Effects of a Salvia officinalis water extract on CCl₄-induced liver toxicity in male and female mice

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INTRODUCTION

The medicinal properties of sage (Salvia officinalis) have long been recognized and some may be conferred by its antioxidant properties. Oxidative damage of biological molecules is implicated in the development of a variety of human diseases. The dietary intake of antioxidant compounds or compounds that reinforce the biological antioxidant mechanisms can help prevent and in some cases treat some of the oxidative-related disorders.

In a previous study we observed a beneficial effect of sage tea drinking (a traditional water extract of S. officinalis) in some antioxidant parameters in mouse and rat livers, namely an enhancement of glutathione-s-transferase (GST) and glutathione reductase (GR) activities. As sage tea enhanced GST activity, we hypothesized that this extract would have a protective effect in a situation of hepatotoxicity due to alcohol-induced formation, such as that caused by CCl₄.

In the liver CCl₄ is activated mainly by cytochrome P450 (CYP2E1), to form the trichloromethyl radical (CCl₃·), that can bind to cellular molecules (lipidic acid, protein, lipid) impairing crucial cellular processes. This radical can also react with oxygen to form its highly reactive derivative trichloromethylperoxy radical (CCl₃O₂·) that initiates the chain reactions of lipid peroxidation (Water et al., 2003). These events result in oxidative cell damage. Because Phase II enzymes activities are known to be gender dependent (Chowell et al., 2003b) the extension of cell damage caused by drugs that are activated by these phase II enzymes can be significantly different in males and females.

In the present study we evaluated the potential protective effect of sage tea drinking on CCl₄-induced hepatotoxicity in male and female mice.

METHODOLOGY

Twenty male and twenty female mice were divided in two groups each. In half the groups drinking water was replaced with sage tea for 14 days. Twenty four hours before the end of the experiment, half the livers of each drinking group of both genders received an i.p. injection of 20 μg/kg of CCl₄ in olive oil and controls vehicle only. Plasma and liver samples were collected to measure a variety of parameters.

RESULTS AND DISCUSSION

A significant increase in plasma transaminases occurred as a result of CCl₄-induced liver toxicity (fig. 1 and fig. 2). This was opposite in both males and females.

This is evidenced by the increase in plasma transaminase activities (CCl₄-sage tea versus CCl₄-water) in male and female mice.

In females the potentiation of CCl₄ toxicity by sage tea drinking group was more pronounced, there was also a 5x increase in GSGS and 40% decrease in GSTH (table 1).

These gender differences were maintained in the activities of several detoxifying antioxidant enzymes (table 1), plus GR (glutathione reductase) and GST (glutathione-s-transferase), plus GSH (glutathione reductase), plus GSH peroxidase and GSH transferase.

In agreement with our previous results, in both male and female mice (table 2), there was a significant increase in GST and GSH activities in the group receiving CCl₄ and GSH drinking groups.

These results also show that herb-toxicant (drug-drug) interactions may be present and that these interactions must be understood before the beneficial effects of herbal products are generalized and assumed as a constant.

REFERENCES


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