 2009

Abstract

It is well known that constituents of many plants and herbs have been attracted a great deal of public and scientific interest because of their health-promoting effects as antioxidants and essential fatty acids sources. Six plants, *Madhuca nerifolia* (Mee), *Sessamum indicum* (Thala), *Brassica juncea* (Aba), *Canarium zeylanicum* (Kekuna), *Calophyllum inophyllum* (Domba) and *Ricinus calamus* (Endaru) were examined in order to determine their fatty acid compositions, phenolic compounds and antioxidant activities. In Sri Lanka medicinal seed oils are used only for limited number of applications in addition to their traditional medicinal purposes. Above medicinal plant oils are commonly used for traditional medicinal purposes.

Mainly oils are extracted from the matured dry seeds by pressing. Traditionally, press works by applying pressure to seed paste to separate the oil and vegetation water from the solid material. The oil and vegetation water are then separated by standard decantation.

සමහරක්
විද්‍යාත්මක පර්යේෂණ (3 වන වර්ගය)
විද්‍යාත්මක.

The six medicinal oils contain a range of fatty acids including polyunsaturated fatty acids (PUFA) that are essential components in diet. The PUFA contents of five of the six investigated medicinal oil were significantly higher than those of palm oil, coconut oil and palm kernel oil. Among the tested six Sri Lankan medicinal oils, thala, mee and aba oils contain higher percentages of PUFA and EFA (Essential Fatty Acid) compared to the other expensive edible oils. According to the GLC analysis all the tested six medicinal oils contained, four common fatty acids Palmitic (C 16:0), Stearic (C 18:0), Oleic (C 18:1) and Linoleic (C 18:2) in different compositions. In addition to the above fatty acids kekuna oil contains caprylic acid (0.58%), capric acid (0.49%), lauric acid (4.10%) and myristic acid (1.63%) in small percentages. Linolenic acid (an omega-3 fatty acid) content of domba, kekuna, aba, mee and endaru oils are 0.21%, 19.09%, 24.37%, 0.06% and 1.87% respectively.

Total polyphenol content (TPC) of medicinal oils was measured by using Folin – Denis method. According to the analysis of the tested six medicinal oils, the greatest TPC, 111mg gallic acid equivalent (GE) per kilo gramme of oil, was detected in the domba seed oil extract, while the lowest TPC, 31 mg GE/kg, was observed in the Endaru seed oil extract.

Methanol and water crude extracts from medicinal oils were investigated for their antioxidant activity in three different assays namely, oxidation of deoxyribose system, 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity and the reducing power. Among the six oil extracts, the domba oil extract showed the most potent antioxidant activity in each assay, showing 39.8% (at 60 µg/ mL) oxidation of deoxyribose method, 68.5% in the DPPH radical scavenging method (at 60 µg/ mL) and 36.8 % (at 50µL extract) of reducing power. Positive correlations were found between total phenolic content in the oil extracts and their antioxidant activities. Therefore medicinal oils may have potential as natural antioxidants.

RP-HPLC (Reversed phase) with UV detection was employed to distinguish phenolic compounds in above six medicinal oils. The phenolic substances were identified and quantified after comparison with reference standards. The tested oils contain, following one or more compounds like 3,4- dihydroxybenzoic acid, (+) – catechin hydrate, *p*-hydroxybenzoic acid, vanillic acid, caffeic acid, syringic acid, vanillin, ellagic acid and cinnamic acid as phenolic compounds in different concentrations.

Medicinal oil blends were prepared by mixing with coconut oil. For that three seed oils were used, specifically aba, mee and thala while these oils contain higher amount of long chain polyunsaturated fatty acids and more compatible as edible oils compared to the other analyzed medicinal oils. Among the prepared blends, 40% aba, 60% mee and 50% thala oil blends are more favorable from the taste, color, texture and appearance than the other blends prepared with the same oils in different volume fractions. The tested thala (50%), mee (60%) and aba (40%) oil blends contain significant amount of EFA compared to the other expensive edible oils.

The tested medicinal oil blends were further subjected to analysis their cholesterol lowering effect *in vivo* studies by using Wistar rats. By this method, total cholesterol level (HDL and LDL) and triglycerides level were tested during the period for 84 days in the blood serum of the Wistar rats. Most interestingly, tested aba oil blend (40%) showed the significant results than the other two-tested oil blends. However other tested two oil blends showed the excellent results compared to the commercial coconut oil. Total cholesterol level in the blood of Wistar rats when fed with aba, thala, mee oil blends and commercial coconut oil are 128 mg/ dL, 131 mg/ dL, 142 mg/ dL and 162 mg/ dL respectively. Significantly lower concentrations of blood serum triglycerides were found among the tested oil blends than the commercial coconut oil. Triglycerides level in the blood of Wistar rats when fed with aba, thala, mee oil blends and commercial coconut oil were found to be 96 mg/ dL, 109 mg/ dL, 136 mg/ dL and 152 mg/ dL respectively. These results suggest that the fatty acid unsaturation of medicinal oil blends were excellent source to reduce the cholesterol level and triglyceride level of the blood serum and provide more beneficial health effect to human beings.

