

To Study the Effect of Sour Tea (Hibiscus Sabdariffa) on Lipid Profile in Hypertensive Patients

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Abstract: Hypercholesterolemia, resulting from cholesterol metabolic changes, is a major cause of cardiovascular disturbance, such as atherosclerosis and coronary heart disease [1,2]. It is assumed that the active dietary constituents contributing to these protective effects are antioxidant nutrients such as α -tocopherol, β -carotene, polyphenols and anthocyanins [3,4,5,6]. In a study it is discovered that Hibiscus sabdariffa extract (HSE) inhibited low-density lipoprotein (LDL) oxidation in vitro and decreased serum cholesterol levels in cholesterol-fed rats [7] and rabbits [8]. Therefore, dietary HSE may reduce the incidence of atherosclerosis through their antioxidant activity. Aim of present study was to see the effect of sour tea (Hibiscus sabdariffa) on lipid profile in hypertensive subjects. Selected 100 patients were given Hibiscus sabdariffa tea on daily basis for two months. In our study the mean value of HDL, LDL, VLDL, Triglyceride and TC was 42.84 ± 4.07 , 128.13 ± 14.70 , 26.92 ± 4.92 , 134.59 ± 24.61 and 211.04 ± 36.67 respectively in pretreatment group and 43.38 ± 4.06 , 128.73 ± 11.87 , 27.34 ± 4.30 , 136.72 ± 21.52 and 177.09 ± 18.50 respectively in post treatment group and p value of HDL, LDL, VLDL, Triglyceride and TC was statistically non-significant during pre and post treatment period ($p=0.349$, $p=0.751$, $p=0.521$, $p=0.515$ and $p=0.230$ respectively). Our study shows no significant therapeutic effect of HS extract on lipid profile of hypertensive subjects. In folk medicine, the HS calyx extracts are used for the treatment of several complaints, including high blood pressure, liver diseases and fever.

Keywords: Hibiscus sabdariffa (HS), Very low-density lipoprotein (VLDL), Low density lipoprotein (LDL), High density lipoprotein (HDL), Total Cholesterol (TC).

1. Introduction

Hypercholesterolemia, resulting from cholesterol metabolic changes, is a major cause of cardiovascular disturbance, such as atherosclerosis and coronary heart disease [1,2]. It is determined that the phenol rich extract exhibited a greater ability to decrease total cholesterol and low-density lipoprotein (LDL) and increased high-density lipoprotein (HDL) in a dose-dependent manner suggesting the importance of polyphenols in lowering bad cholesterol levels [9].

It is assumed that the active dietary constituents contributing to these protective effects are antioxidant nutrients such as α -tocopherol, β -carotene, polyphenols and anthocyanins [3,4,5,6].

Dietary HSE may reduce the incidence of atherosclerosis through their antioxidant activity. Sour tea (Hibiscus sabdariffa) is a genus of the Malvaceae family. It has been called by different local names in various countries. In English-speaking countries, it is named roselle or red sorrel and in Arabic it is called karkade. In Iran, it is mainly known as sour tea. The phytochemical, pharmacologic and toxicologic properties of Hibiscus sabdariffa have been investigated in many studies. The calyces of Hibiscus sabdariffa are used in many parts of the world to make cold and hot drinks. Sour tea contains many chemical constituents including alkaloids, L-ascorbic acid, anisaldehyde, anthocyanin, β -carotene, β -sitosterol, citric acid, cyanidin-3 rutinoside, delphinidin, galactose, gossypetin, hibiscetin, mucopolysaccharide, pectin, protocatechuic acid, polysaccharide, quercetin, stearic acid and wax. In folk medicine, the calyx extracts are used for the treatment of several complaints, including high blood pressure, liver diseases and fever. In view of its reported nutritional and pharmacologic properties and relative safety, Hibiscus sabdariffa and compounds isolated from it could be a source of therapeutically useful products [7,8,10]. Potential mechanisms have been tested to explain the positive impact of HS extract on cholesterol metabolism. For example, cholesterol biosynthesis may be reduced by inhibiting 3-hydroxy-3-methyl-glutaryl (HMG)-CoA reductase [11,12]. Decreases in LDL may be the result of the inhibition of triacylglycerol synthesis by hibiscus acid racemization [13]. The positive effects of the extract in diabetic animal models may be partially the result of the reduction in the expression of connective tissue growth factor (CTGF) and receptor for advanced glycation end products (RAGE) [14]. Additionally, although not directly related to the reduction in cholesterol but beneficial for improving cardiovascular risk factors, HS may hinder atherosclerosis and improve vasoreactivity through:

1. Impediment of the formation of macrophage-derived foam cells [15] and/or
2. Inhibition of LDL oxidation due to antioxidant effects of the extract [7,8,16,17,18,19].

