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Effect of supplementation of Purslane (*Portulaca oleracea*) in hypertriglyceridemic subjects

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ABSTRACT

Background: *Portulaca oleracea* (Purslane) has several health benefits. It is listed by the world health organisation as one of the most used medicinal plants and it has been given the term 'global panacea'. Many studies have demonstrated various pharmacological effects of this plant including hypoglycaemic, hypocholesterolemic, hypotriglyceridemic and antioxidant effects.

Methods: A new product was developed using dried *Portulaca oleracea* leaves which was similar to spice powder/chutney powder/karampodi and is used in South India as a food adjunct. The new product developed was used for supplementation studies for 90 days (3 months) among hyper triglyceridemic subjects after receiving a written informed consent. Biochemical parameters like lipid profile, i.e., total cholesterol, low density lipoprotein cholesterol, triglycerides, high density lipoprotein cholesterol, very low density lipoprotein cholesterol, kidney function test, liver function test were assessed. Baseline information, their medical history and 24 hr dietary recall was elicited from the subjects through a pretested schedule.

Results: The results have shown that the triglyceride levels were significantly decreased. Total cholesterol and its fractions in the test groups showed significant decrease from pre-supplementation to during-supplementation and were stable at post-supplementation period.

Conclusions: Our results indicated that the spice powder was rich in polyunsaturated fatty acids had a strong hypotriglyceridemic effect.

Keywords: Medicinal, Food adjunct, Hypertriglyceridemic, Supplementation, Cholesterol and fractions

INTRODUCTION

In recent years, there has been an adverse dietary changes seen in the consumption structure of the diet towards a high energy density diet with a greater saturated fat intake (mostly from animal sources) reduced intakes of complex carbohydrates and dietary fibre, and a reduced fruit and vegetable intake. Diets in developing countries like India has been changed with rise in family income. The share of staples, such as cereals, roots and tubers, is found to be

reduced, while that of meat, dairy products and oil crops has increased. With an increase in economic prosperity, there has been an increase in the consumption of animal products, hence the associated excess dietary fats has led to the increase of the non-communicable diseases like wise hyperlipidemia, atherosclerosis, hypertension and Diabetes.¹ In fact, these diseases rank at the second position among the major factors causing death.² The link between intake of animal products and risk of developing CVD has largely been attributed to the intake of saturated fatty acids (SFA). The saturated fat intake increases heart

disease risk factors, including LDL (bad) cholesterol and apolipoprotein B (apoB).¹ Purslane (*Portulaca oleracea*) is a kind of annual plant which belongs to Portulacaceae and is commonly called “pigweed” or “little hogweed” in English, “Khursa/Naunia/Chotalunia” in Hindi, “Gangapaayala/Peddapaayala/Peddapaavilaakukooora” in telugu, “Parippukeerai” in Tamil and “Bruhalloani” in Sanskrit. It can be frequently seen in such places as vegetable gardens and empty spaces as well as any roadside. In the Western style, it can be mainly used with lettuce for salads.³ Also, it can be dried and used as a material for various dishes as well as tea or soup.^{4,5} In Korea, people used to blanch a tender shoot of the plant in summer to preserve them for eating throughout the winter.⁶

Purslane shows higher amounts than many other plants of certain biological components, including oleic acid, linoleic acid and γ -linolenic acid, and has been reported to suppress cancer or be effective in decreasing the occurrence rate of heart diseases.^{7,8} Also, Purslane contains great amounts of nutrients such as tocopherol and ascorbic acid.⁹ Moreover, purslane extract shows an antioxidant activity based on phenolic compounds, including flavonoids, which are known to lower cholesterol or triglyceride levels in hyperlipidemic rats.^{5,10-13} However, there are few studies related to the prevention of hyperlipidemia by purslane.¹⁴⁻¹⁶ To verify the biological effect of purslane on hyperlipidemia, this study focuses on the effect of supplementation of dehydrated Purslane spice powder on the change of the lipid components and diabetics in human subjects.

