



# Blood Sugar Reduction of Type 2 Diabetic Patients through a Mindfulness Intervention Program

Lihong Xiao

## ABSTRACT

The aim of this study was to examine the impact of a mindfulness intervention program on focus of attention and increased blood sugar in patients with type 2 diabetes. An experimental study with a 8-month follow-up was designed with an intervention group and control group. The intervention program of this study was developed for patients with type 2 diabetes (intervention group: n = 31; control group: n = 26), age range 20-65 years old. We included a 10-week intervention comprising the quadruple mindfulness steps and homework. The Focus of Attention Questionnaire (FAQ) was used to measure the variable focus of attention. The results showed that the intervention program can protect patients with type 2 diabetes from an increase in blood sugar at the glucose control period.

**Key Words:** Blood Sugar, Type 2 Diabetes, Mindfulness, Intervention

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## Introduction

Diabetes is the most common disease caused by metabolic disorders and, according to some, is the most common endocrine disorder (Krysiak *et al.*, 2012). Today, diabetes is the fifth cause of death in Western societies and the fourth most common reason for referral to a doctor (Kashfi *et al.*, 2009). Diabetes is a complex metabolic disorder which is detected through blood sugar levels above normal levels. Also, it is a result of a disorder of the secretion or function of insulin or both (Barnard *et al.*, 2012) and an increasing threat to global health so that, since 1993, the World Health Organization (WHO) has called on all countries in the world to fight this disease. In other words, diabetes is one of the long-standing discomforts which arises due to the disturbance of metabolism of sugar and starch and causes great health problems (Ebrahimi *et al.*, 2017). Recent estimates indicate that 3.1 million people in the UK and 285 million people worldwide have diabetes, and this may increase to 435 million in

2030 due to problems such as the outbreak of aging, lifestyle changes, the lack of proper diet, sports exercises, and the prevalence of obesity associated with it (Barnard *et al.*, 2012).

One of the biggest challenges faced by diabetic patients is learning how to live with diabetes and controlling complications of blood glucose (Mertig, 2007). One of the most important complications of diabetes is the increased risk of cardiovascular disease, renal disease, visual impairment, blindness and lower limb amputation (Hippisley-Cox and Coupland, 2016). According to studies conducted on diabetic patients, after 10 years, at least 20% of patients experience cardiovascular events, about 5% blindness and less than 1% renal failure or amputation (Barr *et al.*, 2007). The risk of developing cardiovascular diseases in diabetics is 2 to 4 times more than healthy people in the community (UKPDS Group, 1998). Studies have shown that good blood glucose control prevents complications (Mannucci *et al.*, 2013).

**Corresponding author:** Lihong Xiao

**Address:** Network Center, Xiangtan Medicine & Health Vocational College, Xiangtan, 411100, China

**e-mail** ✉ 178450315@qq.com

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Therefore, in order to change lifestyle and, consequently, better control of diabetes, knowledge and understanding of patients about the importance of diabetes mellitus, complications and treatment should be increased.

Mindfulness is one of the effective ways to promote the health of patients with diabetes (Dinardo, 2009). Mindfulness refers to the meditation that emphasizes the presence and awareness of the present. Over the past 30 years, interest in the use of mindfulness therapy has increased, so that a review of the history suggests over 70 scientific articles published until 2007 (Ludwig & Kabat-zinn, 2008). Mindfulness means meaningful and targeted attention in the present and void of prejudice and judgment. In mindfulness, one becomes aware of how mind at any moment and learns the skills to identify more effective ways (Kabat-Zin, 1990).

A review study in 2010 showed that of the 15 studies that had criteria for entry into the study and focused on disorders such as fibroma, chronic pain, multiple chemical sensitization and cardiovascular disease, All, in addition to emphasizing the positive results of therapy by mind-awareness, stated that mindfulness has no side effects and no special negative consequences (Hartman *et al.*, 2012). Therefore diabetes, in particular type 2 diabetes, is one of the most prevalent diseases worldwide, and the management of this disease is important because it affects the lives of 200 million people (Morris *et al.*, 2011). Many psychological interventions have been used to control the disease and its related complications simultaneously with medical interventions (Huges *et al.*, 2014). The effectiveness of mindfulness on blood glucose reduction in diabetic patients has emerged as a paradigm shift in the mind of researchers (Whitebird *et al.*, 2009; Youngwanichsetha *et al.*, 2014).

