

Study on the growth factors and hepatoprotective effect of *Tamarindus indica*

L. pulp aqueous extract in male Wistar rats

SULTANA TURKI ALMOLAFIKH¹, DOHA MUSTAFA ALNOURI¹ and SHAISTA
ARZOO^{1*}

¹Department of Food and Nutrition Sciences, King Saud University, Riyadh-11495, Kingdom of Saudi Arabia

Corresponding author

Shaista Arzoo*

Department of Food and Nutrition Sciences

College of Food and Agriculture Sciences

King Saud University

Riyadh-11495, Kingdom of Saudi Arabia



ABSTRACT

The purpose of this study was to investigate the effect of tamarind juice on growth and liver enzymes. The experiment was conducted on 15 Wistar albino rats, divided into 3 groups. Group 1 was fed with a standard diet (control group), group 2 was fed with a standard diet and 1 ml tamarind extract and group 3 was fed with a standard diet and 2 ml tamarind extract. Statistically insignificant difference was observed between control and experimental groups for total food consumption and food efficiency. Similarly difference was insignificant for initial weight and

final weight but it has been found that change in weight was slightly higher in control group when compared to experimental group. When compared to control group, administration of tamarind did not produce any significant changes in AST and ALT activities in serum but it exhibited antiobesity effect.

Keywords: Tamarind; Liver enzymes; Antiobesity; AST; ALT

1. Introduction

Now a day's natural sources from plants are gaining considerable attention. In recent years; research on the importance of nutrients on the well-being and prevention of disease has gained impetus. Herbs and plants have been widely used as food in the world and have various medicinal benefits as they are used as traditional medicines for the treatment of a wide variety of ailments and disease. Tamarind (*Tamarindus indica* L.) is a tree-type of plant which belongs to the Leguminosae, caesalpinaceae family and grows naturally in many tropical and sub-tropical regions (Martinello et al., 2006). Its fruit pulp is widely used as an acidic flavor in cooking. The fruits have highest levels of protein (2-3/100 gm) and carbohydrate (41.1-61.4 gm) (Fenugchan et al., 1996). It serves as a good source of important minerals (i. e., calcium, potassium and phosphorous), vitamins (i.e thiamine and niacin) and methanol seed, leaf, leaf veins, fruit pulp and skin extracts of *Tamarindus indica* L. possess high phenolic content and antioxidant activities (Razali et al., 2012; Khairunnuur et al., 2009). Its fruit is considered as a digestive, laxative, expectorant, carminative and blood tonic (Komutarin et al., 2004) and the leaves are traditionally used to treat various ailments such as cough, worm infection, rheumatism, jaundice and ulcer (Sreelekha et al., 1993). Liver is the principle organ of biotransformation in the body and so it is very susceptible to damage. Various factors such as alcohol and other chemicals,

environmental, biologic toxins are related with liver diseases that are important public health problem (Kuru, 2014). Severe acute liver disease has been encountered in clinical practice leading to fulminant or acute liver failure (Finlayson et al., 1999). Shammi et al., 2013 mentioned that certain medicines, when taken in overdoses and sometimes even when introduced within therapeutic ranges, may be the cause of liver injury. Researchers are looking for herbal drugs with better hepatoprotective action to cure liver damage. The aim of this study is to find the effect of *Tamarindus indica* L. on growth factors and liver enzymes in Wistar rats.

2. MATERIALS AND METHODS

The experiment was conducted on 15 Wistar albino rats weighing between 110 gm and 140 gm obtained from Experimental Animal Care and Experimental Surgery Center at the Faculty of Medicine, King Saud University, Saudi Arabia. This study is in accordance with the Animal Ethics Committee of the College of Science, King Saud University. The rats were randomly divided by weight into three groups and individually housed in stainless steel cages under controlled temperature (25 ± 2 °C) and relative humidity ($50 \pm 5\%$), with a 12-h light/dark cycle.

2.1. Diets formulation and preparation:

Basal diet was obtained from the General Organization for Grain Silos and Flour Mills, Saudi Arabia. 10 gm of tamarind fruit pulp was mixed in 100 ml boiling water and once it cooled down, the mixture was blended in a blender to obtain tamarind extract. Group 1 was fed with a standard diet (control group), group 2 was fed with a standard diet and 1 ml tamarind extract and group 3 was fed with a standard diet and 2 ml tamarind extract. Tamarind extract was added in 30 ml water in experimental groups. Food and liquid intakes were monitored daily in all groups.

2.2. Assessment of body weight and food consumption

2.2.1. Growth:

Body weight was recorded in the non-fed state at the beginning of study (initial weight) and at time before slaughter (final weight). Weight gain (final body weight (g) – initial body weight (g)) and growth rate (total weight gain (g) /100 days study period) was calculated.