METHODS

An experimental study was conducted among 60 subjects aged between 40 and 60 years. They were selected from Hyderabad after obtaining a written consent of willingness to participate in the study. The study was conducted for a period of 3 months the subjects were identified from the population who underwent a recent triglyceride, cholesterol screening at, family practice clinics for diabetic screenings at biochemical labs in the BHEL general hospital, Ramachandrapuram, Hyderabad. Subjects were further evaluated using two additional complete fasting lipid profiles that included total cholesterol, LDL, HDL, and triglycerides (TGs). Those whose LDL values were interventions between the 50th and 95th percentile for age and sex (lipid research clinics 1980) and triglyceride values below 300 mg/dl based on the mean of the baseline measurements were invited to participate in the study. The resulting sample (n=60) was grouped for this analysis into experimental and control subgroups. Subjects were supplemented with 15 g a day spice powder of dehydrated Purslane for a period of three months. Biochemical parameters like lipid profile, i.e., total cholesterol, LDL-C triglycerides, HDL, VLDL were assessed.¹⁷⁻²⁰ The kidney functioning capacity was assessed by measuring the levels of serum creatinine, urea and uric acid.²¹⁻²³ Liver function test were assessed by serum bilirubin, alkaline phosphatase,

alkaline amino transferase (SGPT/ALAT) using standard kits with help of Roche/Hitachi 904/911 automatic enzyme analyzer.²⁴⁻²⁶ Baseline information, their medical history and 24 hr dietary recall was elicited from the subjects through a pretested schedule.

Selection criteria

The subjects who consented were included on the criteria that they were screened previously and were recorded with serum triglycerides 160-300 mg/dl total cholesterol (total cholesterol) values between the 50th and 95th percentile for age and sex, as outlined by the lipid research clinics.

Period of study

During the study period of 9 months first 3 months from September 2008 to November 2008 a base line study was conducted, between December 2008 and February 2009 supplementation of the developed product was given and between March 2009 to May 2009 a follow up study was taken up. The covariance of the variables and results of study were measured, statistical analyzed and compared.

RESULTS

The 24 hour dietary recall records were used to determine the average daily intake of cereals, pulses, and certain other foods like green leafy vegetables, other vegetables, milk and milk products, oils and fats and meat and meat products. Daily nutrient intake of cereals, pulses, milk and milk products, oils and fats, and meat and meat products was greater in control than that of experimental for all nutrients studied except for other vegetables and leafy vegetables as seen in (Table 3). Cereals intake averaged 373.2 g/day, (control) and 366.4 g/day (in experimental) for all subjects, 41.6 g/day of pulses for control and 40.5 g/day of pulses for experimental was recorded as daily intake and oils and fats (66.6 g/day in control and 62.4 g/day in experimental), meat and meat products (76.2 g/day in control and 68.2 g/day in experimental) were consumed more than the recommended daily allowances. Subgroup analyses revealed that green leafy vegetables, other vegetables, milk and milk products were consumed less than the RDA.

Pulses, oils and fats, and meat and meat products also were observed to be consumed on the higher side in comparison to the RDA as seen in (Table 3). In both the control and experimental group green leafy vegetables and other vegetables along with milk and milk products were seen to be consumed lesser than the RDA in both the groups.

The TGs were 308.47 mg/dl, 309.13 mg/dl, and 298.40 mg/dl in the consecutive 3 month period prior to supplementation for the study subjects and control had TG values of 217.0, 235.17, and 239.87 mg/dl in the same 3 months period (Table 4). The TG levels were all above

the normal range (TG normal range 60-160 mg/dl) for both control and subjects on Purslane spice powder. The resultant effects of Purslane spice powder for 3 months, it was seen that the triglycerides decreased significantly to 211.9 mg/dl (first month), 147.17 mg/dl (second month), 118.17 (third month) in comparison to the control group

where the mean TG was 248.8 mg/dl. The percentage reduction in triglyceride content at the end of three months was 60.4%. Post supplementation the TG value rose slightly from 119.37 mg/dl to 136.33 mg/dl in the subjects and in the control a high triglyceride value (TG >150 mg/dl).

Table 1: General information of the selected hypertriglyceridemic human subjects.

