Hypoglycemic Effect of Sitting Breathing Meditation Exercise on Type 2 Diabetes at Wat Khae Nok Primary Health Center in Nonthaburi Province

Sompong Chaiopanont MD*

** Division of Preventive and Social Medicine, Pranangklao General Hospital, Nonthaburi*

Objective: *To evaluate the hypoglycemic effect of Somporn Kantaradusdi-Triamchaisri technique1 (SKT1) of sitting breathing meditation exercise on type 2 diabetic patients.*

Material and Method: *This quasi experiment study was performed on type 2 diabetic patients at Wat Khae Nok primary health center from April to May 2007 for a two-week period every Tuesday of the week (3 visits). At the first visit, the patients were educated about diabetes self care after breakfast. At the second and third visit, the participants were trained to practice SKT1 as intervention after breakfast. Post prandial plasma glucose and blood pressure before and after the intervention were recorded. Descriptive statistics and paired t-test were used to analyze the study data.*

Results: *Fifty patients participated in the present study, 11 were males and 39 females. They had a mean age of 63.1 years (range 42-80). The present study revealed that SKT1 significantly reduced levels of postprandial plasma glucose by 19.26 $\pm$ 30.99 mg/dl, ($p < 0.001$) in the second visit, and 17.64 $\pm$ 25.48 mg/dl, ($p < 0.001$) in third week visit. Furthermore, systolic blood pressure in the second visit was significantly decreased by 6.49 $\pm$ 11.77 mmHg, ($p < 0.001$). Diastolic blood pressure in the third visit was also significantly decreased by 3.04 $\pm$ 9.79 mmHg, ($p < 0.05$).*

Conclusion: *The present study showed that SKT1 practice in type 2 diabetic patients had a post prandial hypoglycemic effect and a slight reduction to systolic and diastolic blood pressure.*

Keywords: *Plasma glucose, Sitting breathing meditation exercise-SKT1, Type 2 diabetes*

J Med Assoc Thai 2008; 91 (1): 93-8
Full text. e-Journal: *http://www.medassocthai.org/journal*

Diabetes is an important disease that leads to many complications that affect the quality of life, such as retinopathy, nephropathy and neuropathy. Associated illnesses include hypertension, dyslipidemia, coronary heart disease, obesity and metabolic syndrome. The costs of medical care for diabetes and complications are consequently very high[1]. During the year 2003-2005, there were 3.2 million diabetic patients in Thailand[2]. In Nonthaburi province, by the year 2005, there were 2100 diabetic patients[3].

American Diabetes Association (ADA) stated that diabetes needs continuing medical care and patient self-management education to prevent acute complications and to reduce the risk of long-term complications. Prospective randomized control trials such as the Diabetes control and complications trial (DCCT) and the United Kingdom prospective diabetes study (UKPDS) have shown that improved glycemic control is associated with sustained decreases in the rates of retinopathy, nephropathy, and neuropathy. Glycemic control comprises of diabetes self-management education, medical nutrition therapy, physical activity, psychosocial assessment and care, medicines including oral hypoglycemic drugs and insulin injection[4].

Physical activity can improve glycemic control, and reduce the risk of cardiovascular disease (CVD). Before beginning a program of physical activity more vigorous than brisk walking, the patient's age, previous physical activity level, and conditions that might be associated with CVD or that might contraindicate

Correspondence to : Chaiopanont S, Division of Preventive and Social Medicine, Pranangklao General Hospital, Nonthaburi 11000, Thailand. Phone: 0-2528-4567, Fax: 0-2528-4567 ext. 1683, E-mail: drs.pc@hotmail.com

certain type of exercise or predispose to injury, such as uncontrolled hypertension, severe autonomic neuropathy, and retinopathy or macular edema, should be considered[4].

