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Therapeutic effect of tender coconut (*Cocos nucifera*) on hypertension and hypercholestrolemia

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ABSTRACT

Nowadays foods of health benefits are gaining more importance. Several foods are thought to possess antidiabetic as well as hypocholestrolemic activity. Although many foods may have an impact in treating above mentioned disorders one among them is tender coconut (*Cocos nucifera*) which is known for its electrolytes.The present study was carried out in University of Agricultural Sciences, Bangalore. Subjects who were the regular visitors to the dispensary for the health checkup were selected with the help of medical officer. The study was carried out for three months. The impact of the study was assessed by biochemical profile. The mean values of total cholesterol (TC), low density lipoprotein (LDL), very low density lipoprotein (VLDL) and triglyceride (TG) were found to decrease over the period of 90 days whereas high density lipoprotein (HDL) was found to increase. Mean value of TC and TG decreased from 225.7 mg/dl to 203.7 mg/dl and from 189.1 mm/dl to 165.0 mm/dl with significant difference at 5 per cent level till 45 days and was highly significant till 90 days. Systolic blood pressure showed highly significant decrease after 60 and 90 days ie 147.7 mmHg to 138.3 mmHg and 129.5 mmHg respectively. Similarly significant decrease in diastolic blood pressure was observed. The mean values for diastolic blood pressure dropped from 98.1 mmHg to 86.5 mmHg and 85.5 mmHg over 60 and 90 days respectively in hypertensive and hypercholesterolemia subjects.

Keywords: Tender coconut; therapeutic effect; hypertension; hypercholestrolemia

INTRODUCTION

Tender coconut water is a sweet, delicious and refreshing natural drink. It is the most sterile of all the naturally occurring drinks and also a rich source of life saving electrolytes. Tender coconut has number of medicinal properties and it is an essential component in many ayurvedic preparations. Its numerous medicinal properties have been described elaborately in our ayurvedic literature and no other natural drink tends to such diversity of applications and uses in our traditional systems.

Numerous medicinal properties of tender coconut water reported are: good for feeding infants suffering from intestinal

disturbances, is an oral rehydration medium, contains organic compounds possessing growth promoting properties, keeps the body cool, application on the body prevents prickly heat and summer boils, kills intestinal worms and subsides the rashes caused by small pox, chicken pox, measles etc. Presence of saline and albumen makes it a good drink in cholera cases and urinary infections. It is an excellent tonic for the old and sick, diuretic and effective in the treatment of kidney and urethral stones. It can be injected intravenously in emergency cases as it is a blood plasma substitute because it is sterile and does not produce heat and destroy red blood cells and is readily accepted by the body. It aids the quick absorption of the drugs and makes their peak concentration in the blood easier by its electrolytic effect and urinary antiseptic and eliminates poisons in case of mineral poisoning (Bhagya et al 2010).

The present study was done to find out the effect of tender coconut water on the hypertension and hypercholesterolemia of the people at Bangalore.

MATERIAL and METHODS

Hypertensive and Hyper-cholestrolemic subjects were randomly selected from the UAS dispensary at Bangalore who were regular visitors to the dispensary for their health checkup with the help of medical officer. Health records of the subjects from the dispensary records were taken for the preliminary study. Before the intervention trial consent was taken from all the subjects. 60 ml of tender coconut water was given to subjects daily. The duration of the study was 90 days.

The impact of the study was assessed by anthropometric measurements viz height, weight, BMI, waist/hip ratio and per cent body fat. Blood pressure was recorded at an interval of 30 days whereas biochemical profile like total cholesterol (TC), Triglyceridesn (TG), high density lipoprotein (HDL) and low density lipoprotein (LDL) were estimated at an interval of 45 days.

Anthropometric measurements (Jellife 1996)

Anthropometric measurements viz height (cm), weight (kg), mid upper arm circumference (cm), waist and hip circumference (cm) and skin fold thickness were recorded. Height was measured using anthropometric rod to nearest 0.1 cm. Subjects were weighed on portable platform weighing balance to nearest 0.5 kg without footwear. A narrow flexible tape was used to measure the mid upper arm circumference. The measurements were made to nearest 0.1 cm.

Skin fold thickness

Skin fold caliper was the instrument used to measure skin fold thickness. By using skin fold calipers measurements were taken at different sites.

Triceps

The triceps skin fold site is on the posterior aspect of the right arm over the biceps muscle mid way between the lateral projection of the acromion process at the scapula and inferior margin of the olecranon process of the ulna. Double fold of skin and subcutaneous adipose tissue was grasped with the thumb and index finger of the left hand. Spot was marked and the caliper tip was placed on the site where the sides of the skin fold were approximately parallel and 1 cm distal to where the skin fold was grasped. Measurement was obtained after placing caliper tips on the skin fold.

