EFFECT OF *AEGLE MARMELOS* FRUIT PULP POWDER ON GLYCEMIC STATUS OF TYPE 2 DIABETIC PATIENTS

Murshida Aziz, Liaquat Ali and Masfida Akhter

Department of Biochemistry, Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders (BIRDEM), 122 Kazi Nazrul Islam Avenue, Shahbag, Dhaka-1000

Abstract

Plant materials are considered to be attractive potential sources of alternate agents in the prevention and management of type 2 diabetes mellitus (T2DM). Different parts of *Aegle marmelos* have been claimed to possess anti-glycemic property. The present study was conducted at Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka, Bangladesh from July 2010 to June 2011 to determine the anti-glycemic effect of *A. marmelos* unripe fruit pulp in T2DM patients. The experiment was conducted under a crossover design and the effects were analyzed during the 0-21 as well as 28-49 days with 7 days wash out period. The data were then pooled and the baseline *versus* endpoint values was also compared. The mean fasting blood glucose (FBG) values did not significantly differ between the two groups at any time points. No significant difference between the baseline and end point values regarding FBG. The effect on blood glucose was not significant in any of the analysis. This study did not reveal any anti-glycemic effect of *A. marmelos* fruit pulp in T2DM patients.

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Introduction

Diabetes mellitus (DM) is a common endocrine and metabolic disorders affecting large number of people all over the world. It is widely recognized as one of the leading causes of death and disability worldwide.[1,2] It has been estimated that the total diabetic patients in Bangladesh was more than three million in 2000, and this number would rise to 11.1 million by the year 2030. The proportional increase in Bangladesh seemed relatively higher compared to other Asian countries.[3]

Conventionally, Type 1 Diabetes Mellitus (T1DM) is treated with exogenous insulin and T2DM with synthetic oral hypoglycemic agents like sulphonylureas and biguanides.[4] A substantial proportion of T2DM also requires insulin. However, the existing therapeutic agents have considerable limitations in the management of this complex disorder and search for alternate agents are continuing all over the world. Many plant materials had since been described for the treatment of diabetes, but scientific studies with these materials are limited. Among traditional medicinal plants, *Aegle marmelos* (Bael in Bengali) has enormous traditional uses against various diseases. Traditionally, various parts of the plant, *Aegle marmelos*, are used for the treatment of a variety of disorders. *Aegle marmelos* originated in India and is presently growing in most of the countries of Southeast Asia.[5] Extensive chemical investigation on various parts of the tree have been carried out and more than 100 compounds have been isolated. The bioactive compounds isolated from these fruits were marmelosin, luvangetin, aurapten, psoralen, marmelide and tannin.

Aqueous leaf extract (250 & 500mg/kg, orally) produced hypoglycemic effect and increased plasma insulin level of STZ-diabetic rats. Anti-hyperglycemic activity was seen by leaf extract (250mg/kg, orally) in glucose fed hyperglycemic rats.[6] Aqueous fruit extract (250mg/kg, twice daily for one month) produce anti-

Address for Correspondence:

Dr. Murshida Aziz, Assistant Professor, Department of Biochemistry, Ibrahim Medical College, 122 Kazi Nazrul Islam Avenue, Shahbag, Dhaka-1000

hyperglycemic effect along with decreasing glycosylated heamoglobin level in STZ induced diabetic albino wistar rats.[7] Although a number of studies in STZ and alloxan induced diabetic rat model were conducted with *A. marmelos,* but no study had yet been done on human with T2DM.

In the above context, the present study was undertaken to explore the anti-glycemic effects of *A. marmelos* unripe fruit pulp powder in patients with T2DM.

Materials and Methods

Study place and population: The study was conducted in Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka, Bangladesh from July 2010 to June 2011. It was an un-blinded clinical trial conducted under a cross-over design. Previously diagnosed thirty T2DM cases were included in the study. T2DM cases were enrolled from the out-patient department of BIRDEM. The socio-demographic data of all the participants were recorded in a pre-designed questionnaire. They were advised to take their usual diet, to do normal physical activities and to continue their prescribed drugs during the experimental period. Patients unwilling to give consent, insulin dependent DM, pregnant or lactating women, patients with cardiovascular, renal, hepatic, endocrine, metabolic disorders were excluded.

Preparation of A. marmelos fruit pulp powder: Unripe fruits of *Aegle marmelos* were collected from specific area of Chapainawabgonj. Fruit pulps of *A. marmelos* (FPAM) were dried in sunlight for 5 to 6 days, coarsely powdered by grinder machine and stored in a dry cool place.

Study procedure: The fasting blood samples of all the study participants were collected at day zero for estimation of fasting blood glucose levels (FBG). They were then divided randomly into Group A and B each consisting of 15 cases. First, one group (Group A) was given 7 gm of *A. marmelos* fruit pulp powder in one glass of water daily before breakfast for 21 days while another group (Group B) was on their usual diet for 21 days. The dose of 7 gm fruit pulp powder was determined based on earlier study.[8] The fasting blood samples of both groups were collected on 21st day. After 7 days of wash out period, the fasting blood samples were again collected on the 28th day from both the groups. The groups were then crossed over and the cases who consumed *A. marmelos* pulp drink in the first 21 days started their usual diet and the other cases started to consume the *A. marmelos* pulp drink for the next 21 days. The final fasting blood sampling was collected on 49th day from both the groups. All blood samples were preserved at -20^{0}C until analyzed.

Statistical analysis was performed using SPSS (Statistical Package for Social Science) software for Windows version-16 (SPSS Inc., Chicago, Illinois, USA). The data were expressed as proportion and mean$\pm$SD (standard deviation) as appropriate. The statistical significance of differences between the values was assessed by paired or unpaired student's t test as appropriate. Correlation analysis between the parameters was done by using Pearson's Correlation test.