Parameter (n=30)	Control	Experimental
Sex		
Males N (%)	18 (60)	16 (53.33)
Females N (%)	12 (40)	14 (46.66)
Mean age (years)	48.06 \pm 7.2	47.56 \pm 7.7
Mean height (cm)	154.3 \pm 4.62	155.3 \pm 4.51
Mean weight (kg)	69.2 \pm 6.36	68.40 \pm 5.04
Mean BMI (weight/height)	29.2 \pm 3.81	28.5 \pm 5.61
Categories of BMI		
Normal weight N (%)	7 (23.33)	9 (30)
Over weight N (%)	20 (66.66)	18 (60)
Obese N (%)	3 (10)	3 (10)
Social status		
Middle income N (%)	8 (26.66)	8 (26.66)
Upper middle income N (%)	15 (50)	16 (53.33)
Higher income N (%)	7 (23.33)	6 (20)

Table 2: Medical history of the selected hypertriglyceridemic patients.

Parameters	Control	Experimental
Mean blood pressure (mm/Hg)		
Systole	136 \pm 16.25	134.26 \pm 14.80
Diastole	83.2 \pm 6.71	82.16 \pm 7.67
Mean duration of disease	2.1 \pm 1.52	2.1 \pm 1.48
Oral drug	None	None
Positive family history N (%)		
Mother	1 (3.33)	1 (3.33)
Father	4 (13.33)	5 (16.665)
Brother	2 (6.66)	1 (3.33)
Both parents	2 (6.66)	1 (3.33)
Grand parents	-	-
Negative history N (%)	21 (70)	22 (73.33)
Personal habits N(%)		
Smoking	2 (6.66)	1 (3.33)
Alcohol	2 (6.66)	2 (6.66)
None	26 (86.66)	27 (90)

The effects of *Portulaca oleracea* spice powder on lipid profile levels were examined at the end of every month during the entire 9 month period of study. The total lipid profile levels of the subjects who were on the spice powder supplementation substantially decreased compared to the levels in the control group during supplementation. In the experimental group on supplementation with spice powder of *Portulaca oleracea* total cholesterol decreased from 161.7 to 143.3 mg/dl,

LDL from 115.4 to 94.6 mg/dl, VLDL from 59.7 to 23.77 mg/dl and HDL increased and is reflected in table-5 from 36.17 to 48.3 mg/dl. Post supplementation the increases in total cholesterol, LDL-cholesterol (LDL-C), and VLDL-C concentrations, compared to the control group in respective values were substantial. Ratio of total cholesterol/HDL showed no significant differences in males and females. All the test group subjects are below risk level (<4.5 level in males and <4.0 in females during

supplementation of spice powder and post supplementation periods slight increase was seen. Control group subjects are at mild to moderate risk level were regularly followed up and nutrition education was given to them. LDL/HDL ratio also has shown similar effect.

Table 3: Mean food intake of hypertriglyceridemia subjects by 24 hour dietary recall method.

Food groups (g)	Control (n=30)	Experimental (n=30)	RDA
Cereals	373.2±55.9	366.4±43.3	250
Pulses	41.6±20.1	40.5±14.4	30
Green leafy vegetables	43.7±17.3	45.4±26.2	200
Other vegetables	107.7±68.8	108.2±51.3	200
Milk and milk products	110.2±68.6	109.159.9	150
Oils and fats	66.6±36.1	62.4±33.3	20
Meat and meat products	76.2±9.97	68.2710.1	40

The kidney functioning capacity was assessed in this study by measuring the levels of serum creatinine, urea and uric acid in the serum of the subjects and controls as depicted in (Table 6). Kidneys remove metabolic wastes such as urea, uric acid, creatinine and ions, so optimum chemical composition of body fluids is maintained. Administration of spice powder of Purslane showed announced significant decrease ($p < 0.05$) in the levels of serum urea, creatinine, and serum uric acid as compared with the hypertriglyceridemic control group. The reduced levels of creatinine in serum during supplementation may imply that, the spice powder had interfered with creatinine metabolism and its eventual excretion from the blood.

