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Effect of Slow Breathing Exercise on some cardio vascular functions in Type 2 Diabetic Male Patients

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Abstract

Background: Slow breathing exercise (SBE) has some useful effects on cardiovascular system. **Objectives:** To observe the effects of slow breathing exercise on blood pressure in male patients with type 2 diabetes mellitus (DM). **Methods:** This interventional study was implemented on sixty (60) diagnosed male type 2 diabetes mellitus (T2DM) patients aged 45-55 years with disease history 5-10 years, selected from Out Patients Department (OPD) of Endocrinology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. The subjects were divided into two groups, control group (n=30) included type 2 DM patients without SBE and study group included patients performing SBE for 3 months (n=30) and they were enrolled by purposive sampling method. The study group was advised to practice SBE for 30 minutes 2 times daily for 3 months. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), pulse pressure (PP) and rate pressure product (RPP) were recorded at the start of the study and after 3 months in both group of patients. Independent sample t test and paired sample t-test were used for statistical analysis and p<0.05 was taken as statistical significance. **Results:** In this study, the value of mean HR, SBP, DBP, MAP and RPP were significantly (p<0.05) reduced after 3 months of SBE. Again no significant changes observed (p>0.05) after 3 months in the group who did not practice SBE. **Conclusion:** Cardiovascular functions in T2DM patients was improved after performing slow breathing exercise for 3 months.

Keywords: Type 2 diabetes mellitus, blood pressure, slow breathing exercise.

Introduction

Diabetes mellitus (DM) is a chronic disorder of hyperglycemia which occurs due to relative insulin deficiency or resistance or both. Patients with DM can lead a normal life but a long standing DM may leads to several macrovascular and microvascular complications which reduce life expectancy¹. Cardiac autonomic neuropathy (CAN) is the clinically important form of complication in diabetic patients. Sudden death and silent myocardial ischemia (MI) occur in the patients with diabetes having cardiovascular autonomic neuropathy². Hyperglycaemia causes damage to autonomic nerve fibers that innervate heart and blood vessels which is a serious complication of DM³. Resting tachycardia (>100 bpm), orthostasis (a fall of systolic blood pressure >20 mmHg upon standing) are some features of CAN that can affect daily activities of the type 2 diabetic patients⁴.

Yoga is a form of simple exercise which is easy to learn, inexpensive and no one need any professional personnel supervision. Pranayama or breathing exercise is one of the most popular forms of yoga based exercise. Several positive effects on cardiovascular and mental health and good compliance of breathing exercise have been seen in previous studies. It has been observed that slow breathing exercise (SBE) which is a type of pranayama that reduces sympathetic tone and mental stress⁵⁻⁶. SBE is a kind of stress reducing method that has influence on cardio-respiratory and autonomic functions in type 2 diabetic patients⁷⁻⁸.

Some researchers reported that pranayama causes shifting of autonomic nervous function away from sympathetic dominance and improve cardiovascular parameters and hypertension⁹.

RPP is a product of multiplication of resting heart rate and systolic blood pressure. It is used as an indirect index and non-invasive method which give information of myocardial oxygen

consumption that anticipate cardiac function in patients with cardiac diseases. Increased RPP is associated with increased sympathetic cardiac activity¹⁰⁻¹¹. CAN due to sympathetic predominance is observed in previous studies²⁻⁴.

In this study, role of SBE on improvement of cardiovascular function in patients with T2DM has been observed by recording HR, SBP, DBP, MAP, PP and RPP.

Methods

A prospective interventional study was performed in the department of Physiology, BSMMU, Dhaka, after obtaining approval of Institutional review board. Sixty diagnosed male patients with T2DM in the age group of 45-55 years with disease duration 5-10 years were included by purposive sampling from OPD, Endocrinology, BSMMU. Oral hypoglycemic agents (OHA) and diabetic diet were the treatment protocol for this group of patients. History of chronic illness like renal and heart diseases, neurological, psychological and thyroid disorders, smoking were excluded. Sixty (60) patients were divided into two sub group, each of which consisted of 30 individuals. One group of patients performed SBE for 3 months and designated as study group. The group of patients who did not undergo SBE was considered as control. The detailed procedure of SBE and its good effects on disease were demonstrated among them who agreed to practice SBE. After recruitment, all the patients were asked to give informed written consent. All information and findings of physical examinations were written in a prefixed questionnaire. HR, SBP, DBP, MAP, PP and RPP were recorded at the start of the study and after 3 months of interval and compared.

Blood pressure was recorded by a sphygmomanometer containing aneroid manometer (ALP K2, Japan). Pulse rate was counted by placing finger over radial artery against radial bone. MAP, PP and rate pressure product (RPP) were manually calculated.

Breathing exercise

The steps of SBE (alternate nostril breathing)¹² were thoroughly demonstrated to the study group by organizing a training session by researcher. The baseline parameters were recorded before performing the SBE. The training of SBE was given for seven consecutive days. Then study group practiced SBE for 30 minutes twice daily for 3 months.

Statistical analysis

Pre and post interventional data for all parameters were recorded in computer Microsoft Excel. Any alterations over 3 months were analyzed by paired sample t-test. Comparison between the study and control group was analyzed by Independent sample t-test. The statistical analysis was done at 5% level of significance and $p < 0.05$ was considered as statistically significance.