Given these encouraging results, the current study was interested in evaluating the efficacy of mindfulness intervention program on increased blood sugar using a sample of patients with diabetic type 2. We hypothesized that: (1) Mindfulness intervention program protect patients with diabetic type 2 from an increase of glycosylated hemoglobin level during the glucose control period; and (2) Mindfulness has a positive impact on focus of attention.

## Methods

### *Design and Procedure*

In order to prove the research hypothesizes we designed an experimental non-longitudinal study with two repeated measures done in an intervention (mindfulness) and a control group. The study was conducted in September 2016 in a Diabetic Patient Counseling Center in south of China. The three time measurements were directly before the mindfulness intervention program (first measurement), 5 days after (second measurement) and a follow-up 8 months later (third measurement).

Two diabetic patient counseling centers comprising the experimental and control groups were selected to participate in this study because these centers were about to set up a community clinic (January 2017). In the China, a community clinic often comprises different consultations facilities for outpatient and inpatients patients, like home care pre and after disease. We designed this study to prepare patients of the intervention group for future contact with diabetic patients, especially type 2 diabetic patients, attending the consultation center.

Before implementing the study, we received a letter from the patients about the study in which if they sure to participate in the program.

### *Participants*

Forty seven type 2 diabetic patients participated in our study ( $N_{\text{male}}=28$  (60%),  $N_{\text{female}}=19$ (40%)). The age of participants was 20-35( $n=11,23.4\%$ ), 36-50( $n=15,31.9\%$ ) and 51-65( $n=21,44.7\%$ ) years. We randomly assigned participants to a mindfulness intervention group ( $n = 23$ ) and a control group ( $n = 24$ ). Type 2 diabetic patients in the mindfulness intervention group learned and practiced the mindfulness strategies mentioned below, while type 2 diabetic patients in the control group learned something about usual cares. In order to select patients to participate in the both groups, we drew up three following selection criteria:

1. Lack of amputation and organ defect;
2. Non-use of psychiatric drugs;
3. Aged 20 to 65 years old;
4. Glycosylated hemoglobin between 7 and 8.5%.

Type 2 diabetic patients' demographics are presented in Table 1.

**Table 1.** Patients demographics

		Male patients (n = 28)		Female patients (n = 19)	
		Intervention group (n = 14)	Control group (n = 14)	Intervention group (n = 9)	Control group (n = 10)
Education n (%)	High school / vocational	9 (64.3)	8 (57.1)	6 (66.7)	5 (50)
	College, university / graduate school	5 (35.7)	6 (42.9)	3 (33.3)	5 (50)
Glycosylated	7-7.5	3 (21.4)	4 (28.6)	2 (22.2)	3 (30)
	7.6-8	5 (35.7)	6 (42.9)	3 (33.3)	4 (40)
Hemoglobin n (%)	8.1-8.5	6 (42.9)	4 (28.6)	4 (44.4)	3 (30)
Age n (%)	20-35	2 (14.3)	3 (21.4)	3 (33.3)	3 (30)
	36-50	5 (35.7)	5 (35.7)	3 (33.3)	2 (20)
	51-65	7 (50)	6 (42.9)	3 (33.3)	5 (50)

### Intervention

The mindfulness intervention program aimed to empower patients to reduce their blood sugar by decreasing their glycosylated hemoglobin level and improving their understanding of diabetes. The research team modified the structured intervention program with respect to other mindfulness intervention programs, which have been shown to have positive effects on increased blood sugar in the occupational context (Youngwanichsetha *et al.*, 2014; Van Son *et al.*, 2014; Tovote *et al.*, 2014). The program comprised of ten 1.5-hour sessions held per week (i.e. over 2.5 months). More details of the mindfulness intervention program are described in following, indicating its main purposes and content in each of the ten sessions.

