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EFFECT OF SUPPLEMENTING HIBISCUS SABDARIFFA JAM ON HYPERCHOLESTEROLEMIC SUBJECTS

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Abstract: This study has been undertaken with an objective of supplementing Hibiscus sabdariffa jam to hypercholesterolemic subjects and evaluate the effect of it. Thirty subjects between the age group of 40-65 years under anticholesterolemic agents were selected. Fifteen subjects were randomly assigned to a control and experimental group with cholesterol levels of 175-327mg/dl. Fifteen gram of Hibiscus sabdariffa jam was supplemented to an experimental group for 45 days. Serum cholesterol levels were evaluated at baseline, 23rd day and 45thday. At 45th day of supplementation, there was a significant reduction in serum cholesterol levels from 223.1±35.2mg/dl to 186.8±31.7 mg/dl which was significant at 1% level. This study concludes that intake of 15g of Hibiscus sabdariffa jam along with anticholesterolemic drugs lowers the total cholesterol.

Index Terms **- Hibiscus sabdariffa, Antihypercholesterolemic effect, Hypercholesterolemia, Hibiscus sabdariffa jam**

I. INTRODUCTION

Hyperlipidemia is a strong risk factor for CVD. There is an established association between lipid concentrations and the risk of CVD. Lower cholesterol levels result in reduced risk of cardiovascular morbidity or mortality **[1]**. In recent years, a considerable importance has been given to functional foods. Apart from their basic nutritional effects, the functional foods exhibit an important role in disease prevention, or slowing the progression of many chronic illnesses. They may be composed of single compounds that are physiologically active or may include the addition of other food components to make them functional including omega fatty acids, prebiotics, phytochemicals, and bioactive peptides **[2]**. These components from natural resources have contributed significantly to the development of new drugs from medicinal plants Hibiscus sabdariffa is also known as Roselle or Rosella.It belongs to the family of Malvaceae. The Calyx infusion (Sudan Tea) is taken to relieve coughs and remedy for biliousness and are also used to lower the body temperature . The drinks are also used to treat liver disease, fever, hypercholesterolemia, hypertension, antispasmodic and antimicrobial agents **[3]**. Phytochemicals present in Hibiscus sabdariffa are anthocyanins and protocatechuic acid. Anti-inflammatory and antioxidative properties of anthocyanins show beneficial effects in the cardiovascular system. Anthocyanins present in Hibiscus sabdariffa are delphinidin 3-sambubioside, cyanidin 3-sambubioside, delphinidin 3-glucoside and cyanidin 3-glucoside **[4]**. Hibiscus sabdariffa extract powder (HSEP) had significantly reduced total cholesterol and LDL-c and increased HDL-c in both men and women with metabolic syndrome. However, only a few human experimental studies related to cholesterol lowering effects of HSE are available. **[5]**

Therefore, in this study a standardised recipe of Hibiscus sabdariffa jam is used to investigate whether the intake of HS jam decreases serum cholesterol levels in humans.

II. METHODOLOGY

2.1 HS jam preparation

2.1.1 Pre-preparation

The dried Hibiscus sabdariffa calyces were procured and made into fine powder by using an electric mixer. 10g of agar-agar was cleaned, washed and soaked into 10- 20ml of water.

2.1.2 Preparation

15g of Hibiscus sabdariffa calyces powder was mixed with 10ml of water. Then the mixture was poured into a sauce pan and boiled till it turned into a thick consistency. Then 10-20 ml of water was boiled separately to which soaked agar agar was added after straining the water and it was boiled until it dissolves completely. In a sauce pan at medium heat, 50ml of water, 50g of sugar were boiled together. The mixture was boiled and stirred constantly until sugar dissolved and formed a sticky (thread) consistency. Hibiscus sabdariffa, agar-agar mixture was added to the sugar syrup and mixed well for it to blend together. After 3-5 minutes, thick consistency (jam) was obtained. It was then allowed to cool and transferred into an airtight container and refrigerated.

2.1.3 Packaging

15g of Hibiscus sabdariffa jam was measured in a measuring spoon and packed in a zip lock cover.
The developed product contained carbohydrates - 29.5g/100g and anthocyanins-12.35mg/ 100 g.

2.2 Subjects

Thirty subjects (Table 1) were recruited for the study. All subjects had an elevated cholesterol level determined by screening blood samples

Table 1 Physical characteristics of subjects (n=30)

S.no.	Age	Sex	Serum cholesterol (mg/dl)	S.no.	Age	Sex	Serum cholesterol (mg/dl)
1	57	F	301	16	54	M	184
2	57	F	263	17	52	F	228
3	58	F	194	18	63	F	187
4	57	F	224	19	41	F	189
5	55	M	181	20	58	M	203
6	65	M	199	21	52	F	191
7	56	M	219	22	50	M	202
8	58	M	188	23	60	M	208
9	63	M	185	24	47	F	224.7
10	65	M	201	25	59	F	217
11	53	F	192	26	49	M	292
12	61	F	215	27	51	F	249.5
13	44	F	209	28	51	F	226.5
14	54	F	181	29	52	M	253
15	55	M	190	30	57	M	293

2.3 Study design

The study design opted for control group design. In this study the subjects were randomly divided into two groups, control and experimental groups with fifteen subjects in each group. Duration of the study was forty-five days. Initially the basal serum cholesterol levels of all the subjects were measured. Control group was instructed to take a regular diet and medications. Experimental group was supplemented with 15g of Hibiscus Sabdariffa jam for 45 days. Ten packets were given to a subject and he/she was instructed to have one packet each day. For every ten days jam packets were provided.