Superailiac

This skin fold was measured just above the iliac crest at the mid axillary line. The subject stood erectly with the feet together and arms hanging at the sides although the right arm was abducted and flexed slightly to improve access to the site. The skin fold was grasped about one cm posterior to the mid axillary line.

Thigh

The site was vertical skin fold along the mid line of the anterior aspect of the thigh mid way between the junction of the mid line and the lingual crease and the proximal (upper) border of the patella or knee cap. The subject shifted the weight to the left foot and relaxed the leg being measured by slightly flexing the knee with the foot flat on the floor.

Abdomen

The subject stood erect with abdominal muscles relaxed and breathing quietly. A horizontal skin fold three cm to the right of the abdomen and one cm below the umbilicus was selected and measured.

Per cent body fat

The per cent body fat was computed using skin fold measurement viz tricep, abdomen, suprailiac and thigh by referring to the equation and results were interpreted as per below:

Equation for per cent body fat

Males: $0.29288\ (X_2) - 0.00050\ (X_2)^2 + 0.15845\ (X_8) - 5.76377$

Females: $0.29699\ (X_2) - 0.00043\ (X_2)^2 + 0.02963\ (X_8) + 1.4072$

where

X_2= Sum of abdomen, suprailiac, triceps and thigh skin folds

X_8= Age in years

Body mass index (BMI)

BMI was computed according to Naidu et al (1991) by using the formula given by Garrow (1985) to classify the individual as normal, obese or underweight.

$$\text{Body mass index} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

BMI >25:	Obese
18.5-25:	Normal
<18.5:	Lean or under weight

Classification of body fat ranges for persons over 18 years

Classification	Male	Female
Unhealthy range (too low)	d”5%	d”8%
Acceptable range (lower end)	6-15%	9-23%
Acceptable range (upper end)	16-24%	24-31%
Unhealthy range (too high)	e”25%	e”32

Lee and Nieman (2003)

Waist/hip ratio

The abdominal obesity was assessed by waist/ hip ratio (Lean et al 1995).

Male: > 0.95 - Obese
<0.95 - Normal

Female: >0.80 - Obese
<0.80 - Normal

RESULTS and DISCUSSION

General characteristics of the selected subjects

Thirty subjects were recruited for therapeutic study. 53.34 per cent of the subjects belonged to the age group of 50-60 years and 30 per cent to 30-40 years (Table 1). Haynes (1993) reported that age above 40 years increases the risk of diabetes mellitus and cardiovascular diseases. Most of the subjects were literates, employed and belonged to the middle income group or low income group. Most of them were in service (93.34%) and belonged to nuclear family (80%) and were sedentary workers (93%). Sedentary activity is an essential factor in the development of hyperglycemia and associated complecations (Vasanthamani and Savitha 2001). Several factors such as diet, obesity, ethnic background, aging etc have all been shown to influence the development of non-communicable disorders (Raghuram et al 1997).

Out of thirty subjects 8 were diabetic and remaining 22 were having hypertension and hypercholestrolemia.

Anthropometric measurements of hypertensive subjects during therapeutic study (n= 22)

Table 2 depicts the anthropometric measurements of 22 hypertensive subjects. Mean values of BMI and w/h ratio were non-significant at 5 per cent level. BMI decreased from 25.61 to 25.50 but w/h ratio remained same ie 0.91. However per cent body fat was observed to have significant difference at 5 per cent level and mean values decreased from 26.96 to 26.54.

Table 1. Socio-economic profile of subjects selected for therapeutic study of tender coconut water

Characteristic	Respondents (n= 30)	
	#	Per cent
Gender		
Male	18	60.00
Female	12	40.00
Age (years)		
30-40	5	16.66
40-50	9	30.00
50-60	16	53.34
Educational level		
Illiterate	2	6.67
Primary school	3	10.00
High school	4	13.33
PUC	7	23.33
Graduation	13	43.33
Post Graduation	1	3.34
Occupation		
Not in job	2	6.66
In-service	28	93.34
Type of family		
Nuclear	24	80.00
Joint	6	20.00
Activity involved		
Sedentary	28	93.00
Moderate	2	7.00
Income (Rs/month)		
<10,000	4	13.00
10,000-25,000	18	60.00
25,000-50,000	5	17.00
>50,000	3	10.00

Out of the 90 days study mean values of weight were observed to decrease along the intervals ie from 70.85 to 70.20. Till 60 days the difference remained non-significant at 5 per cent level and thereafter it showed significance for males.