2.2.2. Food Consumption:

Food consumption was analyzed daily in all experiments by calculating the difference between the diet provided (before consumption) and the diet consumed using a calibrated scale with 0.01mg precision. The calculation was performed as follows:

Food consumption per day (g) = diet provided (gm) - diet consumed (g).

2.2.3. Food efficiency:

Food efficiency was calculated by the following formula:

Food efficiency: gain weight / total food consumption

2.3. Plasma liver function test:

The parameters measured include alanine transaminase (ALT) and aspartate transaminase (AST). All parameters (ALT and AST) were analysed by using kit provided by United Diagnostic Industry, Dammam, Saudi Arabia (REF 007 and REF 015 respectively) and measured spectrophotometrically.

2.4. Sampling and sample storage method:

After 22 days, rats were food deprived over-night; 10 ml of blood was collected from rat via orbital sinus in vacutainer heparinized tube and centrifuged at 1000 rpm for 5 min at 4 °C to obtain the plasma and was stored in an eppendorf tube at 4 °C for further analysis.

2.5. Statistical analysis:

Data were analyzed using SPSS statistical software package (version 22) and expressed as mean \pm standard deviation. The differences among treatment groups were analyzed by ANOVA at a significance level of $P \leq 0.05$; if significant differences were found, Post-hoc analysis using Duncan's multiple range tests was performed.

3. RESULTS AND DISCUSSIONS

3.1. Dietary intake and growth rate

Table 1 shows food consumption and growth by the control and experimental Wistar rats. Statistically insignificant difference was observed between control and experimental groups for total food consumption and food efficiency. Similarly difference was insignificant for initial weight and final weight but it has been found that change in weight was slightly higher in control group when compared to experimental group, and in experimental group change in weight (i.e, increase in weight) was higher in T1 group (group consuming 1 ml juice) than T2 (group consuming 2 ml juice). Recently a study was conducted by Ribero et al., (2015) on Wistar rats for 11 days. He divided the rats in four groups as standard diet group, standard diet + 1 ml water, protein free diet and standard diet + 25 mg/kg tamarind trypsin inhibitor (TTI) in 1 ml water. It has been found in his study that 25 mg/Kg TTI treatment caused highest reduction in weight gain. The weight gain data corroborates the food consumption data because the food consumption was least in the group T2 (group consuming highest amount of tamarind juice)

followed by T1 and control group. Similar result was obtained by Ribero et al., (2015). In another study, Azman et al., (2012) investigated the effect of *Tamarindus indica* pulp aqueous extract (TIE) in diet induced obese Sprague dawley rats. He concluded that TIE exhibited anti obesity effects. He found significant reduction in the weight of adipose tissue, as well as lowered the degree of hepatic steatosis in the obesity induced rats.

3.2. Biochemical parameters

AST and ALT serum levels were performed to assess liver function. AST and ALT levels remain the most useful tests for the detection of hepatic cell damage, because both are present in high concentrations in hepatocytes. If hepatocytes or their cell membranes get damaged, then these enzymes leak into the circulation (Kew, 2000). High levels of AST indicate liver damage, ALT catalyses the conversion of alanine to pyruvate and glutamate and is released in similar manners, therefore, ALT is more specific to liver and is thus a better parameter for detecting liver damage (Willianson et al., 1996).

No alterations were detected in the animal groups treated with the tamarind extract, during 3 weeks, when compared to the control group (Table 2). In a study by Ekambaram, 2010 when compared to control animals, administration of tamarind alone did not produce any significant changes in AST and ALT activities in serum. Shammi et al., 2013, concluded that in rats pretreated with paracetamol, serum bilirubin, ALT, AST and ALP increased significantly as compared to control group but significant decrease in serum bilirubin, ALT, AST and ALP was observed following administration of ethanolic extract of leaf and seed of *Tamarindus indica* and vitamin E.

4. CONCLUSION

To summarize, the tamarind juice in this study does not significantly lowered the liver enzymes which might be due to short study period, but change in weight was significant between experimental and control group and it was concluded that it exhibited antiobesity effect but doesn't showed any beneficial effect on liver enzymes.