Several studies explored meditation, breathing exercise, Qigong, biofeedback techniques, and other stress relaxation methods. They revealed hypoglycemic effect, decreased blood pressure and reduced cholesterol levels[5-11]. Somporn Kantaradusdi-Triamchaisri technique1 (SKT1) of sitting breathing meditation exercise was developed by Kantaradusdi-Triamchaisri S. and tested in diabetic patients at Ongkaruk Hospital and Prapok-klao Hospital. The results showed that PPG was reduced[12]. Therefore, the purpose of the present study was to evaluate the hypoglycemic effect of SKT1 on type 2 diabetic patients at Wat Khae Nok Primary health care center in Nonthaburi province, Thailand.

Material and Method

Between April and May 2007, 50 patients diagnosed as type 2 diabetes at Wat Khae Nok Primary Health Center under the responsibility of Preventive and Social Medicine Division of Pranangklao General Hospital Nonthaburi voluntary enrolled with purposive sampling. The present study was designed as a quasi-experiment, one group before and after intervention (pre-post test). The inclusion criteria for the participants were being type 2 diabetes, without coronary heart disease, cataract and nephropathy, able to communicate, understand the questions well, and give voluntary informed consent. Patient's demographic data, sex, age, marital status, education levels, occupation, family history of diabetes, exercise habit, and blood pressure, was collected before the intervention.

The patients visited every Tuesday for a two-week period. At the first visit, the participants had fasting blood glucose (FBG) checked, and had a bowl of rice soup with minced pork and celery vegetable. After half an hour, the authors collected a blood sample for pre-intervention post prandial plasma glucose (PPG1), then the health care team educated the participants about diabetes self care. Half an hour later, the authors collected the post-intervention post prandial plasma glucose (PPG2).

1st visit: FBS $\xrightarrow{\text{meal}}$ PPG1 $\xrightarrow{\text{education}}$ PPG2

2nd, 3rd visit: FBS $\xrightarrow{\text{meal}}$ PPG1, SBP1/DBP1 $\xrightarrow{\text{SKT1 practice}}$ PPG2, SBP2/DBP2

At the second and third visit, the participants had their blood tested the same as at the first visit. Instead of diabetes care education, the patients were trained to practice SKT1 in a sitting position, which was done by slowly, deep inhale while counting 1, 2, 3, 4, and 5 in their mind, then holding their breath for a moment while counting 1, 2, and 3 in their mind, after that a slow long exhale while counting 1, 2, 3, 4, and 5 in their mind until the end of the respiratory cycle. The participants repeated the practice for 30 cycles, which lasted time about 30 minutes. FBG, PPG1, PPG2 and blood pressure pre and post-intervention were also recorded.

The research proposal was approved by the Institutional Review Board.

Demographic data of the participants were statistically analyzed and presented in terms of median range, mean, standard deviation (SD) and percentage. Paired t-test was used to analyze mean and standard deviation of post prandial plasma glucose and blood pressure before and after the intervention.

Results

Fifty type 2 diabetic patients participated in the present study, 11 were males and 39 females. The median age was 63.1 years (range 42-80) and 64% lived as a couple. Primary school level of education was 74%. Half of all the participants were housewives. Seventy percent had no family history of diabetes. Half of the participants rarely exercised.

At the first visit, mean post prandial plasma glucose levels, pre and post-diabetes care education were recorded as baselines (192.08 mg/dl, 197.60 mg/dl). At the second and third visit, the same group was trained to practice SKT1 as intervention, mean post prandial plasma glucose levels pre and post intervention were recorded (second visit 187.74, 168.48 mg/dl; third visit 191.96, 174.32 mg/dl). Mean blood pressures also were recorded pre and post intervention (second visit 141.45/81.45, 134.96/80.19 mmHg, third visit 139.30/79.94, 138.48/76.90 mmHg). The results of the present study showed that the PPG1 and PPG2 tested before and after SKT1 during the second and third visit were reduced with statistical significance by 19.26 ± 30.99 mg/dl ($p < 0.001$) and 17.64 ± 25.48 mg/dl ($p < 0.001$), but there was no significant difference during the first visit. Systolic pressure at the second visit session was also significantly decreased by 6.49 ± 11.77 mmHg ($p < 0.001$). Diastolic pressure at the third visit was significantly decreased by 3.04 ± 9.79 mmHg ($p < 0.05$) as shown in Table 1.