Even female subjects showed the similar characteristics wherein BMI and per cent body fat had significant difference with decrease in mean values ie from 24.02 to 23.48 and from 28.63 to 27.72 respectively. However w/h ratio was observed to have

Table 2. Effect of tender coconut water on anthropometric measurements of hypertensive and hypercholestrolemic subjects (n= 22)

Anthropometric measurement	Treatment	Male			Female		
		Mean	SD±	't' value value	Mean	SD±	't' value value
Weight	Initial	70.85	14.10	-	54.80	5.76	-
	30 days	70.80	14.08	NS	54.68	5.63	NS
	60 days	70.62	14.05	NS	53.30	5.54	*
	90 days	70.20	13.75	*	53.10	5.53	*
BMI	Initial	25.61	5.07	-	24.02	0.03	-
	Final	25.50	4.98	NS	23.48	2.95	*
w/h ratio	Initial	0.91	0.05	-	0.78	0.04	-
	Final	0.91	0.05	NS	0.77	0.04	NS
% body fat	Initial	26.96	6.09	-	28.63	6.10	-
	Final	26.54	5.77	*	27.72	4.86	*

*Significant at 5% level, NS= non-significant
BMI= Body Mass Index, w/h ratio - Waist to hip ratio

non-significance characteristics with mean values dropping from 0.78 to 0.77. Finally mean value of weight was found to dip from 54.80 to 53.10. Initially till 30 days difference was non-significant at 5 per cent level and thereafter it continued to remain significant at 5 per cent level for the duration of 90 days.

Effect of tender coconut water on blood pressure of hypertensive subjects during therapeutic study (n= 22)

The effect of tender coconut on blood pressure of hypertensive subjects is depicted in Table 3. The mean values for systolic and diastolic BP (blood pressure) dropped from 147.7 mmHg to 129.5 mmHg and from 98.1 mmHg to 85.5 mmHg. Both systolic and diastolic were non-significant at 5 per cent level till 30 days and thereafter it was having significant difference at 1 per cent level for the next interval of 60 days and 90 days. Both systolic and diastolic blood pressure showed non-significant decrease after 30 days. But systolic blood pressure showed highly significant decrease after 60 and 90 days ie 147.7 mmHg to 138.3 mmHg and 129.5 mmHg respectively. Similarly significant decrease in diastolic blood pressure was observed. The mean values for diastolic blood pressure dropped from 98.1 mmHg to 86.5 mmHg and 85.5 mmHg over 60 and 90 days respectively. Clinical and

Table 3. Effect of tender coconut on blood pressure of hypertensive subjects (n=22)

Treatment	Blood pressure (mmHg)					
	Systolic			Diastolic		
	Mean	SD±	't' value	Mean	SD±	't' value
Initial	147.7	16.7	-	98.1	14.0	-
30 days	142.0	15.5	NS	95.0	95.0	NS
60 days	138.3	18.2	**	86.5	86.5	*
90 days	129.5	13.0	**	85.5	85.5	*

*Significant at 5 per cent level, **Significant at 1 per cent level, NS= non-significant

epidemiological evidence suggests that a high dietary intake of potassium is associated with lower blood pressure which is the most important risk factor for coronary heart disease (Syme et al 2005).

Effect of tender coconut water on lipid profile of hypertensive subjects (n= 22)

The effect of tender coconut on lipid profile is depicted in Table 4. The mean values of total cholesterol (TC), low density lipoprotein (LDL), very low density lipoprotein (VLDL) and triglyceride (TG) were observed to decrease over the period of 90 days wherein high density lipoprotein (HDL) was found to increase. Mean value of TC and TG decreased from 225.7 mg/dl to 203.7 mg/dl and from 189.1 mm/dl to 165.0 mm/dl with significant difference at 5 per cent level till 45 days and was highly significant (at 1%) till 90 days.

For LDL and HDL results were highly significant (at 1%) for whole the duration. But mean values dropped from 159.6 mg/dl to 136.0 mg/dl for LDL and for HDL mean values increased from 43.2 mg/dl to 59.0 mg/dl. Same trend was observed for mean vales of VLDL as well where the values dropped from 41.6 mg/dl to 36.2 mg/dl. Results were non-significant for first 45 days and later results were observed to be highly significant (at 1%) till 90 days (Table 4).

