

## ORIGINAL ARTICLE

# EFFECT OF *TAMARINDUS INDICA* FRUITS ON BLOOD PRESSURE AND LIPID-PROFILE IN HUMAN MODEL: AN *IN VIVO* APPROACH

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## ABSTRACT

Fruits of *Tamarindus indica* were evaluated for their effects on lipid profile, systolic and diastolic blood pressure and body weight in human subjects. Dried and pulverized pulp of *T. indica* fruits, at a dose of 15 mg/kg body weight, was found to reduce total cholesterol level ( $p = 0.031$ ) and LDL-cholesterol level ( $p = 0.004$ ) to a significant extent. Though the fruits exerted no conspicuous effect on body weight and systolic blood pressure, it significantly reduced the diastolic pressure as confirmed by independent sample t-test at 5% significance level.

**Keywords:** *Tamarindus indica*, blood pressure, lipid profile humans.

## INTRODUCTION

Total lipid profile of an individual is a contributive principle resulting from blood cholesterol along with its associated varieties of lipoproteins i.e., high-density lipoproteins (HDL, or  $\alpha$ -lipoproteins), low-density lipoproteins (LDL, or  $\beta$ -lipoproteins), Very-low density lipoproteins (VLDL, or pre- $\beta$ -lipoproteins) and Triglycerides. Disposition of blood pressure and coronary heart disease has been found to be in strong correlation with lipid profile particularly with blood cholesterol level (Cotran, 1999). Natural product medicines from plant sources of wide diversity have long been used effectively in the treatment of blood pressure and higher lipid level (Anderson *et al.*, 1995; Koscielny *et al.*, 1999; Anderson *et al.*, 2000; Castano *et al.*, 2001; Debourdeau *et al.*, 2001; Quiles *et al.*, 2002; Ros *et al.*, 2004; Delaney *et al.*, 2003).

*Tamarindus indica L* is a plant growing and cultivated widely in Bangladesh. The fruit is locally known as Tentul (Tamarind). Fruits of *T. indica L* are used in Bangladeshi folk medicine for their carminative, laxative and digestive properties. Leaves and seeds are astringent while tender leaves and flowers possess antibilious properties. Bark is reported to be prescribed in asthma, amenorrhoea and as febrifuge (Yusuf *et al.*, 1994). *T. indica* fruits have been investigated for its cholesterol-lowering effect on rat, however no similar work has been reported in human model.

In this research, the effect of dried and pulverized pulp of *T.*

*indica* fruit (oral administration) on serum cholesterol, HDL- and LDL-cholesterol and triglycerides have been studied in human models to look for their possible cholesterol lowering activity. In addition, since cholesterol level is intimately associated with body weight and blood pressure, the effect of fruit pulp has also been evaluated on these two parameters.

## EXPERIMENTAL

### *Plant material*

Fruits of *T. indica* were locally collected from cultivated plants in Dhaka (Bangladesh). The plant was identified by Bangladesh National Herbarium, where voucher specimens have been deposited for future reference.

### *Tested material*

Dried and pulverized pulp of *T. indica* fruit.

