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Research Article

THE TOXICITY OF MANGOSTEEN RIND EXTRACTS ON DAPHNIA

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ABSTRACT

Garcinia mangostana is a tropical tree found across Southeast Asia, Australia and Kerala (India). The fruit has several therapeutic properties and its rind in particular has anti-microbial, anti-malarial, antioxidant and larvicidal activity. The protocol for toxicity was followed as per the OECD guidelines number: 202 and observations were recorded after 24 h and 48 h. The dose- response graph was plotted to determine the EC 50 values.The EC 50 value of the cold extract, Soxhlet extract and microwave assisted extract was found to be 0.51 ppm, 0.49 ppm and 0.83 ppm respectively.

Key words: Mangosteen, toxicity, Daphnia, EC50

INTRODUCTION

Garcinia mangostana Linn., commonly known as Mangosteen is a tropical tree that belongs to the Family Clusiaceae. Its fruit holds the title of the 'queen of fruits' and is found across Southeast Asia and Australia. It can be obtained in Kerala (India) from June to July. The edible portion as well as its rind has several medicinal benefits. The secondary metabolites from the pericarp, predominantly xanthones, are known to exhibit numerous properties, particularly, anti-microbial, anti-malarial, antioxidant and larvicidal activity[1, 2, 3]. Daphnia is a freshwater filter-feeding crustacean and is a highly sensitive organism used in ecotoxicity experiments. It is used as a model organism for the standard testing protocols of the U.S. Environmental Protection Agency (EPA), Organization for Economic Cooperation and Development (OECD) as well as the International Standards Organization (ISO)[4]. This study tested the toxic efficacy of three crude extracts of the mangosteen rind (cold extract, Soxhlet extract and microwave assisted extract) against Daphnia.

MATERIALS AND METHODS

The plant material

The fruits of *Garcinia mangostana* were obtained from Kerala and the rind was separated from the edible portion, washed under tap water, dried in an incubator at 40^{O} C for 2 weeks and ground to a fine powder.

Extracts

A cold extract, Soxhlet extract and microwave-assisted hot extract of rind powder (5% w/v in all cases) was obtained using HPLC grade methanol (SRL) as the solvent. The cold extraction was performed by shaking 2.5 g of rind powder in a flask containing 50 ml of methanol for 3 days at 150 rpm on a shaker. This was then filtered through Whatman filter paper No. 1. The rind powder (2.5 gm) was extracted using methanol in a Soxhlet apparatus, set at 60^{O} C and the extraction was continued until the extract in the side arm turned colourless. The microwave assisted extraction was performed by heating a beaker containing 2.5 g rind powder and 10 ml methanol in a microwave adjusted to 100 W power until it boiled. This was filtered and the extraction was repeated using the filtered powder in 10 ml of fresh methanol until the pooled filtrate volume of 50 ml was obtained. The extracts of the cold and microwave assisted and Soxhlet method were dried at room temperature and the yields of the solid residues were calculated. The dried extracts were reconstituted in DMSO and these stock concentrations were stored at 4^{O} C.

Toxicity tests

The protocol for evaluating the toxicity of Daphnia was followed as per the OECD guidelines No. 202[5] with slight modifications and observations were recorded after 24 h and 48 hrs. The sample size of each concentration was 10 organisms. The OECD recommends 5 organisms in 10 ml which was modified to 10 organisms in 20 ml in this study. Each assay was replicated thrice using distilled water and DMSO as negative controls. The dose response graph was plotted using Graphpad Prism® software and the EC 50 values were determined.

RESULTS AND DISCUSSION

The yield obtained from the *G. mangostana* powder was highest in the microwave assisted extraction (24%) followed by the Soxhlet extraction (21.43%) and least from the cold extraction process (14%).The potency of the Soxhlet extract (0.49ppm) was the highest closely followed by the cold extract (Figure 1). In comparison, 5-Fluorouracil, an effective cytostatic drug has an EC50 value of 15 ppm against *Daphnia magna*[6]. Interestingly, even at the highest concentration of the extracts (20 ppm), several unicellular flagellate organisms were seen thriving. This differential toxicity demands exploration and hints at a potential for extrapolation to human normal and cancer cell lines.

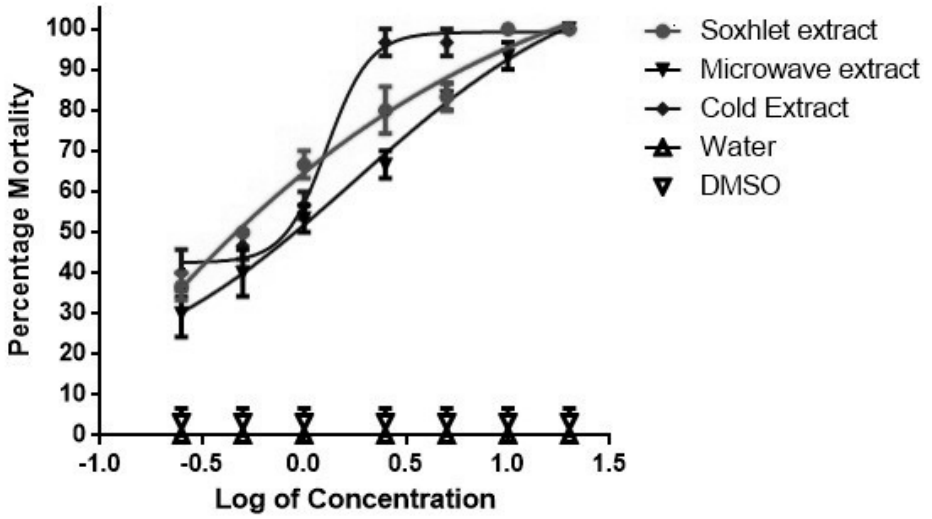

Figure 1.Graph of log-dose vs response after 48 hours treatment (± SEM)

Legend: The graph shows the dose-response curve generated by plotting the log of concentration of each of the extracts in ppm versus the percentage mortality of Daphnia. The EC 50 value of the soxhlet extract, the cold extract and the microwave assisted extract was 0.49 ppm, 0.51 ppm and 0.83 ppm respectively

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