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Research Article

Oil Extraction from Matured Seeds of Cassia Tora and its Nutritional, Antioxidative Properties

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ABSTRACT

The matured seed of *Cassia tora* was analyzed to extract oil content to determine nutritional and antioxidant properties. The seed oil extracted by the steam distillation method, the nutritional profile, free radical scavenging and phosphomolybdenum reduction assay were also determined. The seed derived extracted oil (41.8%) contained free fatty acids 22.15±1.71%, total amino acids 21.09±1.69%, unsaturated fatty acids of oleic acid (13.31±1.72%), linoleic acid (11.25±1.13%), palmitic acid (12.78±1.21%) and total amino acid. The seed oil possessed significant free radical scavenging activity of IC_{50} (28.78±0.69) and phosphomolybdenum reduction (52.4±4.32), which was equal to that of rutin (31.56±0.81) as synthetic antioxidant drug. The result of this study revealed that the oil extracted from matured seeds possess reduced fatty acids, higher unsaturated fatty acids, more content of amino acids, free radical scavenging ability and phosphomolybdenum reduced properties. In conclusion, the *Cassia tora* seed oil may be used as edible in human health and also used for various treatments of rheumatoid, cardiovascular disease and nutritional deficiency.

Key-words: *Cassia tora*, fatty acids, seed oil, free radical and analgesic activity.

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INTRODUCTION

Plant derived medicines have been used in traditional health care systems for the treatment of various ailments and diseases since time immemorial [1]. According to the World Health Organisation (WHO), it has been estimated that 80% of the world's population is still dependant on traditional medicines for maintaining their health status and combating various diseases [2- 5]. In ancient system of medicine, *Cassia tora* have been shown to possess action against a variety of therapeutic uses like bronchitis, constipation, conjunctivitis, ulcer, hypertension, hypercholestrolemic and cardio vascular diseases fungal infection, diabetics edema, glaucoma, nyctalopia, ringworm, skin diseases, plaque and caries [6-10] Decoctions of different parts of *Cassia tora* have been used as analgesic, anticonvulsant, antipyretic, antibacterial, antifungal, antihelmintic, diuretic, expectorant, laxative, purgative and useful in treatment of glaucoma, hypertension, skin disease, ringworm, leprosy, flatulence, colic, dyspepsia, constipation, cough, itch [11].

A water soluble complex polysaccharide consisting of D-galactose, D-glucose, D-mannose and D-xylose in the molar ratio of 2:2:7:1 have been isolated from the defatted seeds. The polysaccharide has a highly branched structure with α-linked D-galactopyranose and D-xylopyranose as end residues into which 1, 4 and 1, 4, 6-linked-β-D-mannopyranose and glucopyranose units of the main chain are likely to be attached [12]. Besides, leaves and seeds contain anthraquinones like chrysophanol, physcion, emodin, rhein, euphol, basseol, obtusifolin, obtusin, chryso-obtusin, rubrofusarin, aurantio-obtusin, chrysophonic acid-9-anthrone including their glycosides and naphthopyrones like rubrofusarin, orrubrofusarin, naptho-alpha-pyrone-toralactune, cassiaside including their glycosides [13-16].

For some food applications, especially baking, a solid fat is needed to provide a healthy replacement for animal fats, palm oil, and hydrogenated vegetables oils. Plant oils rich in stearic and oleic acids could provide this important function without compromising human health. Healthy oils from these types of seeds have the potential to replace solid fats in a wide range of baking and heavy-duty frying applications and are currently in the research pipelines of several major companies. The introduction of modified seed oils such as high oleic acid soybean oil and high oleic/high stearic oils will go a long way in removing the undesirable saturated fatty acids and trans fatty acids from the human diet and help to promote cardiovascular health[17-20].

MATERIALS AND METHODS

Plant material

Matured seeds of *Cassia tora* were collected from Western Ghats of Coimbatore, Tamilnadu region in February 2012 and allowed to dry under the shade. The identification and voucher specimen were deposited at the Department of Botany, Kongunadu Arts and Science College, Coimbatore, Tamilnadu, India.

Oil Extraction

The steam distillation was done using a Clevenger apparatus containing 5 L round bottom glass flask were added 500 g of milled *Cassia* seeds and 2.5 L of distilled water (vegetal material/ extraction solvent rate = 1/5 (m/v). The mixture was left under reflux for 3 hours at 50°C. The yellow in white volatile oil was collected and stored at 4° C for further analysis.