Results

A total number of thirty T2DM cases were included in the study. The detail socio-demographic characteristics of the study participants are given in Table-1. The mean age of the study participants was 51.5 $\pm$ 12.0 years. There were 17 males and 13 females. Majority were urban residents. Table 2 shows the glycemic status of T2DM cases after 21 days of daily drink of *A. marmelos* fruit pulp compared to those who did not receive the intervention. No significant difference was found between the fasting blood glucose levels of the intervention group

Table-1: *Socio-demographic characteristics of the study subjects (n=30)*

Variable	Values
Age (years; Mean$\pm$SD)	51.5 $\pm$ 12.0
Sex (number and %)	
Male	17 (57.0)
Female	13 (43.0)
Education (number and %)	
Illiterate	2 (6.7)
Primary	8 (27.0)
Secondary	10 (33.0)
Graduate	10 (33.0)
Occupation (number and %)	
Service	14 (47.0)
Business	6 (20.0)
Housewife	10 (33.0)
Residence (number and %)	
Urban	27 (90.0)
Rural	3 (10.0)

Table-2: *Glycemic status of T2DM cases following A. marmelos fruit pulp drink daily for 21 days among control and intervention groups*

Group	Mean FBG level (mmol/l) at		*p value*
	0 day	21 day	
Group A: Intervention Group (n=15)	10.9 ± 4.1	10.2 ± 5.2	0.65
Group B: Non-Intervention Group (n=15)	10.2 ± 4.7	10.4 ± 4.6	0.82
t/p value	*0.45/0.65*	*-0.16/0.88*	

FBG= Fasting Blood glucose.

compared to non- intervention group after 21 days of fruit pulp administration. Similarly, Table 3 shows the effects of *A marmelos* fruit pulp powder on glycemic status of T2DM cases during 28 to 49 days time period after cross over and 7 days of wash period. No significant difference of fasting blood glucose was observed between the intervention and non-intervention groups after 21 days of *A. marmelos* drink at day 49. Similarly, there was no significant change in fasting blood glucose level after 21 days of fruit pulp drink compared to the initial level in intervention group. There was no significant change of fasting blood glucose levels of all cases (Group A and B) at base point (day zero) *versus* end point (day 49).

Discussion

A number of parts of *A. marmelos* have been studied for the anti-diabetic properties in diabetic rat models. The present one was probably the first study in which a part of the plant was tested on human for anti-diabetic properties. The part chosen was the unripe fruit pulp of *A. marmelos* as this was the commonest part consumed by people as drink and prescribed by the traditional healers in Bangladesh. In fact, a few commercial preparations of the pulp are now available in Bangladesh market with wide spectrum of therapeutic claims including for diabetes. Testing the efficacy and safety of the fruit pulp has thus public health importance.

Table-3: *Glycemic status of T2DM cases following 21 days of A. marmelos fruit pulp drink daily among control and intervention groups after cross over and 7 days wash out period*

Study group	Mean FBG level (mmol/l) at		*p value*
	28 day	49 day	
Group A: Non-Intervention Group (n=15)	10.6 ± 5.8	10.7 ± 3.6	0.94
Group B: Intervention Group	9.7 ± 4.0	10.4 ± 4.4	0.67
t/p value	*-0.52/0.61*	*-0.25/0.81*	

FBG= Fasting Blood glucose.

The present study was conducted under a crossover design and the effects were analyzed for 0-21 as well as 28-49 days (with 7 days wash out period) intervention. The data were then pooled and the baseline versus endpoint values was also compared. The effect on blood glucose level was not significant in any of the analysis. Though, studies in animal showed anti-glycemic effects of different parts of *A. marmelos* plant, but the present study did not reveal any such anti-glycemic effect of *A. marmelos* unripe fruit pulp in T2DM patients. [6, 7] However, the result did not indicate conclusively that *A. marmelos* fruit pulp had no anti-glycemic property as we could not do a dose response curve.

References

1. Zimmet P. Diabetes epidemiology as a tool to trigger diabetes research and care. *Diabetologia* 1999; **42**: 499-518.
2. Songer TJ, Zimmet P. Epidemiology of type II diabetes: an international perspective. *Pharmacoeconemics* 1995; 8: 1-11.
3. Wild S, Roglic G, Green A, Sicree R, King H. Global Prevalence of Diabetes. Estimates for the year 2000 and projections for 2030. *Diabetes Car* 2004; **27**: 1047-1053.
4. Rosac C. The pathophysiological basis of efficacy and clinical experience with new oral antidiabetic agents. *J of Diabetes and its Complications* 2002; **16**: 123-132.
5. Parmar C, Kaushal MK. In: Wild Fruits. Kalyani Publishers, New Delhi, India, *Aegle marmelos* 1982; 1-5.
6. Sachdewa A, Raina D, Srivastava AK, Khemani ID. Effect of *Aegle marmelos* and *Hibiscus rosasinensis* leaf extract on glucose tolerance in glucose induced hyperglycaemic rats (Charles foster). *J Environ Biol* 2001; **22**: 53-56.
7. Kamalakkanan N, Prince PSM. Hypoglycemic effect of water extract of *Aegle marmelos* fruits in streptozotocin induced diabetes rats. *J Ethnopharmacol* 2003; **87**: 207-210.
8. Kamalakkanan N. and Prince PS.. The effect of *Aegle marmelos* fruit extract in streptozotocin diabetes: a histopathological study. J. Herb Pharmacother 2005; **5**: 87-96.