Saudi Journal of Biological Sciences (2015) **22**, 32–36

King Saud University

Saudi Journal of Biological Sciences

www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

Reduction of post-prandial hyperglycemia by mulberry tea in type-2 diabetes patients

Shaheena Banu [a], Nasimudeen R. Jabir [b], Nanjappa C. Manjunath [a], Mohd Shahnawaz Khan [c], Ghulam Md Ashraf [b], Mohammad Amjad Kamal [b], Shams Tabrez [b,*]

[a] *Sri Jayadeva Institute of Cardiovascular Science and Research, Department of Biochemistry, Bangalore, India*
[b] *King Fahd Medical Research Center, King Abdulaziz University, P.O. Box 80216, Jeddah 21589, Saudi Arabia*
[c] *Department of Biochemistry, College of Science, King Saud University, Riyadh, Saudi Arabia*

Received 6 April 2014; revised 29 April 2014; accepted 30 April 2014
Available online 23 May 2014

KEYWORDS

Type 2 diabetes;
Mulberry tea;
Glucose level;
Post-prandial hyperglycemia;
Metabolic disorders

Abstract *Aim:* The dietary contents have a very important role in the management of metabolic syndrome along with type 2 diabetes mellitus (T2DM). Indian diet contains a large amount of carbohydrates that set off unpredictable blood sugar fluctuations and leads to increased risk of diabetic complications. The aim of the present study was to identify the effect of mulberry tea in the reduction of abnormally high postprandial blood glucose (PPG) levels in T2DM patients.

Methods: The study design was follow-up T2DM, 20 diabetic patients were given plain tea (control) and 28 diabetic patients were given mulberry tea (test subject) to measure the effect of mulberry tea on fasting blood glucose and PPG levels. Fasting blood glucose samples were collected after a standard breakfast. The PPG levels were recorded after the consumption of 70 ml tea along with 1 teaspoon of sugar after 90 min in all 48 patients.

Results: Fasting blood glucose levels in control and test group samples were found to be 178.55 ± 35.61 and 153.50 ± 48.10, respectively. After the consumption of plain tea and mulberry tea, the PPG values were recorded as 287.20 ± 56.37 and 210.21 ± 58.73, respectively. A highly significant ($p < 0.001$) change in the PPG level was observed in response to mulberry tea in all the test patients compared with control. Moreover, the effect size was also found to be very large (1.31).

Conclusion: Mulberry tea suppresses postprandial rise of blood glucose levels after 90 min of its consumption.

1. Introduction

Due to its high prevalence and potential deleterious effects, type 2 diabetes mellitus (T2DM) continues to be a major medical concern worldwide, especially in the developing countries (Zimmet, 2011). Despite remarkable growth in this field of research, the diabetes occurrence has been increasing very rap-

* Corresponding author. Tel.: +966 26734089; fax: +966 26952076.
E-mail address: shamstabrez1@gmail.com (S. Tabrez).

Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

1319-562X © 2014 Production and hosting by Elsevier B.V. on behalf of King Saud University.
http://dx.doi.org/10.1016/j.sjbs.2014.04.005

idly with uncontrolled causative factors. Recent report suggests that approx. 150 million people worldwide are affected with diabetes and this number is expected to rise up to 300 million by the year 2025 (Kumar et al., 2012). The diabetic paradigm in India is also increasing rapidly and is expected to reach approx. 57.2 million by the year 2025 (Kumar et al., 2012). Some promising developments in the last decade in understanding the pathophysiology of T2DM have fueled new approaches toward its therapy and management. Recently, the usage of some naturally derived phytochemicals for the treatment of T2DM has been highlighted in the literature (Bulku et al., 2010; Dembinska-Kiec et al., 2008; Leiherer et al., 2013).