2.4 Outcome measures

Serum cholesterol was assessed on the 23rd and 45th day. 3ml of blood was drawn as per standard procedure by a professional phlebotomist. Serum cholesterol was assessed for both control and experimental groups to monitor the effect of supplementation.

2.5 Statistical analysis

The collected data was analyzed with the SPSS 16.0 version. To describe the data descriptive statistics the mean and standard deviation (SD) were used. To find the significant difference between the paired groups repeated measures of ANOVA were used. In the above statistical tools, the probability value 0.005 is considered as a significant level.

III. RESULT AND DISCUSSION

3.1 Effect of HS jam on serum cholesterol level

The average baseline serum cholesterol level in the control group was 209.4±33.1. On the twenty third day of the treatment the cholesterol level was 207.5.±32.6. After 45 days the average serum cholesterol was 205±32.5. The average baseline cholesterol level in the experimental group was 223.1±35.2. After twenty-three days the average serum cholesterol level was 207.6±32.9. By forty fifth day the average serum cholesterol level was 186.8±31.7

Table 2 Comparison of total cholesterol in control group

Interval- Total cholesterol (mg/dl)		p value
Baseline 209.4±33.1	Mid value 207.5.±32.6	0.032 **
	Final value 205±32.5	0.000 **
Mid value 207.5.±32.6	Baseline 209.4±33.1	0.032 **
	Final value 205±32.5	0.000 **
Final value 205±32.5	Baseline 209.4±33.1	0.000 **
	Mid value 207.5.±32.6	0.000 **

** significant at 1% level

In comparison, the average serum cholesterol level (Table 2) in the control group from baseline to 23rd day and 45th day was significant ($p \leq 0.05$). And also, the average serum cholesterol level from 23rd day to 45th day was found to be significant ($p \leq 0.01$).

Table 3 comparison of total cholesterol in experimental group

Interval- Total cholesterol (mg/dl)		p value
Baseline 223.1±35.2	Mid value 207.6±32.9	0.000 **
	Final value 186.8±31.7	0.000 **
Mid value 207.6±32.9	Baseline 223.1±35.2	0.000 **
	Final value 186.8±31.7	0.000 **
Final value 186.8±31.7	Baseline 223.1±35.2	0.000 **
	Mid value 207.6±32.9	0.000 **

** significant at 1% level

In comparison, the average serum cholesterol level (Table 3) in the experimental group showed that the reduction among the experimental group from baseline to 23rdday, 23rd to 45th day and baseline to 45th day was found to be highly significant ($p \leq 0.01$).

Table 4 Comparison of difference in total cholesterol level from baseline to 23rdday

Group	Difference in total cholesterol (mg/dl) Mean±SD	P value
Experimental	15.52±9.27	0.00 **
Control	1.88±2.47	

** significant at 1% level

The difference in total cholesterol level from baseline to 23rd day and 45thday was compared (Table 4). On 23rdday the mean difference of total cholesterol in the control group was 1.88±2.47 mg/dl ($p<0.01$) and also the difference in serum cholesterol level in the experimental group was highly significant ($p<0.01$) compared with baseline values 15.52±9.27.

Table 5 Comparison of difference in total cholesterol level from baseline to 45th day

Group	Difference in total cholesterol (mg/dl) Mean±SD	P value
Experimental	36.29±4.4	0.00 **
Control	4.41±2.99	

** significant at 1% level

After supplementation there was a reduction in total cholesterol levels when the baseline and final values were compared (Table 5). The difference between total cholesterol from baseline to 45thday in the experimental group was found to be 36.29±4.4mg/dl, whereas the difference was found to be 4.41±2.99mg/dl in the control group. When the differences were compared the amount of reduction found in the experimental group was found to be higher and it was statistically significant.

In this study the comparison data between before and after treatment showed that serum cholesterol decreased significantly after the 23rd day and also after the 45th day.

Consumption of added sugars has been implicated in increased risk of cardiovascular disease. The American Heart Association has recommended restrictions on calories from added sugars, an upper limit of no more than 150 kcal of added sugars per day for the average adult male and no more than 100 kcal of added sugars per day for the average adult female **[6]**. However the amount of sugar included in the product is within the recommended limit .
In cases like T2DM, the evidence linking intake of sugar directly to diabetes is unconvincing, excess consumption of sweetened foods have an important role in increasing the risk of diabetes **[7]**. Since this study is conducted only on hypercholesterolemic subjects and not diabetic subjects, this product may not be safe for diabetes. Hibiscus sabdariffa calyces based supplement is found to be beneficial in reducing serum total cholesterol levels. Thus, consumption of 15g of Hibiscus sabdariffa jam on a daily basis would help in reducing total cholesterol levels in hypercholesterolemic individuals. Hibiscus sabdariffa significantly decreases serum cholesterol level in humans. Hypolipidemic effect of Hibiscus sabdariffa was highly indicated among all natural foods.

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