#### Theme/Session 1

- Introduction of participants;
- A brief description of 10 sessions and explanations about the relationship between diabetes, diabetes management, complications of diabetes and related emotional disturbances;
- Definition of mindfulness, meditation as well as the purpose and benefits of mindfulness, the relationship between mindfulness and the reduction of pain and stress;
- A 30-minute implementation of body scanning meditation;
- Homework.

#### Theme/Session 2

- Discussing about the homework;
- Discussing about the barriers to practicing and mindfulness solutions for this issue;
- Discussing about the difference between thoughts and feelings;
- Implementation of meditation in sitting position;
- Homework.

#### Theme/Session 3

- Mindfulness training, sitting on the ground, practice walking and smiling;
- Eating one raisin and discussing about their feelings;
- Implementation of brushing and washing dishes at home like the eating raisins;
- A three-minute practice of breathing space;
- Homework.

#### Theme/Session 4

- Sitting meditation with four focuses;
- Discussion of stress responses and the response of a person to difficult situations and alternative attitudes and behaviors;
- Practicing walking with mindfulness;
- Homework.

#### Theme/Session 5

- Implementation of sitting meditation;
- Practicing body mindfulness exercises;
- Homework.

#### Theme/Session 6

- A three-minute practice of breathing space;
- Training mindfulness and positive psychology, finding potential abilities, enjoying the moment, and seeing from a positive angle;
- Discussing about the homework in 2-individual groups;
- A practice known as "Creation, Thought, Separate Views";
- Four exercises for one hour and in a sequential manner;
- Homework.

#### Theme/Session 7

- Discussing what the mindfulness in what way reduces depression and anxiety;
- Training fighting with automatic thoughts, non-focusing on problematic thoughts, confronting



anxiety using mindfulness, coping with pain and using mindfulness to control pain;

- Homework.

*Theme/Session 8*

- Four-dimensional mediation and awareness of everything that comes on at the time of vigilance;
- Specifying the pleasant and unpleasant life events and designing a program for the creation of pleasant events in life;
- A three-minute practice of breathing space;
- Homework.

*Theme/Session 9*

- Meditation of body scans;
- Discussions about the experiences gained from the homework and the Benefits of Mindfulness;
- Homework.

*Theme/Session 10*

- Meditation of body scans;
  - A three-minute practice of breathing space;
  - Discussions on compromise methods with barriers to the meditation;
- Questions about the 10 sessions.

**Measures**

*Focus of attention*

The Focus of Attention Questionnaire (FAQ), developed by Woody, Chambless and Glass (1997), was used to assess focus of attention. The scale has two subscales (FAQ-Self and FAQ-External) with 5-point graded questions. Participants responded to the questions of the scale based on the notion of previous social interaction. Each item contains a 5-point scale, indicating how far the focus of the participants' attention is in harmony with phrases. Empirical evidence supported the reliability and validity of the FAQ (Khayyer *et al.*, 2008).

**Analysis**

2 × 2 MANOVA was used to compare the mindfulness and control groups. We performed all descriptive statistics using SPSS 18.0. We also considered P values < 0.05 and 0.01 significant.

**Results**

*Demographics*

The participants were composed of 28 male patients with a mean age of 44.5(±14.3) years and 19 female patients with a mean age of 44.2 (±14.6) years (Table 1). The average glycosylated hemoglobin obtained 7.91 for the male patients and 7.72 for the female patients. Seventeen male patients (60.7%) and 11 female patients (57.9%) had a High school/vocational education, and eleven male patients (39.3%) and eight female patients (42.1%) had a College, university/graduate school education. According to Table 1, there were no differences concerning glycosylated hemoglobin (mindfulness group: mean=7.78, SD=1.27; control group: mean=7.81, SD=1.15), age (mindfulness group: mean=45.1, SD=2.11; control group: mean=44.7, SD=2.34), high school/vocational education (mindfulness group: n=15(65.2%); control group: n=13(54.2%), and college, university/graduate school education (mindfulness group: n=8(34.8%); control group: n=11(45.8%)).