The mean values of TC, LDL, VLDL and TG were observed to decrease over the period of 90 days whereas HDL was found to increase. Mean values of TC and TG decreased from 225.7 mg/dl to 203.7mg/dl and from 189.1 mm/dl to 165.0 mm/dl with significant difference at 5 per cent level till 45 days and were highly significant till 90 days.

For LDL and HDL results were highly significant (at 1% level) for whole of

Table 4. Effect of tender coconut water on lipid profile of hypertensive subjects (n= 22)

interval of observation	Lipid profile (mg/dl)														
	TC			LDL			HDL			VLDL			TG		
	Mean	SD±	't' value	Mean	SD±	't' value	Mean	SD±	't' value	Mean	SD±	't' value	Mean	SD±	't' value
Initial	225.7	45.1	-	159.6	29.9	-	43.2	9.9	-	41.6	13.9	-	189.1	88.0	-
45 days	216.6	46.3	*	148.4	23.0	**	50.5	12.2	**	40.1	12.8	NS	178.0	83.0	*
90 days	203.7	45.2	**	136.0	22.5	**	59.0	13.4	**	36.2	11.2	*	165.0	80.9	**

*Significant at 5 per cent level, **Significant at 1 per cent level
Total cholesterol (TC), Low density lipoprotein (LDL), High density lipoprotein (HDL), Very low density lipoprotein (VLDL), Triglyceride (TG)

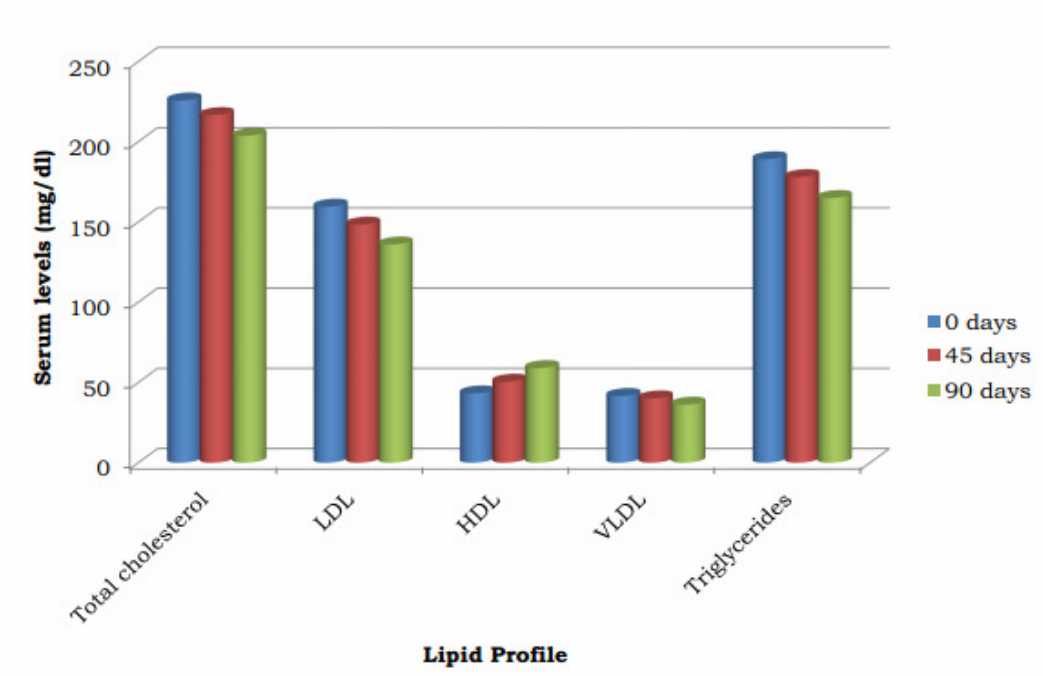

Fig 1. Lipid profile of the selected subjects for the duration of 90 days

the duration. But mean values dropped from 159.6 mg/dl to 136.0 mg/dl for LDL and for HDL mean values increased from 43.2 mg/dl to 59.0 mg/dl. Same trend was observed for mean vales of VLDL as well the values dropped from 41.6 mg/dl to 36.2 mg/dl. Results were non-significant for first 45 days and later results were observed to be highly significant till 90 days.Treatment with TCW reduced the level of total cholesterol, triglycerides and free fatty acids both in serum and tissues. The results suggested that TCW treatment could prevent and reverse high blood pressure probably due to its hypolipedimic effect (Bhagya et al 2010).

CONCLUSION

People know that tender coconut is a good source of electrolytes and minerals. From the therapeutic study conclusion can be derived that tender coconut water helps to control hypertension and hypercholestrolemia by consuming for a period of three months.

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