5. REFERENCES

1. Azman KF, Z Amom, A Azlan, NM Esa, RM Ali, ZM Shah and KK Kadir, 2012, Antiobesity effect of *Tamarindus indica* L. pulp aqueous extract in high-fat diet-induced obese rats, *Journal of Natural Medicine*, Vol. 66, No. 2, p. 333-42.
2. Ekambaram P, T Namitha, S Bhuvaneshwari, S Aruljothi, D Vasanth and M Saravanakumar, 2010, Therapeutic efficacy of *Tamarindus indica* (l) to protect against fluoride-induced oxidative stress in the liver of female rats, *Research report, Fluoride*, Vol. 43, No.2, p.134-140.
3. Feungchan S, T Yimsawat, S Chindaprasert and P Kitpowsong, 1996, Tamarind (*Tamarindus indica* L.) plant genetic resources in Thailand, *Thai Journal of Agricultural Science (Special issue)* Vol. 1, p. 1-11.
4. Finlayson NDC, NC Hayes and Simpson KJ, 1999, Diseases of the liver and biliary system. In: Haslett C, Chilvers ER, Hunter J, editors. *Davidson's Principle and Practice of Medicine*. 18th ed. Churchill Livingstone, Harcourt Brace and Company, p. 683-736.
5. Kew MC, 2000, Serum aminotransferase concentration as evidence of hepatocellular damage, *Lancet*, Vol. 355, No. 9204, p. 591-592.
6. Khairunnuur FA, A Zulkhairi, A Azrina, MM Mohamad Aris, S Khairullizam, MS Zamree and MM Mohd Shahidan, 2009, Nutritional composition, in vitro antioxidant

activity and *Artemia salina* L. lethality of pulp and seed of *Tamarindus indica* L. extracts. Malaysian Journal of Nutrition, Vol. 15, No. 1, p. 65–75.

7. Komutarin T, S Azadi, L Butterworth, D Keil, B Chitsomboon, M Suttajit and BJ Meade, 2004, Extract of the seed coat of *Tamarindus indica* inhibits nitric oxide production by murine macrophages in vitro and in vivo, Food and Chemical Toxicology, Vol. 42, No. 4, p. 649–658.
8. Kuru P, 2014, *Tamarindus indica* and its health related effects, Asian Pacific Journal of Tropical Biomedicine, Vol. 4, No. 9, p. 676-681.
9. Martinello F, SM Soares, JJ Franco, AC Santos, SB Gracia, C Curti and SA Uyemura, 2006, Hypolipemic and antioxidant activities from *Tamarindus indica* L. pulp fruit extract in hypercholesterolemic hamsters, Food and Chemical Toxicology, Vol.44, No. 6, p. 810-81.
10. Razali N, S Mat-Junit, AF Abdul-Muthalib , S Subramaniam and A Abdul-Aziz, 2012, Effects of various solvents on the extraction of antioxidants phenolics from the leaves, seeds, veins and skins of *Tamarindus indica* L, Food Chemistry, Vol. 131, No.2, p. 441-448.
11. Ribeiro JA, AC Serquiz, PF Silva, PB Barbosa, TB Sampio, RF Araujo Jr, AS, Oliveira, RJ, Machado, BL Maciel, AF, Uchoa, EA Santos and AH Morais, 2015, Trypsin inhibitor from tamarindus indica L. seeds reduces weight gain and food consumption and increases plasmatic cholecystokinin levels, Clinics (Sao Paulo), Vol. 70, No.2, p.136-43.
12. Shammi NJ, ZK Choudhry, MI Khan, and MM Hossain, 2013, A comparative study on the hepatoprotective effect of *Tamarindus indica* and vitamin E in long Evans rats, Bangladesh Journal of Medical Biochemistry, Vol. 6, No. 2, p. 63-67.

13. Sreelekha TT, T Vijayakumar, R Ankanthil, KK Vijayan and MK Nair, 1993, Immunomodulatory effects of a polysachcharide from *Tamarindus indica*, *Anti-Cancer Drugs*, Vol. 4, No. 2, p. 209-212.
14. Willianson EM, DT Okpako and FJ Evans, 1996, Selection, Preparation and Pharmacological evaluation of plant material. England: John Wiley, John Wiley & Sons, Chichester, U.K, p. ix + 228.

Table. 1. Growth indicators of males Wister rats fed with *Tamarindus indica*.

	Control	T1 (1 ml juice)	T2 (2 ml juice)
Initial weight (gm)	127.6±2.30 ^a	117.6±5.68 ^b	132.75±4.86 ^a
Final weight (gm)	264.8±29.45 ^a	244.8±9.18 ^a	238.75±8.99 ^a
Change in weight (gm)	137.2±27.88 ^b	127.2±14.67 ^{ab}	106±7.78 ^a
TFC (gm)	508.57±63.49 ^a	488.75±56.96 ^a	467.54±82.41 ^a
FE (%)	0.27±0.034 ^a	0.26±0.02 ^a	0.23±0.028 ^a

Small alphabet letters in each row indicates significant difference among dietary treatment groups separately as indicated by ANOVA followed by Duncan's multiple range tests.

Table. 2. Liver enzymes of males Wister rats fed with *Tamarindus indica*

	Control	T1 (1 ml juice)	T2 (2 ml juice)
ALT (U/L)	73.02±43.03 ^a	54.33±15.67 ^a	71.13±43.23 ^a
AST (U/L)	6.48±3.18 ^a	3.19±2.28 ^a	8.052±7.86 ^a

Small alphabet letters in each row indicates significant difference among dietary treatment groups separately as indicated by ANOVA followed by Duncan's multiple range test.