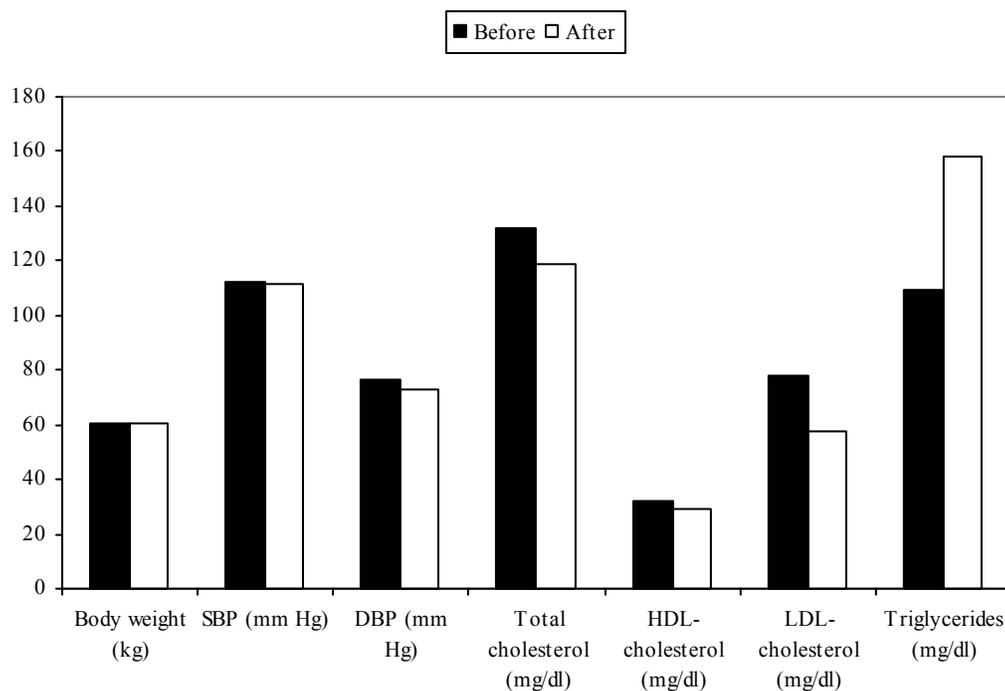
### *Study subjects and protocol*

Twenty male and ten female volunteers ( $n=30$ ) were chosen randomly within the age limit of 25-49. The physical and pathological histories of these volunteers were recorded and normal diet was provided. Volunteers did not take any medicine for two months prior to conduction of study. National protocols for utilizing human subjects were closely adhered. Dried and pulverized pulp of *T. indica* fruit was orally administered at a dose of 15 mg/kg body weight to each of the experimental volunteers ( $n=15$ ) twice a day for 4 weeks. Body weight, systolic and diastolic blood pressure were recorded with standardized procedure after the oral

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**Table 1:** Effect of tamarind on body weight, blood pressure and lipid profile

	Experimental volunteers (n=15)	Control volunteer (n=15)	P-value
	Mean ± SD	Mean ± SD	
Body weight (kg)	60.1667 ± 10.46180	60.4375 ± 10.80591	0.257
Systolic blood pressure, mm (Hg)	111.3333 ± 10.95313	112.5417 ± 11.13545	0.489
Diastolic blood pressure, mm (Hg)	73.2083 ± 9.20765	76.667 ± 9.49905	0.013
Total cholesterol (mg/dl)	118.4583 ± 27.90664	131.8333 ± 24.98985	0.031
HDL-cholesterol (mg/dl)	29.1563 ± 7.00972	31.7688 ± 8.39046	0.194
LDL-cholesterol (mg/dl)	57.3646 ± 25.33150	78.1979 ± 26.47688	0.004
Triglycerides (mg/dl)	157.9167 ± 68.29216	109.3333 ± 77.62321	0.016



**Fig. 1:** Graphical presentation of effect of fruits of *T. indica* on body weight, blood pressure, total cholesterol, HDL-cholesterol, LDL-cholesterol and triglyceride.

administration. In control group (n=15) lactose was provided at a dose 15 mg/kg body weight for four weeks to each volunteer and all parameters as mentioned earlier were determined. Ethical permission was obtained from Bangladesh Medical Research Council (BMRC).

**Lipid profile analysis**

Venous blood was collected from the volunteers and allowed to clot. It was then centrifuged for 15 min at 3,000 rpm. Clear serum was then separated from the cells and stored at -80°C if not analyzed immediately.

The serum samples were assayed for total cholesterol (Trinder, 1969; Richmond, 1973; Roeschlau *et al.*, 1974)

and triglyceride (Trinder, 1969; Nagele *et al.*, 1984) was determined by enzymatic method using a commercially available reagent kit (Randox laboratories Ltd., United Kingdom). In order to determine the HDL-cholesterol, low density lipoproteins (LDL and VLDL) and chylomicrone fractions were precipitated quantitatively by the addition of phosphotungstic acid in the serum in presence of magnesium ion (Lopes-Virella *et al.*, 1977). After precipitation sample was centrifuged. Cholesterol concentration in the supernatant fraction was determined by using cholesterol kit. Serum LDL cholesterol was determined according to previously reported methods (Wieland *et al.*, 1999). The low-density lipoproteins (LDL) were precipitated by heparin at their isoelectric point (pH

**Table 2:** Socio-demographic status of volunteers

Parameter	Experimental and control volunteers (n =30)		
	n	%	Mean $\pm$ SDs
<b>Education</b>			
Illiterate	2	6.66	
Secondary	3	10	
Higher secondary	2	6.66	
Graduate and above	23	76.66	
<b>Occupation</b>			
Student	14	46.66	
Service	13	43.33	
Small business	1	3.33	
Unemployed	2	6.66	
<b>Age in years</b>			
25 – 30	27	90	27.4500 $\pm$ 3.37932
31 – 35	1	3.33	
36 – 40	1	3.33	
41 – 45	1	3.33	
<b>Smoking behavior</b>			
Non smoker	14	46.66	
Partial smoker	3	10	
Habituate	13	43.33	
<b>Marital Status</b>			
Married	12	40	
Unmarried	18	60	
Divorced	0	0	

5.12) and centrifuged for 15 minutes at  $\sim$  3000 rpm. The cholesterol concentration of supernatant was determined by using total cholesterol kit.