Liver functions in hypertriglyceridemia

The overall ALT alanine transaminase or alanine amino transferase or SGPT concentrations decreased significantly from 23.2 u/l to 20.7 u/l (Table 7). The serum bilirubin activity of the spice powder of purslane has been studied in 30 hyper triglyceridemic patients. The patients were studied at 3 month intervals during 3 months of pre supplementation and 3 months of supplementation and 3 months of post supplementation of the twice a day 7.5 g (total 15 g) spice powder daily.

At the end of administration, serum bilirubin which was high prior to the 3 direct months from 0.79 mg/dl significantly was suppressed from 0.76 mg/dl to 0.65 mg/dl and later a slight increase in the consequent 3 month period of post supplementation to 0.73 mg/dl was

seen, in (Table 7). It evidently showed that the spice powder of Purslane administration significantly suppressed increases in serum bilirubin, serum alkphosphatase, and alanine aminotransferase when compared to the control group.

DISCUSSION

Along-standing association exists between elevated triglyceride levels and cardio vascular disease (CVD).^{27,28} Special attention has been paid recently to natural products and alternatives by specialists to minimize problems and complications of diseases.²⁹ *Portulacaoleracea* which was rich in omega- 3 fatty acids as seen earlier and studied by several investigators, is known to regulate lipid and sugar metabolism in the body hence it was further chosen for this study to see the changes of effect of supplementation of the 15 g a day spice powder of *Portulacaoleracea* in hypertriglyceridemic subjects in pre supplementation, during supplementation and post supplementation.

It was seen that there was 31 to 60% reduction in serum triglycerides levels of hypertriglyceridemic subjects after supplementation of *Portulacaoleracea* spice powder in the test group. Post supplementation the TG value rose slightly from 119.37 ± 11.49 mg/dl to 136.33 ± 10.86 mg/dl in the subjects and in the control group a high triglyceride value (TG > 150 mg/dl) 248.76 ± 10.47 was seen which correlated with Gao et al who studied the effect of supplementation of polysaccharide from *Portulacaoleracea* for 28 days in aloxan induced diabetic rats and which resulted in a significant decrease in triglycerides.³⁰ All the test group subjects were below risk level (< 4.5 level in males and < 4.0 in females during supplementation of spice powder and post supplementation period slight increase was seen. Control group subjects were at mild to moderate risk level and were given nutrition education. Results also are agreed with Ford et al who stated that the increase in HDL-C is one of the most important criteria of anti-hypercholesterolemic agent.³¹

One of the metabolic waste uric acid has been shown to have a mechanistic role in atherosclerosis both by scavenging nitric oxide and, from studies reducing concentrations of uric acid with allopurinol, by improving endothelial dysfunction.³² Administration of spice powder of *Portulacaoleracea* showed significant decrease ($p < 0.05$) in the levels of serum urea, creatinine, and serum uric acid as compared with the hypertriglyceridemic control group. A study by Dkhil et al showed that *Portulacaoleracea* administration at 1.5 mg/kg *Portulacaoleracea* aqueous juice for 12 days caused significant decrease in urea and creatinine respectively. Hypertriglyceridemia often leads to liver damage and progress to liver cirrhosis and failure with severe morbidity, ultimately leading to mortality abnormalities and is frequently observed in patients receiving parenteral nutrition.^{34,35}

Table 4: Effect of spice powder supplementation on serum triglyceride levels of hyper triglyceridemic subjects (n=30).

Period of supplementation (months)	Triglyceride levels (mg/dl)	% reduction	Normal values
Pre-supplementation			
1	308.47±56 (217.0±57.8)	-	
2	309.13±59.13* (235.17±22.73)	-	
3	298.40±82.36 (239.87±23.12)	-	
During supplementation			
1	211.9±60 * (242.07±22)	31.3	
2	147.17±25.55* (244.80±26)	52.4	60-160 mg/dl
3	118.17±11.41* (246.87±21.55)	60.4	
Post supplementation			
1	119.37±11.49* (247.33±15.77)	-	
2	133.30±10.74* (248.63±13.92)	-	
3	136.33±10.86* (248.76±10.47)	-	

*Significant at 0.05% level (p<0.05)

Table 5: Effect of *Portulacaoleracea* spice powder supplementation on lipid profile in hyper triglyceridemic subjects (n=30).

