ORIGINAL ARTICLE

Lagenaria siceraria: A nutraceutical for good health

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Background: Health education is the essential requirement for the empowerment of developing India. It is the physical, mental, social and nutritional well being of the person. Health and plant foods have an age-old association. Several plant foods are reported to have nutraceutical functions. *Lagenaria siceraria* (bottle gourd) is reported to have several health benefits and hence may be used as a nutraceutical also. **Aim:** To assess the beneficial effect of bottle gourd juice on biochemical parameters of normal healthy subjects. **Materials and Methods:** 200 ml freshly prepared *Lagenaria siceraria* fruit extract (LSFE) was administered every day at fasting state early in the morning to normal healthy subjects. Anthropometric measurements, fasting blood sugar levels, lipid profile, antioxidant status and kidney and liver functions markers were monitored at the beginning and at the end of the 3 months of therapy. **Results:** Analysis of the data using *t*-test revealed that there was significant improvement at $P<0.05$ level in triglycerides (TG), High-Density Lipoprotein-Cholesterol (HDL-c) and Very Low-density Lipoprotein-Cholesterol (VLDL-c) levels. A considerable decrease in risk ratio for heart disease was also observed. There was 3.9% reduction in blood glucose level. A marked improvement in antioxidant status was seen. A significant improvement in kidney function at $P<0.05$ level in urea and uric acid was found. Liver function markers showed significant reduction at $P<0.001$ level in bilirubin levels. **Conclusion:** Findings of the study indicated that LSFE administration may act as a nutraceutical for disease prevention and favour good health

Key words: Antioxidant, health, bottle gourd, *Lagenaria siceraria*, lipid lowering, nutraceutical

INTRODUCTION

The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed.[1] Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine. The indigenous knowledge consists of a vast array of knowledge regarding the use of plant material for health purposes. World Bank Report in 1998 has shown 20% of medicines as contribution from "Indigenous Knowledge World".[2]

The past decade has also witnessed intense interest in "nutraceuticals" in which phytochemical constituents can have long-term health promoting or medicinal qualities. Although the distinction between medicinal plants and nutraceuticals can sometimes be vague, a primary characteristic of the latter is that nutraceuticals have a nutritional role in the diet and the benefits to health may arise from long-term use as foods (*i.e.,* chemoprevention).[3] In contrast, many medicinal plants exert specific medicinal actions without serving a nutritional role in the human diet and may be used in response to specific health problems over short- or long-term intervals.

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Lagenaria siceraria (Molina) Standley syn. *L. leucantha* Rusby; *L. Vulgaris* Ser. (Family: Cucurbitaceae) is commonly known as bottle gourd or Lauki, with bottle, oval or dumbbell-shaped fruit. The fruits of *Lagenaria siceraria* standly (Cucurbitaceae) are widely used for medicinal and nutritional purposes. Modern pharmacological study shows that *L. siceraria* fruit possesses various beneficial effects. Chloroform and alcoholic extract of *L. siceraria* showed significant effects in lowering total cholesterol, triglycerides (TG) and low-density lipoproteins (LDL) along with an increased high-density lipoprotein (HDL) level in triton-induced hyperlipidaemia in rats.[4] *L. siceraria* fruit showed maximum antioxidant activity against *in vitro* model using 2-2-Diphinyl -1-picryl hydrazyl radical. The juice as such and its 10 times dilution showed radical scavenging activity.[5] The study evaluates antihypertensive, antihyperlipidaemic and antioxidant effect of *L. siceraria* fruit extract in normal subjects.

MATERIALS AND METHODS

Fifty subjects in the age group of 40–60 years were selected for the study. All the subjects were explained the health benefits of bottle gourd juice, verbally as well as with the help of paper handouts. A baseline

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questionnaire requested information on diet pattern, lifestyle, known risk factors for disease and socioeconomic background, *etc*. All the subjects were given counselling about the foods to be taken and avoided during the course of the study, and leaflets containing the relevant dietary guidelines were also provided to each subject although rigid dietary restrictions were not imposed. The subjects were also advised not to change their routine lifestyle during the study period. A written consent was obtained from each participant before registering for the study. The study design and experimental protocols were approved by the Institutional Human Ethics Committee.