Nutraceutical properties [21-22]

Fatty acid and free fatty acid composition was analyzed by the standard procedure. The estimation of total amino acid was done by Ninhydrin method introduced by Moore and Stein.

Antioxidant activity

Free radical scavenging assay by DPPH

The samples were diluted in dichloromethane at the concentration of 1.0 mg/mL and different aliquots of the sample were mixed with methanol DPPH solution. The reaction mixtures were incubated further 20 minutes in dark. The reduction of the DPPH free radical was measured by reading the absorbance at

517nm and related to the absorbance of the control as DPPH [23]. Inhibition percent was calculated from the following equation:

% of inhibition = [(Control OD–Sample OD)/Control OD] x 100.

IC_{50} is the concentration of the test sample leading to decrease the initial concentrations of the DPPH by 50% was calculated.

Phosphomolybdenum assay

The antioxidant activity of samples was evaluated by the phosphomolybdenum complex formation according to the method [24]. An aliquot of 100 µL of sample solution (in 1 mM dimethyl sulfoxide, DMSO) was combined with 1 mL of reagent solution (0.6 M sulphuric acid, 28 mM sodium phosphate, and 4 mM ammonium molybdate) in a 4-mL vial. The vials were capped and incubated in a water bath at 95˚C for 90 minutes. After that the samples were allowed to cool at room temperature, the absorbance of the mixture was measured at 695 nm against a blank. The results reported (ascorbic acid equivalent antioxidant activity) are mean values expressed as g of ascorbic acid equivalents/100 g extract.

Statistical analysis

The results were expressed as mean±SD. The total variation and difference among means were analyzed through one-way analysis of variants (ANOVA) followed by Duncan multiple range test analysis and the *p* value less than or equal to 0.5 were considered significant.

RESULTS AND DISCUSSION

Physico-chemical properties

Table 1 confirms the physical characteristics of the total oil content and its nutritional properties of the fatty acids, free amino acids and unsaturated fatty acids. Oil content is the predominant compound in seed sample, but it also contains high amounts of amino acids, free fatty acids and unsaturated fatty acids of volatile oil compounds. Determination of oil content in plants seed is important because it predicts the profitability of given plants as potential source of oil. High yield of oil content in plant seed implies that processing it for oil would be economical and healthy [25]. Thus, the oil yield found in the seeds of *Cassia tora* contained 41.8% comparatively favorable with the oil yield reported for some other commercial plant oils such as cotton seed (36%), olive (17%), sunflower (44%), soybeans (18%) and corn 3.4% [26]. Polyunsaturated fatty acid and fatty acid has been reported to possess some beneficial potential in mental conditions such as schizophrenia. The plant seed oil could be a good source of essential fatty acid in food formulations and could ameliorate of some food and health problems. Unfortunately, palm oil is very rich in saturated fatty acids, the consumption of which has been linked to cardiovascular disease in humans [27-30]. Plant derived Nutraceuticals/functional foods have received considerable attention because of their presumed safety and potential nutritional and therapeutic effects. Some popular phyto-nutraceuticals include glucosamine from ginseng, Omega-3 fatty acids from linseed, Epigallocatechin gallate from green tea, lycopene from tomato [31].

Antioxidant properties

IC_{50} values of the free radical scavenging ability of the seed oil of *Cassia tora* were recorded in Fiugure 1. The DPPH antioxidant assay is based on the ability of scavenging stable free radical to decolourization indicate the presence of antioxidant potential of the oil and reference standard quercetin. *Cassia tora* seed oil was used to determine the total antioxidant capacities by the formation of phosphomolybdenum complex solution. The formation of the complex at 95˚C was measured by the intensity of absorbance (695 nm) in oil at the concentration ranges of 50-200 µg/ml as shown in Figure 2. The phosphomolybdenum method was based on the reduction of Mo (VI) to Mo (V) by the antioxidant compound and the formation of a green phosphate/Mo (V) complex with a maximal absorption at 695 nm and total antioxidant capacity was expressed in ascorbic acid equivalents. The essential oil from *Rosa damascena* has no bitter taste and because of its potential antioxidant activity and good taste, can be used

as food flavor and as preventing agent for many diseases [32]. *Sesamum indicum* seed oil is rich with antioxidant components like lignans allowing for greater shelf-life of foods plus improving their flavor and taste [33]. In recent report of the medicinal plant seed oil had good antioxidant, anti-inflammatory, analgesic, diuretic and nutritional properties for human health Recently supplementation of *C. tora* leaves extract at 0.4 g/L in drinking water improved growth performance in broiler birds due to its antimicrobial and antioxidant activity and it could be used as an alternative to antibiotic growth[34-38].