Period of supplementation	Cholesterol levels (mg/dl) 125-200	LDL-C levels (mg/dl) 85-130	HDL-C levels (mg/dl) 30-65	VLDL-C levels (mg/dl) 5-40
Pre supplementation				
1st month	164.03±11.44 (158.03±4.64)	121.9±9.6 (126.4±8.00)	35.27±3.6 (32.67±3.7)	61.87±11.05 (46.07±4.7)
2nd month	162.07±11.62 (161.77±5.14)	120.8±8.0 (127.97±7.05)	36.0±4.3 (31.3±3.4)	62.0±11.61 (47.8±4.5)
3rd month	161.70±10.37 (165.83±5.22)	115.4±10.0 (128.8±7.2)	36.17±4.22 (31.5±3.65)	59.73±16.43 (47.17±4.62)
During supplementation				
1st month	149.63±7.9 * (170.57±8.63)	103.13±7.90* (130.37±6.44)	45.0±2.7 * (30.03±3.0)	41.77±9.5* (46.33±4.5)
2nd month	146.27±6.92* (172.73±8.32)	96.17±6.58 * (132.43±5.78)	46.83±3.1* (29.13±3.1)	29.53±5.0* (47.4±5.2)
3rd month	143.3±7.37* (175.0±6.71)	94.6±5.07* (133.1±6.21)	48.3±2.7 (29.57±3.5)	23.77±2.14* (47.83±4.3)
Post supplementation				
1st month	151.3±7.53 * (177.93±7.85)	95.53±4.93* (134.83±5.28)	44.8±3.25* (28.87±3.4)	24.0±2.34* (48.6±3.2)
2nd month	147.07±2.63* (178.60±9.04)	97.50±4.25* (135.07±6.61)	43.27±2.55* (28.03±3.34)	26.97±2.09* (49.27±2.8)
3rd month	151.83±6.45* (179.30±6.74)	98.27±4.33* (135.63±3.7)	41.83±2.11* (28.17±49.43)	27.8±2.25* (49.43±2.12)

*Significant at 0.05% level (p<0.05)

Table 6: Effect of supplementation on blood urea, serum creatinin and serum uric acid in hyper triglyceridemic subjects (n=30).

Period of supplementation	Blood urea (mg/dl)	Serum creatinin (mg/dl)	Serum uric acid (mg/dl)
Pre supplementation	35.53±3.75	0.7±0.1	4.42±.66
1st month	(37.87±3.2)	(0.77±0.1)	(4.57±0.69)
2nd month	35.4±4.0	0.7±0.09	4.38±.66
3rd month	34.53±3.0	0.68±0.07	4.3±0.7
During supplementation	29.07±2.46 *	0.62±0.056 ns	3.72±0.47 ns
1st month	(31.93±3.61)	(0.65±0.056)	(3.95±0.61)
2nd month	27.2±2.78 *	0.61±0.034 ns	3.50±0.47 ns
3rd month	(30.20±4.2)	(0.63±0.054)	(3.74±0.54)
Post supplementation	25.5±3.3 ns	0.62±0.048 ns	3.35±0.38 ns
1st month	(29.8±5.13)	(0.65±0.05)	(3.65±0.53)
2nd month	26.67±4.08 ns	0.633±0.048 ns	3.43±0.39 ns
3rd month	(30.0±4.36)	(0.65±0.05±)	(3.74±0.47)
	27.03±4.0 ns	0.68±0.08 ns	3.52±3.8 ns
	(32.27±3.5)	(0.713±0.068)	(3.82±4.5)

*Significant at 0.05% level (p<0.05); ns: non significant.

Table 7: Effect of spice powder supplementation on liver function test in hyper triglyceridemic subjects (n=30).