Results

Comparison of general characteristics and baseline HR, SBP, DBP, MAP, PP and RPP between the control and study group is given in Table I and Table II. It was observed that there was no significant ($p > 0.05$) difference in baseline values of all parameters in both group.

Table I: General characteristics in different groups (n=60)

Parameters	Control (n=30)	T2 DM (n=30)
Age(years)	49.9±0.49	49.86±0.56
BMI(kg/m ²)	23.44±0.26	23.24±0.23
FPG(mmol/L)	7.45±0.15	7.93±0.21

T2DM-Type 2 diabetes Mellitus BMI= Body mass index, FPG= Fasting plasma glucose. Data were expressed as Mean±SD & P value was > 0.05 . Independent sample 't' test was done.

Table II: The values of baseline cardiovascular parameters in both groups (n=60)

Parameters	Control(n=30)	T2 DM (n=30)
HR(beats/min)	81.47±0.55	82.69±0.84
SBP(mmHg)	129±1.13	129.14±1.41
DBP(mmHg)	79.83±0.66	80.34±0.89
MAP(mmHg)	96.18±0.64	97.4±0.78
PP(mmHg)	49.17±1.18	50.33±1.09
RPP(mmHg/min)	10508±113.38	10852±156.02

T2DM-Type 2 diabetes Mellitus, HR= Heart rate, SBP=systolic blood pressure, DBP= diastolic blood pressure, MAP= mean arterial pressure, PP= pulse pressure, RPP= rate pressure product. Data were expressed as Mean±SD & P value was > 0.05 . Independent sample 't' test was done.

Table III shows that significant reduction of HR ($p < 0.001$), SBP ($p < 0.05$), DBP ($p < 0.001$), MAP ($p < 0.001$) and RPP ($p < 0.001$) occurred in type 2 diabetes mellitus patients after 3 months of SBE.

Table III: HR, SBP, DBP, MAP, PP, RPP before and after SBE in study group (n=30)

Parameters	Pre-SBE	Post-SBE
HR(beats/min)	82.69±0.84	76.48±0.73***
SBP(mmHg)	129.14±1.41	127.07±0.19*
DBP(mmHg)	80.34±0.89	74.65±0.86***
MAP(mmHg)	97.41±0.78	92.14±0.48***
PP(mmHg)	50.33±1.09	52.50±1.47
RPP(mmHg/min)	10852±156.02	9755±128.89***

HR= Heart rate, SBP=systolic blood pressure, DBP= diastolic blood pressure, MAP= mean arterial pressure, PP= pulse pressure, RPP= rate pressure product. Data were expressed as Mean±SD. ***= $p < 0.001$, *= $p < 0.05$. Paired sample 't' test was done.

Table IV shows that all parameters were not significantly changed ($p > 0.05$) after 3 months in the group of diabetes mellitus who were not under SBE.

Table IV: HR, SBP, DBP, MAP, PP, RPP at baseline and after 3 months of follow-up in control (n=30)

Parameters	Baseline	After 3 months
HR(beats/min)	81.47±0.55	82.33±0.61
SBP(mmHg)	129.01±1.13	130.17±0.97
DBP(mmHg)	79.83±0.66	79.67±0.72
MAP(mmHg)	96.18±0.64	95.69±0.63
PP(mmHg)	49.17±1.18	48.17±1.34
RPP(mmHg/min)	10508±113.38	10249±345.42

HR= Heart rate, SBP=systolic blood pressure, DBP= diastolic blood pressure, MAP= mean arterial pressure, PP= pulse pressure, RPP= rate pressure product. Data were expressed as Mean±SD & P value was >0.05. Paired sample 't' test was done.

Discussion

The results of this study showed that there were significant reductions in HR, SBP, DBP, MAP and RPP in the study group after 3 months of yogic intervention. Similar results were reported after yogic exercise in healthy young people and hypertensive, heart failure patients¹³⁻¹⁸.

Another group of researchers also found significant decrease of HR, SBP and DBP in T2DM¹⁹⁻²⁰.

It is well recognized that practicing of slow breathing exercise increases parasympathetic tone and, decreases sympathetic activity but there is no change in parasympathetic activity after practicing fast breathing exercise¹².

The exact mechanism of how SBE reduces blood pressure is still under research. But research evidence has shown that performance of SBE decreases the release of adrenaline and sympathetic activity that might decrease heart rate and blood pressure. Slow breathing exercise also improves balance between sympathetic and parasympathetic nervous system²¹. Some other researchers also reported that yoga based exercise might increase vagal tone and decrease sympathetic activity^{13, 22-23}.

In this study, control group have shown tendency to increase blood pressure and heart rate after 3 months of follow up. Thus the results of current research emphasize the importance of performing breathing exercise along with conventional treatment in non-insulin dependent diabetic patients to maintain healthy cardiac condition.

Conclusion

Yogic slow breathing exercise may effectively improve cardiovascular function in type 2 diabetic patients. Therefore slow breathing exercise can be recommended for regular practice along with traditional medical treatment in T2DM patients to improve cardiac health.

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