Preparation of Bottle Gourd Juice

The fruit of *L. siceraria* was purchased from local vendor of Gwalior. Fruit was washed properly and cut into four vertical pieces, followed by extraction of juice by commercial juicer.

Administration of Juice

Each participating subject was administered with freshly prepared 200 mL *Lagenaria siceraria* fruit extract (LSFE) on empty stomach every day early in the morning, consecutively for 90 days. The subjects were specially instructed to discard the juice if it tasted even slightly bitter. Daily attendance record was maintained throughout the study period.

Monitoring of Anthropometric and Biochemical Variables

Selected anthropometric and biochemical parameters were monitored at regular monthly intervals. The selected subjects were asked to devoid of food for 12 h or overnight before collecting the blood samples. Venous blood samples were drawn; the serum was separated and stored at -20°C for analysis of biochemical parameters.

Anthropometric measurements included determination of body weight and Body Mass Index (BMI). Hypertension was monitored by Sphygmomanometer. Fasting blood glucose level and lipid profile were measured at baseline and at 30, 60 and 90 days of the study period. Blood glucose was assessed by Glucose Oxidase–Peroxidase method,[6] TG using Glycerol phosphate oxidase–peroxidase method,[7] total cholesterol by Cholesterol oxidase–peroxidase method,[8] and HDL-c by Phosphotungstate Method[9]. All the estimations were carried out by spectrophotometric assay employing commercially available kits. LDL-c and VLDL-c were calculated from Freidewald's formula. Risk factor for cardiovascular disease was calculated at every 1-month interval.

Kidney function was monitored by studying the changes in urea[10] and uric acid by using uricase/PAP method.[11] Liver function markers were assessed by the estimation of bilirubin level by modified Jendrassik and Grof's method[12] Serum glutamate pyruvate transaminase (SGPT) level and Serum glutamate oxaloacetate transaminase (SGOT) level by modified IFCC methods.[13] Commercial kits manufactured by Crest Biosystems, verna, Goa, India Pvt. Ltd. were used for the estimations.

Markers of oxidative stress such as super oxide dismutase (SOD),[14] catalase,[15], reduced glutathione (GSH)[16] and lipid peroxidation (TBARS level),[17] and protein estimation[18] were monitored once at the beginning (0th day) of the study and at the end of the study (90th day). Statistical analysis of data was carried out by paired *t-Test* using Microsoft excel 2007.

Feedback of the Subjects

Feedback on acceptability and the viewpoints of participating subjects were recorded at the end of the study.

RESULTS

Fasting blood glucose level and lipid profile of the subjects administered with LSFE has been presented in Table 1, which indicates a significant improvement (P<0.05) in serum HDL-c (mean increment of 16.7%) and VLDL-c levels (mean reduction of 18.1%) A marginal decrease in fasting blood glucose and total cholesterol was observed at the end of the study with mean change of 3.9% and 3.0%, respectively. A considerable reduction in the TG (22.1%) and LDL-c (17.9%) level was also noted.

The data presented in Table 2 shows that there was appreciable improvement in antioxidant levels after administration of LSFE. Marked improvement (elevation of 35.7%) in SOD level was seen. Mean increment of 3.6% and 3% was observed in GSH and Catalase levels, respectively. A mean drop of 8.7% was noted in lipid peroxidation products.

Kidney function markers were also evaluated and it was seen that consumption of LSFE contributed to a significant

Table 1: Effect of bottle gourd juice on blood glucose and lipid level

Parameters	Mean values		Mean % change	*P* value
	Before	After		
Fasting blood glucose	87.5±13.4	84.1±11.2	3.9	0.118
Total cholesterol	132.1±28.8	128.2±28.9	3.0	0.364
Triglycerides	103.6±31.2	80.7±28.2	22.1	0.008
HDL-c	36.2±7.7	43.4±12.7	16.7	0.04*
LDL-c	81.0±34.6	66.5±23.1	17.9	0.144
VLDL-c	19.7±7.5	16.1±5.6	18.1	0.03*
Risk ratio	3.7±1.2	3.2±0.9	14.6	0.140

*P<0.05 as compared to 0th day value; HDL-c – High-density lipoprotein-cholesterol; LDL -c – Low-density lipoproteins cholesterol; VLDL-c – Very low-density lipoprotein-cholesterol

decrease (P<0.05) in urea level (mean drop 34.2%) with a considerable improvement (mean reduction of 22.6%) in uric acid level [Table 3].