Period of supplementation	Serum bilirubin (mg/dl)	Serum alkaline phosphatase (IU/l)	SGPT (U/l)
Pre supplementation	0.79±0.09	8.3±0.99	23.63±3.3
1st month	(0.76±0.11)	(8.23±0.95)	(24.33±3.5)
2nd month	0.78±0.1	8.27±1.0	23.13±3.0
3rd month	(0.77±0.1)	(8.23±0.9)	(24.37±3.0)
During supplementation	0.69±0.08*	7.8±0.56*	21.53±2.1*
1st month	(0.79±0.08)	(8.28±0.71)	(24.93±2.08)
2nd month	0.66±0.66*	7.73±0.69*	21.07±1.94*
3rd month	(0.78±0.62)	(8.5±0.62)	(25.0±1.9)
Post supplementation	0.65±0.067*	7.67±0.60*	20.7±1.70*
1st month	(0.79±0.077)	(8.53±0.63)	(25.04±1.85)
2nd month	0.71±0.079*	8.0±0.64*	21.7±2.07*
3rd month	(0.8±0.08)	(8.59±0.84)	(25.90±1.51)
	0.73±0.084*	8.1±0.8*	22.03±2.35*
	(0.81±0.09)	(8.63±0.7)	(25.93±1.76)

*Significant at 0.05% level (p<0.05).

Test group evidence suggests that steatotic livers more readily develop hepatitis and function abnormalities when exposed to endotoxin.³⁶ Conversely, reduced liver function as a result of lipid infusion is thought to disturb immune function.³⁷ Visschers et al assessed the influence of patient characteristics such as the occurrence of sepsis on changes in triglyceride concentration. The secondary end point included changes in aspartate aminotransaminase (ASAT, U/l), alanine

aminotransaminase (ALAT, U/l), alkaline phosphatase (ALP, U/l), γ -glutamyltranspeptidase (γ -GT, U/l), bilirubin (μ mol/l), glucose (mmol/l), albumin (g/l) and leukocyte count and has seen that increases in triglyceride concentration aggravates or induces hepatocellular and systemic inflammatory effects. So with all the above factors when spice powder made with *Portulaca oleracea* (Purslane) was administered for three straight months in hyper-triglyceridemic subjects the liver function tests

were checked to see the impact of the same. SGPT concentrations decreased significantly from 21.53 u/l to 20.7 u/l. The reduction in SGPT concentration was significantly associated with the control group who had a mean of 22.9 ± 1.6 u/l ALT or SGPT. Determined whether hypertriglyceridemia in healthy Miniature Schnauzers (dogs) is associated with high serum liver enzyme activities and suggested that moderate to severe hypertriglyceridemia was associated with high serum liver enzyme activities. At the end of administration, serum bilirubin which was high prior to the 3 direct months from 0.79 mg/dl significantly was suppressed from 0.69 mg/dl to 0.65 mg/dl and later a slight increase in the consequent 3 month period of post supplementation to 0.73 ± 0.084 mg/dl. Here it evidently shows that the spice powder of *Portulacaoleracea* (Purslane) administration significantly suppressed increases in serum bilirubin, serum alkphosphatase, and alanine aminotransferase when compared to the apparently normal group which was echoed by Dkhil et al who studied that *Portulacaoleracea* (purslane) aqueous extract administration caused a significant reduction in AST, γ -GT, ALP and bilirubin (-7.4, -10.1, -31.0 and 13.3%) respectively while ALT was non significantly changed indicating that *Portulacaoleracea* administration support the function of liver and he further stated that this could probably be due to the presence of antioxidants present in *Portulacaoleracea* in abundance which act against oxidative stress.³³

Limitations

The study subjects who were screened for hypertriglyceridemia also suffered other co morbidities and were consuming oral medications. The impact and interference of the oral medications on the supplementation of the spice powder was not taken into consideration.

CONCLUSION

The present study concludes that the product developed using *Portulacaoleracea* (Purslane) is a helpful plant in prevention of development of hyperlipidemia, fatty liver, etc. through preventing oxidative stress and chronic inflammation, improvement of fat metabolism, decreasing triglycerides, LDL, and total cholesterol, regulating the levels of liver enzymes (transaminases), etc. The study results indicated that the spice powder was rich in polyunsaturated fatty acids had a strong hypolipidemic, hypotriglyceridemic and hypocholesterolemic effects with a reduction of plasma LDL-C levels and an increase in HDL-C levels in hyperlipidemic subjects.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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