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Comparison of oxidative stability of sesame (*Sesamum indicum*), soybean (*Glycine max*) and mahua (mee) (*Madhuca longifolia*) oils against photo-oxidation and autoxidation

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Abstract

Lipid oxidation is one of the major causes of food spoilage. This study was conducted to evaluate and compare the oxidative stability of sesame (*Sesamum indicum*), soybean (*Glycine max*) and mahua (*Madhuca longifolia*) against photooxidation and autoxidation. Stability of oils against photo-oxidation and autoxidation was determined by exposing the oils to florescent light over 28 days and storing the oils at an elevated temperature (60 °C) for 28 days, respectively. The level of oxidation was determined by measuring peroxide value (PV), thiobarbituric acid reactive substances (TBARS), conjugated dienes (CD) and conjugated trienes (CT). Sesame oil exhibited the strongest oxidative stability against both photo-oxidation and autoxidation while Mahua oil exhibited the least stability highest both photo-oxidation and autoxidation as measured by primary oxidative products. However, Mahua oil showed the strongest stability against both photo-oxidation and autoxidation as measured by secondary oxidative products. In conclusion, higher oxidative stability was shown by the Mahua oil than sesame and soybean oils for photooxidation and autoxidation.

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Keywords: Oxidative stability; autoxidation; photo-oxidation; sesame oil; Mahua oil

1. Main text

1. Introduction

Quality and stability of edible oils influence its acceptability and suitability for consumption. Stability of oils against oxidation is an important indicator of the quality and shelf life of edible oils. Lipid oxidation involves a succession of chemical reactions leading to the production of low molecular weight off flavor compounds leading to loss of consumer appeal, nutritional quality and safety. During processing and storage, edible oils undergo autoxidation or phto-oxidation depending on the type of environmental conditions that they are exposed to and more importantly the type of oxygen present. Triplet oxygen induces autoxidation while singlet oxygen induces photo-oxidation. Oxidation leads to generation of a wide array of undesirable compounds some of which are detrimental to health[1].

Mahua oil which has been used for culinary purposes in Sri Lanka many a decade ago currently remains as an underutilized oil. It is extracted from seeds of *Madhuca longifolia.* Oil is pale yellow in color with a plastic consistency. Mahua oil has very high medicinal value thus it is used in traditional medicine such as Ayurvedic medicine. Currently, it is also used for manufacturing laundry soaps and detergents. It is used as cooking oil in various tribal region of India and also used in the manufacture of Vanaspati[2]. Sesame (*Sesamum indicum*) oil rich in monounsaturated fatty acids is considered to be a healthy oil. It is resistant to oxidative deterioration compared to most other plant oils and is important due to its medicinal effects. Sesame oil contains lignans which act as antioxidants[3]. Soybean (*Glycine max*) oil extracted from soybean oil is rich in polyunsaturated fatty acid (PUFA) and as result highly susceptible for oxidation[4].

The studies on oxidative stability of mahua oil as edible oil is very much limited. Therefore, the aim of this study was to compare the oxidative stability of mahua oil with another two edible oils with relatively high content of unsaturated fatty acids namely sesame and soybean oils. This study could help to make a comparison among three oils for their suitability for processing such a deep frying.

Materials and Methods

Sesame, soybean and mahua oil were obtained from local market in Sri Lanka. The stability of these oils against autoxidation was evaluated using the Schaal oven test[5]. Briefly, thoroughly mixed oil samples (50 mL) were placed in 5 mL open glass vials and stored in a Schaal oven maintained at 60 °C for 28 days. The oil samples were drawn on day 1, 3,5,7,14,21 and 28. The stability of oils against photo-oxidation was evaluated by exposing the oils to fluorescent light for 28 days. The photo-oxidation study was performed by transferring 50 mL of oil samples into open glass vials (5 mL) and placing them in a tightly closed plastic container fitted with a fluorescence bulb (10 W) and maintaining in the container up to 28 days. The oil samples were drawn at the same intervals mentioned above. The two set of oil samples drawn was analyzed for Peroxide Value (PV)[6], 2-tert Thiobarbaturic Acid Reactive Substances (TBARS)[7], Conjugated Dienes (CD) and Conjugated Trienes (CT)[8]. Each assay was done three times from the same