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Review

Effects of *Hibiscus sabdariffa* L. on serum lipids: A systematic review and meta-analysis

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ABSTRACT

Ethnopharmacological relevance: Prevention of cardiovascular disease by modifying its major risk factors, including serum cholesterol levels, is an important strategy. *Hibiscus sabdariffa* L. has been promoted for reducing cholesterol levels, but its reported impact on cholesterol levels has been inconsistent. The study aimed to assess systematically the evidence and quality of current research on the effect of *Hibiscus sabdariffa* L. on blood lipids and its adverse effects.

Materials and methods: Electronic databases were searched up to June 2013 for relevant randomised controlled trials (RCTs). Journals and conference proceedings were also searched. The quality of the selected trials was assessed using the Cochrane Risk of Bias Assessment Tool. The efficacy results of similar studies were pooled if they used the same comparator. Outcomes examined were levels of total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and triglycerides.

Results: Six studies involving 474 subjects met our inclusion criteria. These studies varied in terms of the types of interventions, comparators used, and duration of trials. Overall, *Hibiscus sabdariffa* L. did not produce any significant effect on any of the outcomes examined, when compared with placebo, black tea or diet. With short-term use it is well tolerated.

Conclusions: The available evidence from RCTs does not support the efficacy of *Hibiscus sabdariffa* L. in lowering serum lipids. Further rigorously designed trials with larger sample sizes are warranted to confirm the effects of HS on serum lipids.

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1. Introduction

Coronary heart disease (CHD) is the leading cause of cardiovascular death worldwide (Gaziano et al., 2010). One of the known risk factors for CHD is elevated serum lipid levels (Verschuren et al., 1995; Khot et al., 2003). General recommendations for lowering elevated lipid levels are changes in diet (Takahashi et al., 2010; de Oliveira et al., 2013) and lifestyles practices, including not smoking (Brischetto et al., 1983; Gepner et al., 2011), exercising regularly and maintaining a healthy weight (Chrysohoou et al., 2007). However, most people find it difficult to make such dietary and lifestyle changes. Therefore, drug intervention is often necessary.

The lipid-lowering agent of first choice is a statin (National Institute for Health and Clinical Excellence (NICE), 2008) and data from several studies show that among the lipid-lowering agents, statins are the most commonly prescribed (American Heart Association, 2002; Moser and Segars, 2010). Statins are effective in reducing low-density lipoprotein cholesterol (LDL-C) levels and lowering the risk of CVD (Shepherd et al., 1995; Sacks et al., 1996; Downs et al., 1998). However, many patients may not tolerate long-term use of statins, due to statin-associated myopathy (Law and Rudnicka, 2006). Adverse events can affect treatment adherence, and it has been shown that a major issue for control of elevated lipid levels is adherence (Avorn et al., 1998). Agents of natural origin are often more acceptable to patients. One reported alternative anti-lipidemic agent is *Hibiscus sabdariffa* L. (HS).

Hibiscus sabdariffa L. (Fig. 1), is an annual dicotyledonous, herbaceous shrub belonging to a species of the Malvaceae family, known variously as Roselle, Rosella, Red Sorrel, Karkade, Sour tea and Red tea. It is a tropical shrub widely distributed in South East Asia, the West Indies, India, and many areas of Central Africa, West Africa and America (Ngamjarus et al., 2010). Various parts of HS (leaves, flowers and calyx) have been used for both non-medicinal (e.g. beverages) and medicinal purposes (Wright et al., 2007). In the tropics and regions in the West Indies and Africa, HS is most commonly used for its anti-hyperlipidemic (Abu-Irmaileh and Afifi, 2003; Hirunpanich et al., 2006) and anti-hypertensive effects (Abu-Irmaileh and Afifi, 2003; Herrera-Arellano et al., 2004; AbouZid and Mohamed, 2011; Alzweiri et al., 2011). Other uses of HS in folk medicines include uses as diuretics (Morton, 1987) and anti-inflammatory agents (Dafallah and Al-Mustafa, 1996). The compounds found in HS such as polyphenols, anthocyanins, flavonoids, and proanthocyanidins detected in the calyces of HS are potentially bioactive with cardiovascular effects through their anti-oxidant activities (Jonadet et al., 1990; Chen et al., 2004).

Although there is evidence from animal studies that HS reduced hyperlipidaemia (Chen et al., 2003; Carvajal-Zarrabal et al., 2005; Olatunji et al., 2005; Hirunpanich et al., 2006; Ochani and D'Mello, 2009; Yang et al., 2009), the results of reported randomised controlled trials (RCTs) appear contradictory. We therefore aimed to systematically review the evidence on the effect of HS on hyperlipidaemia. Unlike the previous review (Hopkins et al., 2013), which examined evidence of HS effectiveness on cardiovascular risk factor based on ethnomedicinal, pharmacological, and phytochemical information, our review focussed on examining evidence only from RCTs assessing HS for hyperlipidaemia. This is the first systematic review to include a quantitative summary of the effects of HS on lipid levels.

Fig. 1. *Hibiscus sabdariffa* L. plant.

2. Materials and methods

2.1. Search strategy

The searches for relevant trials involved multiple strategies. The following electronic databases were searched from their earliest record to June 2013: MEDLINE via Ovid, CINAHL via EBSCOhost, The Cochrane Database of Systematic Reviews (CDSR) and The Cochrane Central Register of Controlled Trials (CENTRAL), AMED (Allied and Complementary Medicine Database), BIOSIS and Food Science and Technology Abstracts. We also hand searched related topics of HS on hyperlipidemia in conferences and proceedings to identify posters and abstracts that were not identified with other searches. The references of published papers on clinical trials and reviews were scrutinised for additional articles and local manufacturers marketing HS were also contacted to identify any unpublished or ongoing trials.

2.2. Selection of trials and data extraction

There was no restriction on the basis of language, date of trial or publication status for including trials in the review. Studies involving patients of any age described as having elevated lipid levels were included. We included all trials comparing the effectiveness of HS (of any species) used as a single active substance with any control such as placebo, diet, or any pharmacological

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