*The Effects of the Intervention on 2 type diabetes patients' blood sugar*

First we tested whether there is a difference in blood sugar scores between both groups. According to the t-test analysis, there was no main effect of group, indicating that there was no significant difference in blood sugar scores between the mindfulness and control groups at before the intervention (Table 2). The t-test analysis revealed a significant interaction effect between group and second measurement. The scores in second measurement indicate that 2 type diabetes patients' blood sugar in the intervention group was significantly more negative immediately after the mindfulness intervention program was carried out. We also found a significant interaction effect between group and third measurement, indicating that the effect of the mindfulness intervention program did last in the intervention group.

**Table 2.** Blood sugar of 2 type diabetes patients by condition and time

Group	First measurement		Second measurement		Third measurement	
	Mean	SD	Mean	SD	Mean	SD
Intervention (n = 23)	153	7.34	131	5.11	120	6.02
Control (n = 24)	155	6.82	143	5.32	146	5.71



**Table 3.** Average scores and standard deviations of the mindfulness group and control group

Variables	Mindfulness group (n=23)						Control group (n=24)					
	T1		T2		T3		T1		T2		T3	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Glycosylated hemoglobin level	8.11	0.35	6.72*	0.41	6.05**	0.46	7.89	0.51	7.45	0.52	7.61	0.55
Focus of attention	5.33	4.57	18.22*	6.48	27.19**	7.47	6.22	5.49	7.04	4.37	6.84	5.11

\* $p < 0.05$ , \*\* $p < 0.01$

The scores of the mindfulness intervention program show that there is a significant decrease of glycosylated hemoglobin level in the mindfulness group (Time 1: M=8.11, SD=0.35; Time 2: M=6.72\*, SD=0.41; Time 3: M=6.05\*\*, SD=0.46). In the control group, we found a tendency of decreased glycosylated hemoglobin level at Time 2, but no significant effect (Time 1: M=7.89, SD=0.51; Time 2: M=7.45, SD=0.52; Time 3: M=7.61, SD=0.55). Analyses in respect of focus of attention revealed no significant difference between the mindfulness and control groups before the mindfulness intervention (mindfulness group: M=5.33, SD=4.57; control group: M=6.22, SD=5.49), but a significant difference after the mindfulness intervention at Time 2 (mindfulness group: M=18.22\*\*, SD=6.48; control group: M=7.04\*, SD=4.37) and Time 3 (mindfulness group: M=27.19\*\*, SD=7.47; control group: M=6.84\*, SD=5.11).

### Discussion

The current study explored the possibilities of reducing increased blood sugar of patients with type 2 diabetes through a mindfulness intervention program. By means of an experimental and non-longitudinal design, our study examined a 10-session mindfulness intervention program in a mindfulness group consisting of twenty three type 2 diabetic patients. Our findings show that the mindfulness intervention program significantly reduces increased blood sugar after the intervention program in the mindfulness group compared to type 2 diabetic patients in the control group. The findings at follow-up also show a significant reduction of blood sugar in the mindfulness group compared to type 2 diabetic patients in the control group.

#### Glycosylated hemoglobin level

With respect to type 2 diabetic patients, the findings of this study show that implementing a mindfulness intervention program had a considerable influence on their glycosylated hemoglobin level. This is in line with other studies which also reported positive outcomes

(Rosenzweig *et al.*, 2007; Faude-Lang *et al.*, 2010). Lack of adherence to treatment, irregular blood glucose monitoring and inappropriate treatments increase blood glucose and anxiety in diabetic patients, which can be improved to control blood glucose and increase in patient's happiness by using mindfulness techniques. This is in line with the study of Lin *et al.*, 2012.

#### Implications of the Study

Our results clearly point out the potential of the mindfulness intervention program to influence glycosylated hemoglobin level and focus of attention. Also this study showed that mindfulness can act as a factor in reducing blood sugar in patients with diabetes mellitus and be effective in a simultaneous form in increasing their happiness. This finding means that mindfulness therapies programs can play an important role in improving the physical condition of patients' body (lowering blood glucose levels and glycosylated hemoglobin). According to the results of this study, it can be stated that the use of the mindfulness therapies program is one of the ways to help control and reduce glycosylated hemoglobin in people with diabetes. Therefore, it can be recommended that the mindfulness therapies program should consider as one of the components of treatment for diabetic patients along with medical treatments. The results of this study can be used as a basis for further research on recognition of effective educational programs for diabetic patients.

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