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2. Aims and Objectives

To study the effect of hibiscus tea on Lipid Profile in Hypertensive individuals.

A. Material and method

This is a cross-sectional study and carried out in the department of physiology and department of medicine, S.P. Medical College and attached group of hospitals, Bikaner (Rajasthan). The study was conducted on Prehypertensive patients. The duration of study was two months.

Selection of patients: 100 subjects (between 35 -60 years) with hypertension selected for study after fulfilling inclusion criteria.

1) Inclusion criteria

All nonsmoking patients of either sex with systolic BP (SBP) ≥ 140 mmHg and diastolic BP (DBP) ≥ 90 mmHg following JNC7 criteria are enrolled for study.

2) Exclusion criteria:

Patients with secondary hypertension and underlying diseases such as cardiovascular abnormalities, thyroid diseases or diabetes and those who are consuming more than two antihypertensive drugs were excluded from this study.

Data collection: This study was conducted after ethical approval by the Rajasthan University of health & sciences, Jaipur. An informed consent was obtained from all participants.

B. Formulation of hibiscus tea

Sour tea (Hibiscus Sabdariffa) is prepared by taking 2 spoonful of blended (powder) tea per glass brewed in boiling water for 20-30 minutes.

C. Procedure

The subjects included are consuming one glass daily of HS tea prepared for two months and subjects has been assessed for Lipid profile before starting the intervention and after two months of intervention.

3. Result

Table 1
Distribution of cases according to lipid profile of subjects (Hypertensive)
Pretreatment and Post treatment

Lipid profile (mg/dl)	(Hypertensive)		T value	p-value
	Pre-treatment	Post Treatment		
HDL	42.84 \pm 4.07	43.38 \pm 4.06	0.939	0.349
LDL	128.13 \pm 14.70	128.73 \pm 11.87	0.318	0.751
VLDL	26.92 \pm 4.92	27.34 \pm 4.30	0.643	0.521
Triglyceride	134.59 \pm 24.61	136.72 \pm 21.52	0.652	0.515
T. CHOL	211.04 \pm 36.67	177.09 \pm 18.50	1.205	0.230

The above table depicts that the mean value of HDL, LDL, VLDL, Triglyceride and TC was 42.84 \pm 4.07, 128.13 \pm 14.70, 26.92 \pm 4.92, 134.59 \pm 24.61 and 211.04 \pm 36.67 respectively during pretreatment and 43.38 \pm 4.06, 128.73 \pm 11.87, 27.34 \pm 4.30, 136.72 \pm 21.52 and 177.09 \pm 18.50 respectively during post treatment and mean value of HDL, LDL, VLDL, Triglycerides and TC was statistically non-significant (p=0.349, p=0.751, p=0.521, p=0.515 and p=0.230 respectively).

A. Discussion

This study was done to see the effect of hibiscus sabdariffa extract on lipid profile of hypertensive subjects after fulfilling above mentioned inclusion criteria. It was observed that in hypertensive subjects there was no significant change observed in HDL, VLDL, Triglycerides, LDL and total cholesterol. This concludes that there is no significance of the therapeutic effect of HS extract on lipid profile in hypertensive subjects.