Table 1. Comparison of the means of post prandial glycemia (PPG), systolic and diastolic blood pressure (SBP, DBP) before and after SKT1intervention

Variable		Mean	SD	Number	p-value
Visit 1	PPG1	192.08	64.08	50	0.391
	PPG2	197.60	83.75		
Visit 2	PPG1	187.74	63.93	50	<0.001**
	PPG2	168.48	61.46		
Visit 3	PPG1	191.96	46.56	50	<0.001**
	PPG2	174.32	45.64		
Visit 2	SBP1	141.45	23.41	47	<0.001**
	SBP2	134.96	21.21		
	DBP1	81.45	10.91	47	0.384
	DBP2	80.19	9.71		
Visit 3	SBP1	139.30	24.07	50	0.739
	SBP2	138.48	26.42		
	DBP1	79.94	12.69	50	0.033*
	DBP2	76.90	12.44		

Discussion

The main objective of the present study was to assess the hypoglycemic effect of SKT1 as complimentary treatment of type 2 diabetic patients. After 2 weeks of SKT1 practice half an hour each session, post prandial plasma glucose levels were significantly reduced at the second and third visit. Systolic blood pressure at the second visit and diastolic blood pressure at the third visit were significantly decreased. The present results were comparable with the findings in clinical trials that assessed the effects of Qigong[7-9,13]. The studies of Qigong relaxation exercise for 4 months intervention in type 2 diabetic patients, demonstrated significant improvement in HbA1c level[7]. Qigong practice for 16 weeks in essential hypertension patients also significantly decreased blood pressure and total cholesterol[8,9,13]. There was a significant reduction of norepinephrine, metanephrine and epinephrine that Qigong may stabilize the sympatheic nervous system which urinary catecholamines and blood pressure were decreasingly detected[13]. The effect of transcendental meditation for 16 weeks on components of the metabolic syndrome and coronary heart disease showed improvement in blood pressure and insulin resistance[11]. Barnes et al examined the impact of TM on cardiovascular function at rest and during acute stress in adolescents with high normal blood pressure, exhibited greater decrease in systolic blood pressure, heart rate and cardiac output[5]. The present study showed results only on PPG and blood pressure, but did not evaluate the effect on HbA1c, which would have been due to time limitation of a two-week period that was considered from convenience of the patients to participate in. However, other studies have shown that reducing PPG contributes to reduce HbA1c in type 2 diabetic patients[14,15].

Stress has long been considered an important factor in type 2 diabetes, and frequently found in type 2 diabetes mellitus (T2DM) patients higher than healthy individuals[16,17]. ADA recommended many ways of relaxation, such as breathing exercises, progressive relaxation therapy, exercise, and replace bad thoughts with good ones technique[18]. Stress management can result in a clinically significant reduction in HbA1C[6,7,10]. Stress can affect blood glucose levels in type 2 diabetes, stress hormones that include adrenaline and cortisol play role in their primary effects to mobilize stored energy into glucose and fatty acids in the blood stream. Stress also has direct effects on the nerves controlling the pancreas, which inhibit insulin release. In healthy individuals, these energy sources can be quickly utilized. However, in people with diabetes, the lack of insulin or the presence of insulin resistance causes the newly released glucose to build up in the blood stream[16,19]. The deterioration of the autonomic nervous system was associated with poor glycemic control in diabetic patients[20]. Meditation has the effects to suppress stress hormones[6,21], reduce sympathetic activity[22], and enhance parasympathetic activity that result in decreasing blood pressure, reducing plasma glucose level[5,23]. Similar to the present study that SKT1 practice resulted in decreasing systolic and diastolic blood pressure and reducing post prandial plasma glucose.

In addition, baroreceptor and chemoreceptor are the modulator parts of the autonomic nervous system that involve the mechanisms related to hypertension and insulin resistance[24]. An increase in baroreceptor sensitivity results in decreasing blood pressure and improving insulin resistance[25-29].