Table 1. Physico-chemical and nutritional profiles of *Cassia tora* seed oil

S. No	Chemical content	Relative percentage
1	Total oil content	41.8±3.18^{a}
2	Free fatty acid	22.15±1.71^{b}
3	Palmitic acid	12.78±1.21^{e}
4	Oleic acid	13.31±1.72^{d}
5	Linoleic acid	11.25±1.13^{f}
6	Total free amino acids	21.09±1.69^{bc}

Values are mean±SD (*n=3*); Mean values followed by different superscripts in a column are significantly different (*P<0.5*) according to Duncan's multiple range tests (DMRT).

Figure 1. Free radical scavenging ability of the seed oil of *Cassia tora*

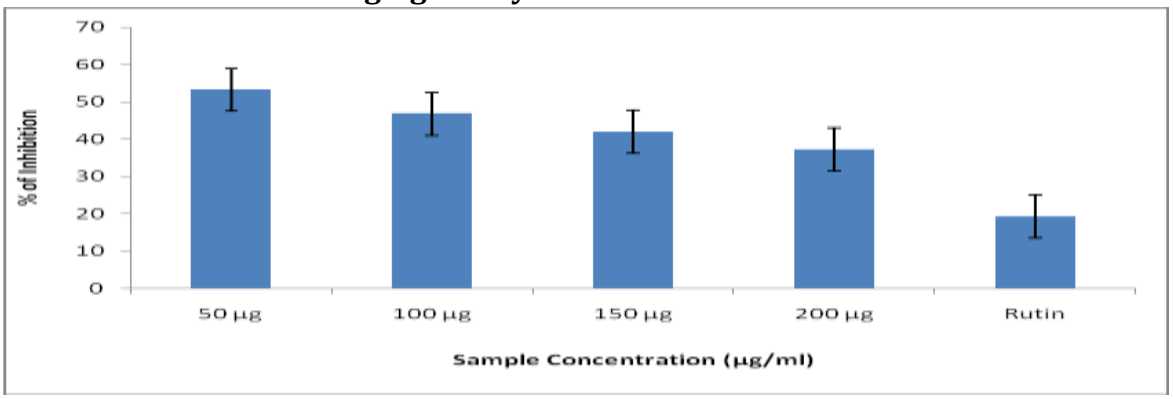
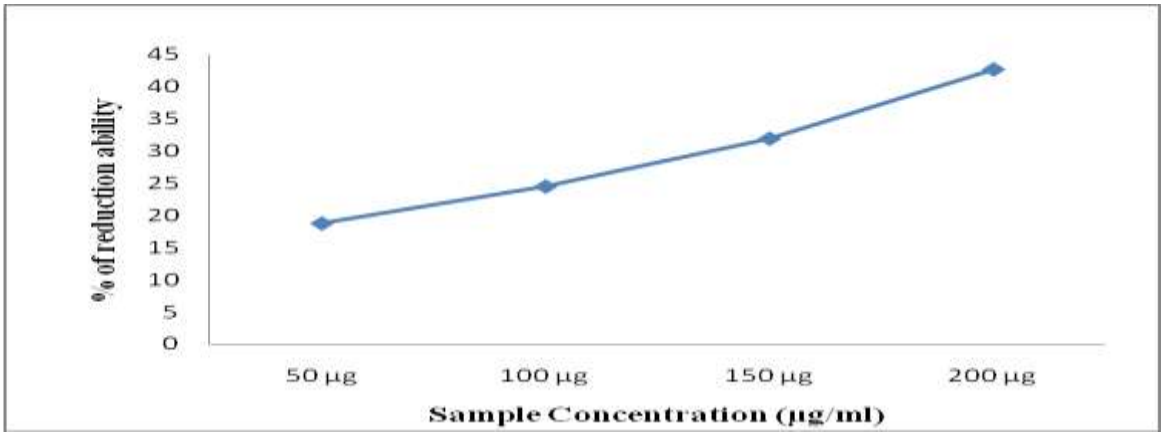


Figure 2. Ascorbic acid equivalent reduction potential of Phosphomolybdenum in seed oil of *Cassia tora.*



CONCLUSION

The *Cassia tora* seed oil is rich in free amino acids, saturated and unsaturated fatty acids were used for applications of food formulation, cardiovascular and oxidative disease. Future demand of nutraceutical depends upon consumer perception of mankind and the relationship between diet supplementary and disease. Plant seed/nut oil as greater nutraceutical and functional food have significant role in the promotion of human health.

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