Appreciable reduction in SGOT (28.7%) and SGPT (19.1%) was observed, whereas a significant improvement (P<0.001) in bilirubin levels was observed on administration of LSFE [Table 4].

There were no difference in the baseline and final values of body weight and BMI among the subjects. Marginal difference in waist/hip ratio was noticed at the end of the study. Blood pressure remained more or less unchanged during the course of the study. Mean drop of 1.3% was observed in diastolic blood pressure of the subjects [Table 5].

Daily nutrient intake, excluding the supplement provided by the study, as assessed by 7-day food frequency questionnaires showed that all the subjects had more or less similar dietary intakes before and after the study.

Feedback from the Subjects

A positive feedback was obtained. It helped in digestion and relieved constipation. Relief in headache and other body pain was experienced. Subjects felt more energetic and lighter. Subjects felt that LSFE was beneficial for them and was highly acceptable.

DISCUSSION

Medicinal plants have been used for the treatment of many diseases in developing countries where the cost of the conventional medicines presents a burden to the population.[19,20] The present study validated the preventive effect of freshly administered LSFE in human subjects having normal health. A beneficial effect of LSFE was observed on selected parameters like antioxidants, blood glucose level, HDL-c, TG and VLDL-c. The findings obtained are supported by the studies, which revealed the blood cholesterol and TG lowering effects of hydroalcoholic extracts of *L. siceraria*[21] and radical scavenging activity *in vitro*.[22] A marginal improvement in BMI and systolic blood pressure was observed. Considerable improvement in kidney and liver function markers indicated that LSFE has health promoting effect. Diseases associated with high TG levels (diabetes mellitus, obesity, chronic renal disease, primary hyperlipoproteinaemia) carry high risk of cardiovascular disorder.[23] Hypercholesterolaemia is reportedly the major risk factors in lifestyle-related diseases such atherosclerosis and related cardiovascular complications including cerebral paralysis and myocardial infarction.[24] It has been suggested that there is an inverse relationship between dietary intake of antioxidant rich foods and the incidence of human disease.[25] Thus, LSFE having lipid lowring action,being a rich source of soluble fibre and the potential sources of antioxidant molecules and easy to adopt as a nutritional supplement may be advocated as a health tonic, which will prevent approaching metabolic ailments due to increasing stress and modern pace of life.

Table 2: Effect of bottle gourd juice on oxidative stress markers

Parameters	Mean values		Mean % change	*P* value
	Before	After		
GSH	3.1±0.6	3.3±0.5	3.6	0.310
SOD	0.06±0	0.09±0.1	35.7	0.092
Catalase	2.5±3.2	2.6±1.3	3.0	0.471
TBARS	357.5±173.9	326.5±59.6	8.7	0.300

GSH – Reduced glutathione; SOD – Super oxide dismutase; TBARS – Thiobarbituric acid reacting substances

Table 3: Effect of bottle gourd juice on kidney function markers

Parameters	Mean values		Mean % change	*P* value
	Before	After		
Urea	28.9±8.3	19.0±10.5	34.2	0.01*
Uric acid	5.5±1.4	4.3±0.7	22.6	0.008*

*P<0.05 as compared to 0th day value

Table 4: Effect of bottle gourd juice on liver function markers

Parameters	Mean values		Mean % change	*P* value
	Before	After		
Bilirubin	0.8±0.2	0.5±0.1	37.0	0.001**
SGOT	27.3±13.5	22.1±7.4	28.7	0.07
SGPT	34.8±17.1	27.3±12.3	19.1	0.14

**P<0.001 as compared to 0th day value; SGOT – Serum glutamate oxaloacetate transaminase; SGPT – Serum glutamate pyruvate transaminase

Table 5: Effect of bottle gourd juice on anthropometry and blood pressure

Parameters	Mean values		Mean % change	*P*-value
	Before	After		
Body weight	59.6±10.0	59.4±10.5	0.4	0.313
Body mass index	22.3±2.9	22.2±2.8	0.4	0.328
Waist/hip ratio	0.9±0	0.9±0.1	0.1	0.470
Systolic blood pressure	117±4.8	118±4.2	-0.9	0.172
Diastolic blood pressure	78±6.3	77±4.8	1.3	0.339

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