In our study the mean value of HDL, LDL, VLDL, Triglyceride and TC was 42.84 \pm 4.07, 128.13 \pm 14.70, 26.92 \pm 4.92, 134.59 \pm 24.61 and 211.04 \pm 36.67 respectively in pretreatment group and 43.38 \pm 4.06, 128.73 \pm 11.87, 27.34 \pm 4.30, 136.72 \pm 21.52 and 177.09 \pm 18.50 respectively in post treatment group and p value of HDL, LDL, VLDL, Triglyceride and TC was statistically non-significant during pre and post treatment period (p=0.349, p=0.751, p=0.521, p=0.515 and p=0.230 respectively). Our study shows no significant therapeutic effect of HS extract on lipid profile of hypertensive subjects. A similar study was conducted by Mohagheghi et al in 2011 to assess the efficiency of HS extract in reducing serum lipid profile of hypertensive patients. Ninety hypertensive patients were randomly assigned to receive Hibiscus Sabdariffa (HS) tea or black tea for 15 days. The patients were asked to drink the tea within 20 minutes following its preparation. This process had to be repeated two times daily. Patient's Fasting Blood Sugar (FBS) and lipid profile were collected at the first visit day (day 0) and on the day 30. There were no significant differences between pre and post experiment values within the two groups. An upward trend in total cholesterol, HDL and LDL was evident in both groups. The increase in total and HDL in both groups relative to their initial values were significant²⁰. The exact effect of HS on lipid profile is unclear. Human and animal studies illustrate different results. It was previously reported that a 10-week administration of HS extract (0.5% and 1%) to cholesterol-fed rabbits resulted in 46%–59% fall in the serum triglyceride and a significant decline in the level of total cholesterol and LDL cholesterol in comparison to the control group⁸. However, the daily oral administration of HS extract to spontaneously hypertensive rats and Wistar Kyoto rats led to no significant changes after 30 days²¹. These discrepancies in results may be due to the duration of the studies, amounts of the administered HS, the number of study population and other factors. Many studies have shown variety of pharmacological effects of HSE like antioxidative, antimutagenic, anticancer and hepato-protective. HSE have potent inhibitory effect on development of atherosclerosis but further studies are required to define the exact hypolipidemic mechanism of HSE.

4. Conclusion

This study has been done with the aim of evaluating therapeutic effect of HSE on lipid profile parameters of hypertensive subjects. We concluded that HSE when given for a period of two months had not improved the lipid profile parameters of hypertensive subjects. As hypercholesterolemia, resulting from cholesterol metabolic changes, is a major cause of cardiovascular disturbance, such as atherosclerosis and

coronary heart disease. Previously done researches have documented a well-known hypocholesterolemic and blood pressure lowering effect of HSE on hypertensive subjects.

El-Saadany et al in 1991, reported the hypocholesterolemic effect of sour tea and attributed it to a number of its components which stimulate hormonal secretions (such as adrenal corticoid hormones) and therefore activate cholesterol metabolic pathways and facilitate its conversion to other products [22]. Though further mechanism of action and other related effects should be done in future.