The present study showed that deactivation of chemoreceptor reflexes also can cause reduction in blood pressure and plasma glucose level[30]. The arterial baroreflexes also have a powerful inhibitory influence on the chemoreflexes[31]. Several experimental studies indicated that reducing postprandial dysmetabolism (postprandial state characterized by abnormally increased levels of glucose and lipids) appears to significantly slow atherosclerotic progression and may improve cardiovascular prognosis[32,33].

In conclusion, the present study showed that SKT1 practice for a two-week period, might affect the stress hormones and autonomic nervous systems, by not inducing stress hormones. This suppresses sympathetic activity, and enhances parasympathetic activity via the increased baroreceptor sensitivity. The deactivation of chemoreceptor reflexes result in significantly reducing both systolic & diastolic blood pressure and post prandial plasma glucose, which benefit in prevention of cardiovascular risk factor. Further study should evaluate SKT1 practice for a longer than 16 weeks period to explore whether SKT1 has the effects on HbA1c and lipid profiles such as total cholesterol and triglycerides.

Acknowledgements

The author wishes to thank Assoc Prof. Dr. Somporn Kantharadusdi-Triamchaisri, Faculty of Public Health, Mahidol University for allowing the SKT1 technique and assistance in writing the manuscript. The author wishes to thank Dr. Prapon Tangsrikiatkul, Director of Pranangklao General Hospital for allowing the study, and Dr. Somsak Ngamakeur, Chief of Preventive and Social Medicine Division, Pranangklao General Hospital for allowing and contributing to the study. The author wishes to thank Dr. Worranan Prasanatikom, Faculty of Medicine Ramathibodi Hospital, Mahidol University for her help and advice during the preparation of this manuscript.

References

1. Sriussadaporn S, Nitiyanant W. Diabetes mellitus. Bangkok: Ruankaew Press; 2005.
2. Taineua W. Thailand to pilot stopped the dangers of high blood pressure and diabetes. Available from: http://www.thailand.or.th/English/ [Oct 16, 2007]
3. Ministry of Public Health, Bureau of Non Communicable Disease. Technical promotion and support cluster. Amount and morbidity of diabetes in hospital admission. Available from: http://ncd.ddc.moph.go.th/ncd%20web1/bncd/data/conner_download/table06.xls. [Oct 15, 2007].
4. Standards of medical care in diabetes--2007 Diabetes Care 2007; 30(Suppl 1): S4-41.
5. Barnes VA, Treiber FA, Davis H. Impact of Transcendental Meditation on cardiovascular function at rest and during acute stress in adolescents with high normal blood pressure. J Psychosom Res 2001; 51: 597-605.
6. Surwit RS, van Tilburg MA, Zucker N, McCaskill CC, Parekh P, Feinglos MN, et al. Stress management improves long-term glycemic control in type 2 diabetes. Diabetes Care 2002; 25: 30-4.
7. Tsujiuchi T, Kumano H, Yoshiuchi K, He D, Tsujiuchi Y, Kuboki T, et al. The effect of Qi-gong relaxation exercise on the control of type 2 diabetes mellitus: a randomized controlled trial. Diabetes Care 2002; 25: 241-2.
8. Lee MS, Lee MS, Kim HJ, Choi ES. Effects of qigong on blood pressure, high-density lipoprotein cholesterol and other lipid levels in essential hypertension patients. Int J Neurosci 2004; 114: 777-86.
9. Cheung BM, Lo JL, Fong DY, Chan MY, Wong SH, Wong VC, et al. Randomised controlled trial of qigong in the treatment of mild essential hypertension. J Hum Hypertens 2005; 19: 697-704.
10. McGinnis RA, McGrady A, Cox SA, Grower-Dowling KA. Biofeedback-assisted relaxation in type 2 diabetes. Diabetes Care 2005; 28: 2145-9.
11. Paul-Labrador M, Polk D, Dwyer JH, Velasquez I, Nidich S, Rainforth M, et al. Effects of a randomized controlled trial of transcendental meditation on components of the metabolic syndrome in subjects with coronary heart disease. Arch Intern Med 2006; 166: 1218-24.
12. Triamchaisri S. Applied meditation for complementary therapy and healing. Bangkok: Faculty of Public Health Mahidol University; 2007.
13. Lee MS, Lee MS, Choi ES, Chung HT. Effects of Qigong on blood pressure, blood pressure determinants and ventilatory function in middle-aged patients with essential hypertension. Am J Chin Med 2003; 31: 489-97.
14. Bastyr EJ, III, Stuart CA, Brodows RG, Schwartz S,