#### Statistical analysis

Statistical analysis was performed using SPSS windows version 11.5. All values are expressed as mean  $\pm$  SD. For all generated data statistical differences were assessed by independent sample t-test. P values of  $\leq$  0.05 were considered significant. The same experiment was repeated for control group (N=15) with placebo and all the parameters were recorded as stated before.

#### RESULT

This study was attempted to identify the effect of fruits of *T. indica* on body weight, systolic and diastolic blood pressure, total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides. The parameters were measured after the oral administration of tamarind. Table 1 presents the data of body weight, systolic and diastolic blood pressure, total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides. Mean, standard deviation and P-values also for independent sample t-test at 5% significance level are

included in this table 1. The average body weight of 15 control volunteers was 60.43 kg after taking placebo and 60.16 kg for experimental group after taking tamarind. P-value for independent sample t-test was  $>$ 0.05, indicates that there is no significant change in body weight after administration of tamarind to the volunteers. No significant change was also observed in systolic blood pressure after administration of tamarind ( $P >$ 0.05). However, for diastolic blood pressure, P value for independent sample t-test was found to be  $<$ 0.05 which indicates a significant effect of tamarind on diastolic blood pressure. Average diastolic blood pressure was 76.66 mm (Hg) for control group and 73.20 mm (Hg) for experimental group (table 1).

Total blood cholesterol level was significantly reduced from 131.83 mg /dl to 118.45 mg/dl after administration of tamarind ( $P <$ 0.05). Again, tamarind significantly lowered the LDL-cholesterol from 77.98 mg/dl to 57.36 mg/dl with a P-value of 0.016. Tamarind was found to impart no significant effect on HDL cholesterol level at 95% confidence level ( $P >$ 0.05). However, it was observed that, after oral administration of tamarind, there was a significant rise in triglyceride level in blood from 109.33 to 157.91 mg/dl (table 1). The overall result has been shown in fig. 1.

## DISCUSSION

The data generated in this study indicates that, fruits of *T. indica* has a diversified effect on total lipid profile. It was found to impart a significant impact in lowering total cholesterol level and LDL-cholesterol level in body without altering the level of HDL-cholesterol. LDL-cholesterol which is also known as 'bad cholesterol' is taken up by the cells via LDL-receptors. LDL-receptor is a transmembrane glycoprotein that recognizes apoB-100, the exclusive apoprotein of LDLs and takes up LDL molecules through receptor mediated endocytosis. The endocytosed membrane vesicles fuse with lysosomes and, in which the apoproteins are degraded and the cholesterol esters are hydrolyzed to yield free cholesterol. The cholesterol is then incorporated into plasma membrane as necessary. Since tamarind reduced the total cholesterol level, there is probably a decrease in intracellular cholesterol, and it is known that a decrease in intracellular cholesterol level causes an upregulation of LDL-receptor. Pulverized pulp of *T. indica* was also found to reduce the diastolic blood pressure though it had no effect either on systolic blood pressure or body weight. The regulation of blood pressure in humans is a complex interplay between several exogenous and endogenous factors such as renin-angiotensin system or endothelin system. The experiment, though confirms the potentiality of *T. indica* fruits on lowering cholesterol and LDL-cholesterol level, however further investigation is required on larger population to quantify and qualify this issue. Although no group did this particular work to see the effect of fruits of *T. indica* on total lipid profile, similar type of work has been reported using other plants. It has been reported that long-term consumption of foods containing psyllium seed husk has effect on serum lipids in subjects with hypercholesterolemia (Davidson *et al.*, 1998). Psyllium-enriched cereals also lower blood total cholesterol and LDL cholesterol, but not HDL cholesterol, in hypercholesterolemic adults (Olson *et al.*, 1997). Similarly, it has been reported that supplementation with a pine bark extract rich in polyphenols increases plasma antioxidant capacity and alters the plasma lipoprotein profile (Devaraj, 2002). Our findings definitely reveals a new dimension on the effect of fruits of *T. indica*, but further study is required in larger population to quantify and qualify this issue.

## ACKNOWLEDGEMENT

The authors express their gratefulness to BCSIR, Bangladesh for funding this project.

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Received: 10-3-2006 – Accepted: 26-4-2006