**Hibiscus sabdariffa: a Potential Strategy to Decrease Aging-induced Cardiovascular Risk?**

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1. Introduction

- Progressive and inevitable deterioration of normal functions, which predisposes to diseases
- Main contributor to cardiovascular health in elderly, it is a risk factor for cardiovascular disease (CVD) regardless of other risk factors
- Functional and structural changes in heart and arterial system
- Endothelial dysfunction is associated with an important cause of mortality and morbidity
- Increased levels of oxidative stress

2. Aims

- To evaluate the effect of oxidative stress to the main triggers of CVD in elderly.
- To analyze the scientific evidences of a non-pharmacological treatment which provides antioxidant and cardioprotective properties.

3. Materials and Methods

- Search in PubChem database.

4. ROS, NO and Atherosclerosis

![Diagram of ROS, NO and Atherosclerosis](image)

- Nitric oxide (NO) is the main contributor to blood vessels vasodilation. ROS induce NO degradation; as a result, NO-dependent vasodilation is reduced. This process not only triggers arterial hypertension, but also induce cellular damage through ONOO–.

5. Hibiscus sabdariffa

**Antioxidant Capacity**
- Strong dose-dependent antioxidant effect in vitro assays
- Increased ability to scavenge ROS in plasma of HS-treated rats
- HS induced antioxidant enzymes activity
- Probably polyphenols are the main generators of the effect

**Endothelial NO**
- Induction of eNOS protein, eNOS mRNA and NO production in HS-treated endothelial cells cultures
- Vasorelaxant responses in HS-treated aorta rings of hypertensive rats, whereas eNOS and cGMP inhibition decreased relaxations
- Ethyl-acetate extract (containing anthocyanins) had the strongest vasorelaxant effects in isolated aorta of male Wistar rats

**Toxicity**
- Low degree of acute toxicity
- Few studies to evaluate toxicity

**In Vitro, Ex Vivo and Animal Studies**
- LDL
- Prevention of LDL oxidation and lipid accumulation in vitro
- Hypolipidemic effects in HS-treated animals
- Decreased atherosclerotic levels and foam cell formation in HS-treated rabbits
- Total cholesterol, LDL and triglycerides have been lowered in the majority of animal studies. In contrast, HDL was generally not affected

**Human Studies**
- 6 studies analyzed:
  - 31 patients with metabolic syndrome
  - 65 pre- and mildly hypertensive patients
  - 60 mildly hypertensive diabetic patients
  - 75 mildly and moderately hypertensive patients
  - 193 stage 1-2 hypertensive patients
- Decline in systolic and diastolic blood pressure in HS-treated patients
- Not concluding results
- Some studies showed an improvement of lipid profile, others demonstrated no difference in total cholesterol, LDL, and triglycerides in HS-treated group

**Bioactive Compounds**
- Anthocyanins, a group of flavonoids (polyphenols), are considered to be the phytochemicals responsible for the beneficial effects of HS
- Particularly delphinidin 3-sambubioside and cyanidin 3-sambubioside are believed to be the major bioactive compounds
- Anthocyanin metabolites may also contribute to the effects of HS
- Some scientific evidences of anthocyanin-rich extracts: prevent loss of NO-mediated relaxation, oxidative stress protection in endothelial cells, upregulation of eNOS, increased serum antioxidant capacity

6. Future Research

- To find all the bioactive compounds and the molecular pathways of its action
- To standardize the studies: large-scale studies controlled in dose, bioactive compounds, bioavailability and other important variables
- To analyze the influence of HS on lipid profile
- To analyze pharmacological interactions with drugs and adverse effects
- To find an effective dose

7. Conclusions

- ROS levels increase in aging and contribute to cardiovascular risk
- HS increases antioxidant capacity and ROS scavenging
- HS improves endothelial function by increasing NO production and preventing LDL oxidation in vitro
- HS may have an effect on lipid profile
- Studies in hypertensive patients have demonstrated HS is an hypotensive agent
- Anthocyanins are probably the main contributors to the observed effects

8. References