Graf CJ, Zagar A, et al. Therapy focused on lowering postprandial glucose, not fasting glucose, may be superior for lowering HbA1c. IOEZ Study Group. Diabetes Care 2000; 23: 1236-41.
15. Woerle HJ, Neumann C, Zschau S, Tenner S, Irsigler A, Schirra J, et al. Impact of fasting and postprandial glycemia on overall glycemic control in type 2 diabetes Importance of postprandial glycemia to achieve target HbA1c levels. Diabetes Res Clin Pract 2007; 77: 280-5.
16. Surwit R. Type 2 diabetes and stress. Diabetes Voice 2002; 47: 38-40.
17. Okada S, Hamada H, Ishii K, Ichiki K, Tanokuchi S, Ota Z. Factors related to stress in patients with non-insulin-dependent diabetes mellitus. J Int Med Res 1995; 23: 449-57.
18. American Diabetes Association. Stress-All about diabetes-American Diabetes Association. Available from: http://diabetes.org/type-1-diabetes stress.jsp [Aug 16, 2007].
19. Goetsch VL, Abel JL, Pope MK. The effects of stress, mood, and coping on blood glucose in NIDDM: a prospective pilot evaluation. Behav Res Ther 1994; 32: 503-10.
20. Mustonen J, Uusitupa M, Mantysaari M, Lansimies E, Pyorala K, Laakso M. Changes in autonomic nervous function during the 4-year follow-up in middle-aged diabetic and nondiabetic subjects initially free of coronary heart disease. J Intern Med 1997; 241: 227-35.
21. Infante JR, Torres-Avisbal M, Pinel P, Vallejo JA, Peran F, Gonzalez F, et al. Catecholamine levels in practitioners of the transcendental meditation technique. Physiol Behav 2001; 72: 141-6.
22. Curiati JA, Bocchi E, Freire JO, Arantes AC, Braga M, Garcia Y, et al. Meditation reduces sympathetic activation and improves the quality of life in elderly patients with optimally treated heart failure: a prospective randomized study. J Altern Complement Med 2005; 11: 465-72.
23. Parshad O. Role of yoga in stress management. West Indian Med J 2004; 53: 191-4.
24. Frontoni S, Bracaglia D, Gigli F. Relationship between autonomic dysfunction, insulin resistance and hypertension, in diabetes. Nutr Metab Cardiovasc Dis 2005; 15: 441-9.
25. Korner PI. Baroreceptor resetting and other determinants of baroreflex properties in hypertension. Clin Exp Pharmacol Physiol Suppl 1989; 15: 45-64.
26. Mussalo H, Vanninen E, Ikaheimo R, Laitinen T, Laakso M, Lansimies E, et al. Baroreflex sensitivity in essential and secondary hypertension. Clin Auton Res 2002; 12: 465-71.
27. del Paso GA, Gonzalez MI. Modification of baroreceptor cardiac reflex function by biofeedback. Appl Psychophysiol Biofeedback 2004; 29: 197-211.
28. Eguchi K, Tomizawa H, Ishikawa J, Hoshide S, Fukuda T, Numao T, et al. Effects of new calcium channel blocker, azelnidipine, and amlodipine on baroreflex sensitivity and ambulatory blood pressure. J Cardiovasc Pharmacol 2007; 49: 394-400.
29. Stauss HM. Identification of blood pressure control mechanisms by power spectral analysis. Clin Exp Pharmacol Physiol 2007; 34: 362-8.
30. Izdebska E, Izdebski J, Cybulska I, Makowiecka-Ciesla M, Trzebski A. Moderate exercise training reduces arterial chemoreceptor reflex drive in mild hypertension. J Physiol Pharmacol 2006; 57(Suppl 11): 93-102.
31. Kara T, Narkiewicz K, Somers VK. Chemoreflexes--physiology and clinical implications. Acta Physiol Scand 2003; 177: 377-84.
32. Ceriello A. Postprandial hyperglycemia and diabetes complications: is it time to treat? Diabetes 2005; 54: 1-7.
33. O'Keefe JH, Bell DS. Postprandial hyperglycemia/hyperlipidemia (postprandial dysmetabolism) is a cardiovascular risk factor. Am J Cardiol 2007; 100: 899-904.