References

- [1] Kannel WB, Castelli WP, Gordon T, McNamara PM. Serum cholesterol, lipoproteins and the risk of coronary heart disease. *Annals of Internal Medicine*, vol. 74, pp. 1-12, 1971
- [2] Keys A. Coronary heart disease in seven countries. *Circulation* vol. 41, no. 1, pp. 211, 1970.
- [3] Tsuda T, Kato Y, Osawa T. Mechanism for the peroxynitrite scavenging activity by anthocyanins, 484, pp.207-10, 2000.
- [4] Ramirez-Tortosa C, Andersen OM, Gardner PT, Morrice PC, Wood SG, Duthie SJ. Anthocyanin-rich extract decreases indices of lipid peroxidation and DNA damage in vitamin E-depleted rats. *Free Radical Biology and Medicine*, vol. 31, pp. 1033-7, 2000.
- [5] Laura B. Polyphenols: chemistry, dietary sources. Metabolism and nutritional significance. *Nutrition Reviews*, vol. 56, pp. 317 – 33, 1998
- [6] Tsuda T, Shiga K, Ohshima K, Kawakishi S, Osawa T. Inhibition of lipid peroxidation and the active oxygen radical scavenging effect of anthocyanin pigments isolated from *Phaseolus vulgaris* L. *Biochemical Pharmacology*, vol. 52, pp. 1033-9, 1996
- [7] Chen CC, Chou FP, Ho YC, Lin WL, Wang CP, Hao ES. Inhibitory effects of *Hibiscus sabdariffa*, extract on low-density lipoprotein oxidation and anti-hyperlipidemia in fructose-fed and cholesterol-fed rats. *Journal of the Science of Food and Agriculture*, vol. 84, pp. 1989-96, 2004.
- [8] Chen CC, Hsu JD, Wang SF, Chiang HC, Yang MY, Kao ES, Ho YC, Wang CJ. *Hibiscus sabdariffa* extract inhibits the development of atherosclerosis in cholesterol-fed rabbits. *Journal of Agricultural and Food Chemistry*, vol 51, pp. 5472-7, 2003.
- [9] Carvajal-Zarrabal O, Waliszewski S, Barradas-Dermitt D, Orta-Flores Z, Hayward- Jones P, Nolasco-Hipólito C, Angulo-Guerrero O, Sánchez-Ricaño R, Infanzón R, Trujillo P. The consumption of *Hibiscus sabdariffa* dried calyx ethanolic extract reduced lipid profile in rats. *Plant Foods for Human Nutrition*, vol. 60, pp. 153–9, 2005.
- [10] Ali BH, Al WN, Blunden G. Phytochemical, pharmacological and toxicological aspects of *Hibiscus sabdariffa* Linn.: A review. *Phytotherapy Research*, vol. 19, pp. 369–75, 2005.
- [11] Yang MY, Peng CH, Chan KC, Yang YS, Huang CN, Wang CJ. The hypolipidemic effect of *Hibiscus sabdariffa* polyphenols via inhibiting lipogenesis and promoting hepatic lipid clearance. *Journal of Agricultural and Food Chemistry*, vol. 58, pp. 850–9, 2010.
- [12] Duangjai A, Ingkaninan K, Limpeanchob N. Potential mechanisms of hypocholesterolaemic effect of Thai spices/dietary extracts. *Natural Product Research*, vol. 25, pp. 341–52, 2011.
- [13] Carvajal-Zarrabal O, Waliszewski S, Barradas-Dermitt D, Orta-Flores Z, Hayward- Jones P, Nolasco-Hipólito C, Angulo-Guerrero O, Sánchez-Ricaño R, Infanzón R, Trujillo P. The consumption of *Hibiscus sabdariffa* dried calyx ethanolic extract reduced lipid profile in rats. *Plant Foods for Human Nutrition*, 60, pp. 153–9, 2005.
- [14] Peng CH, Chyau CC, Chan KC, Chan TH, Wang CJ, Huang CN. *Hibiscus sabdariffa* polyphenolic extract inhibits hyperglycemia, hyperlipidemia and glycation-oxidative stress while improving insulin resistance. *Journal of Agricultural and Food Chemistry*, vol. 59, pp. 9901–9, 2011.
- [15] Kao ES, Tseng TH, Lee HJ, Chan KC, Wang CJ. Anthocyanin extracted from *Hibiscus* attenuate oxidized LDL-mediated foam cell formation involving regulation of CD36 gene. *Chemico-Biological Interactions*, vol.179, pp. 212–8, 2009.
- [16] Farombi EO, Ige OO. Hypolipidemic and antioxidant effects of ethanolic extract from dried calyx of *Hibiscus sabdariffa* in alloxan-induced diabetic rats. *Fundamental and Clinical Pharmacology*, vol. 21, pp. 601–9, 2007.
- [17] Ochani PC, D'Mello P. Antioxidant and antihyperlipidemic activity of *Hibiscus sabdariffa* Linn leaves and calyces extracts in rats. *Journal of Experimental Biology*, vol. 47, pp. 276–82, 2009.
- [18] Hirunpanich V, Utaipat A, Morales NP, Bunyapraphatsara N, Sato H, Herunsale A, Suthisang C. Hypocholesterolemic and antioxidant effects of aqueous extracts from the dried calyx of *Hibiscus sabdariffa* L. in hypercholesterolemic rats. *Journal of Ethnopharmacology*, vol. 103, pp. 252–60, 2006.
- [19] Lee WC, Wang CJ, Chen YH, Hsu JD, Cheng SY, Chen HC, Lee HJ. Polyphenol extracts From *Hibiscus sabdariffa* Linnaeus attenuate nephropathy in experimental type 1 diabetes. *Journal of Agricultural and Food Chemistry*, vol. 57, pp. 2206–10, 2009.
- [20] Kuriyan R, Kumar D, Rajendran R, Kurpad A. An evaluation of the hypolipidemic effect of an extract of *Hibiscus sabdariffa* leaves in hyperlipidemic Indians. *BMC Complementary and Alternative Medicine* vol. pp. 10: 27, 2010.
- [21] Onyenekwe PC, Ajani EO, Ameh DA, Gamaniel KS. “Antihypertensive effect of roselle (*Hibiscus Sabdariffa*) calyx infusion in spontaneously hypertensive rats and a comparison of its toxicity with that in Wistar rats”. *Cell Biochemistry and Function*, vol. 17, pp. 199–206, 1999.
- [22] El-Saadany SS. Biochemical dynamics and hypo-cholesterolemic action of *hibiscus sabdariffa* (karkade), vol. 35, pp. 567-76, 1991