T2DM is a metabolic disorder of the endocrine system, primarily characterized by glycemic imbalance, which stimulates several metabolic turbulence and ultimately results into oxidative stress and chronic inflammation (American Diabetes Association, 2010). Uncontrolled hyperglycemia could also result in many chronic impediments such as micro-vascular complications like neuropathy, stroke and peripheral vascular disease (Cade, 2008). Medical complications of T2DM on the central nervous system such as increased risk of Alzheimer's disease and vascular dementia have also been reported (Banu et al., 2013; Helzner et al., 2009; Jabir et al., 2014; Kamal et al., 2014). Glycemic control is a primary concern in diabetic care as its impairment leads to several complications and mess up the prognosis among hospitalized diabetic patients (Kagansky et al., 2003; Solís et al., 2012; Turchin et al., 2009). Overall glycemic control could help and prevent the onset as well as delay in the progression of long term complications of diabetes. It also reduces morbidity and mortality of patients suffering from this disease (Solís et al., 2012). The abnormal insulin secretion by β-cells in response to a meal, impaired hepatic glucose production and defective glucose uptake by peripheral insulin-sensitive tissues (skeletal muscles) result into postprandial hyperglycemia (PPG), which is a serious issue in the management of glycemic patients. Moreover, control of the PPG level is critical in the treatment of not only diabetic patients but also in individuals with impaired glucose tolerance (Huang et al., 2012).

Recently, several treatment strategies for glycemic control have been implemented, viz. change in life style, diet therapy, use of synthetic and herbal agents (American Diabetes Association, 2011; Kumar et al., 2012; Painter et al., 2013). However, multiple medications are often needed to achieve adequate glycemic control in majority of the patients (American Diabetes Association, 2011; Painter et al., 2013; Rodbard et al., 2009). Due to their limited adverse effects, herbal agents have gained attention for the treatment of various diseases recently (Akilen et al., 2012; Kamboj et al., 2011; Kumar et al., 2012; Prince et al., 1998; Tabrez et al., 2013). The herbal agents as diabetic diet therapy could be quite effective in the management of carbohydrates in the normal diet. One such agent, mulberry (*Morus alba*) plant leaf extracts have been reported to possess several beneficial effects against various diseases. Glycemic control by mulberry leaf extracts due to their therapeutic potential has also been reported in various animal models (Chan et al., 2013; Jaruchotikamol and Pannangpetch, 2013; Kim et al., 2011; Kwon et al., 2011; Sharma et al., 2010). As far as our knowledge goes, there is no literature available on the glucose lowering effect of mulberry tea. This is the first research article reporting the effect of mulberry tea in reducing the PPG level in T2DM patients.

2. Materials and methods

In this study design, follow-up diabetic patients taking oral anti-diabetic drugs were selected at Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bangalore, India. Fasting blood glucose level was measured after routine standard breakfast and after consumption of 70 ml of mulberry tea with 1 teaspoon of sugar. The PPG levels were measured in total 48 patients after prior consent and Institutional ethics committee approval. Mulberry tea (*Mulbericha green*) was provided by Karnataka State Sericulture Research and Development Institute, Bangalore, India.

2.1. Methods

The first sample of fasting blood for glucose estimation was collected in morning. All the patients were instructed to consume routine standard breakfast (two idlis with chutney). Idli contains fermented mixture of ground rice and beans. Each idli contains approx. 1.67 g protein, 0.14 g fat, 9.12 g carbohydrates, 0.21 g minerals, 0.09 g fibers and 44.5 Kcal energy. Chutney is the coconut paste spiced up with chillies. The mulberry tea was prepared by the addition of one teaspoon of '*Mulbericha green*' in one cup of hot water along with one teaspoon of sugar and given to diabetic patients for drinking. Similarly, the control group also consisted of diabetic patients and they were given normal tea (70 ml). After 90 min, the second blood sample was collected for the measurement of the PPG level. Analyses were carried out on a Roche Hitachi 912 analyzer.

2.2. Statistical analysis

Descriptive statistical analyses were performed in this study. Results on continuous measurements are presented as Mean ± SD and results on categorical measurements are presented in number (%). Student's *t*-test was performed to find out the significance of study parameters on continuous scale between two inter group analysis. Student's *t*-test and Chi-square test were also performed to identify the homogeneity of samples based on parameters on categorical scale between two groups. Significance was assessed at 5% level of significance.

2.3. Effect size

$$d = \frac{Mean1 - Mean2}{Pooled\ SD}$$

No effect (N)	$d < 0.20$
Small effect (S)	$0.20 < d < 0.50$
Moderate effect (M)	$0.50 < d < 0.80$
Large effect (L)	$0.80 < d < 1.20$
Very large effect (VL)	$d < 1.20$

3. Results

The age of the patients involved in this study was in the range of 30–70 years. The mean age of the control and test groups