ศึกษาผลการลดระดับน้ำตาลในเลือดของการปฏิบัติสมาธิออกกำลังกายประสาทสัมผัส Sitting Breathing Meditation Exercise ในผู้ป่วยเบาหวานชนิดที่ 2 ที่ศูนย์สุขภาพชุมชนวัดแคนอก จังหวัดนนทบุรี

สมพงษ์ ชัยโอภานนท์

วัตถุประสงค์*: เพื่อศึกษาผลการลดระดับน้ำตาลในเลือดของการปฏิบัติสมาธิออกกำลังกายประสาทสัมผัสด้วยวิธี Somporn Kantaradusdi-Triamchaisri technique1 (SKT1) ในผู้ป่วยเบาหวานชนิดที่ 2*

วัสดุและวิธีการ*: การศึกษากึ่งการทดลองในผู้ป่วยเบาหวานชนิดที่ 2 ที่ศูนย์สุขภาพชุมชนวัดแคนอก จังหวัดนนทบุรี ระหว่างเดือนเมษายน พ.ศ. 2550 ถึง พฤษภาคม พ.ศ. 2550 ดำเนินการศึกษาทุกวันอังคารสัปดาห์ละครั้งเป็นระยะเวลา 2 สัปดาห์ รวมทั้งหมด 3 ครั้ง ในครั้งแรกของการศึกษาจะให้สุขศึกษาการดูแลสุขภาพโรคเบาหวานด้วยตนเองแก่ผู้ป่วยหลังอาหารเช้า ในครั้งที่ 2 และครั้งที่ 3 ของการศึกษาผู้ป่วยจะได้รับการฝึกปฏิบัติ SKT1 หลังอาหารเช้า ค่าระดับน้ำตาลในเลือดก่อนอาหารเช้า ค่าระดับน้ำตาลในเลือดหลังอาหารเช้ารวมทั้งค่าความดันโลหิตก่อนและหลังการฝึกปฏิบัติ SKT1 ถูกบันทึกไว้ สถิติเชิงพรรณนาและ paired t-test ถูกนำมาใช้วิเคราะห์ข้อมูลในการศึกษา*

ผลการศึกษา*: ผู้ป่วยเบาหวานชนิดที่ 2 จำนวน 50 คน เป็นเพศชาย 11 คน หญิง 39 คน อายุเฉลี่ย 63.1 ปี (42-80 ปี) พบว่าระดับน้ำตาลในเลือดหลังอาหาร postprandial plasma glucose (PPG) ลดลงอย่างมีนัยสำคัญทางสถิติ (ครั้งที่ 2 ลดลง 19.26 $\pm$ 30.99 mg/dl, $p < 0.001$; ครั้งที่ 3 ลดลง 17.64 $\pm$ 25.48 mg/dl, $p < 0.001$) และยังพบว่าความดันซิสโตลิคในครั้งที่ 2 ลดลงอย่างมีนัยสำคัญทางสถิติ (6.49 $\pm$ 11.77 mmHg, $p < 0.001$) ความดันไดแอสโตลิคในครั้งที่ 3 ลดลงอย่างมีนัยสำคัญทางสถิติ (3.04 $\pm$ 9.79 mmHg, $p < 0.05$)*

สรุป*: การศึกษานี้แสดงให้เห็นว่าการปฏิบัติสมาธิออกกำลังกาย SKT1 มีผลลดระดับน้ำตาลในเลือดหลังอาหารเช้าได้และมีผลลดความดันโลหิตทั้งซิสโตลิคและไดแอสโตลิคได้เล็กน้อย*