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Research Article

CONTROLLED VESTIBULAR STIMULATION: PHYSIOLOGICAL INTERVENTION IN DIABETES CARE

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ABSTRACT

Objective: The present study was aimed to assess the role of vestibular stimulation in the management of diabetes care.

Methods: We carried out the present study in 83-year-old man with 20 years history of Type 2 diabetes. Controlled vestibular stimulation was achieved by swinging on a swing (back to front direction). Blood Pressure and Blood glucose levels were measured by standard methods.

Results: Fasting blood glucose and blood pressure levels came down significantly after controlled vestibular stimulation.

Conclusion: The present study confirmed the useful role of vestibular stimulation in the control of diabetes mellitus. We recommend a further detailed study to elucidate the therapeutic value of controlled vestibular stimulation in diabetes care.

Keywords: Controlled vestibular stimulation, Diabetes care, Physiological intervention.

INTRODUCTION

Diabetes is a chronic metabolic disease, which occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces. This leads to an increased concentration of glucose in the blood (hyperglycemia) [1]. A total of 347 million people worldwide have diabetes. In 2004, an estimated 3.4 million people died from consequences of fasting high blood sugar. A similar number of deaths have been estimated for 2010. More than 80% of diabetes deaths occur in low- and middle-income countries [2-5]. India is having a second largest number of subjects with diabetes [6-8]. Indian population is more likely to develop Type 2 diabetes due to changes in their lifestyle toward deleterious pattern, and this transition is more rapid in Kerala [9]. Simple lifestyle measures have been shown to be effective in preventing the onset of Type 2 diabetes [9].

The vestibular system is directly connected with the dorsal motor nucleus of the vagus, nucleus tractus solitarius, hypothalamus, dorsal raphe nucleus, nucleus tractus solitarius, locus coeruleus, and hippocampal formation [10]. The electrical vagal stimulation produced an increase in both insulin and glucagon secretion. Depression, general emotional stress and anxiety, sleeping problems, anger, and hostility are associated with an increased risk for the development of Type 2 diabetes [11,12]. Vestibular stimulation relieves pain, reduces stress, and promotes sleep [13-15]. There exists several methods to stimulate vestibular system [16-19], swinging is a simple way of stimulating vestibular system effectively. Swing was incorporated in our tradition and swing can be used by all age groups [20]. Vestibular stimulation may prevent/delay development of diabetes, in terms of both its onset and its exacerbation [21].

The following case study introduces traditional intervention in the management diabetes care.

METHODS

The study was approved by Institutional Ethics Committee. A written, informed consent was obtained from the participant. The study was performed in accordance with the "Ethical Guidelines for Biomedical Research on Human Participants, 2006" by the Indian Council of Medical Research and the Declaration of Helsinki, 2008.

Controlled vestibular stimulation

Controlled vestibular stimulation was achieved by swinging on a swing (back to front direction). The participant was advised to adjust frequency, duration, and intensity, according to comfort [22,23]. Frequency, intensity, and duration were recorded manually.

Measurement of blood pressure

Blood pressure was measured by using digital BP instruments of Industrial Electronic & Allied Products, Pune, India [22].

Measurement of blood glucose levels

The blood glucose levels were measured by Digital Glucometer (ACCU-CHEK) manufactured by Roche Diagnostics India Pvt. Ltd., Mumbai.

Study design

Experimental (pre and post) design. Pre and post values were recorded every week end for 26 weeks.

Background

An 83-year-old man with 20 years history of Type 2 diabetes was seen for an annual physical examination at his primary care provider's office. The patient does not exercise regularly. In 2012, he experienced hyperglycemic coma, and his blood glucose level increased to 836 mg/dl as he had forgotten to take insulin injection. His diet is comprised mainly of oats, bread, butter, and protein-rich high meals with 250 ml of alcohol.

Medical history

The patient had a history of Type 2 diabetes mellitus (T2DM) for 20 years and balance problems for past 2 years. He was under medication for the past 18 years (Daonil, Glyciphase, Metformin).

Family history

The participant's father had DM and died at the age of 68 in a road accident. He has one younger brother who is obese and slightly elevated blood glucose levels.

Social history

The participant has worked as a professor for more than 30 years in various medical colleges in India and abroad. He was separated from his wife from last 5 years and has 2 sons. He drinks 250 ml of alcohol occasionally.

Physical examination

The findings of the physical examination showed the following: participant alert and cooperative; weight - 75 kg; height - 175 cm; body mass index - 24.5 kg/m^2; systolic blood pressure - 159.50±10.09 mmHg; diastolic blood pressure - 100.25±6.28 mmHg; heart rate - 102 beats/minutes and regular; respiratory rate - 18 breaths/minutes; and body temperature - 37°C. His fundi is clear, with no arteriolovenous nicking or retinopathy. His light and accommodation reflex are normal. His lungs are clear to auscultation. He has no hepatomegaly and splenomegaly. His prostate is normal. He has sensory neuropathy.

Table 1: Mean value of intensity, frequency and duration preferred by the participant

Intensity in centimeter center to back	85.48±2.99
Intensity in centimeter center to front	110.49±3.33
Frequency in cycles/minutes	22±1.76
Duration in minutes	3.13±0.34

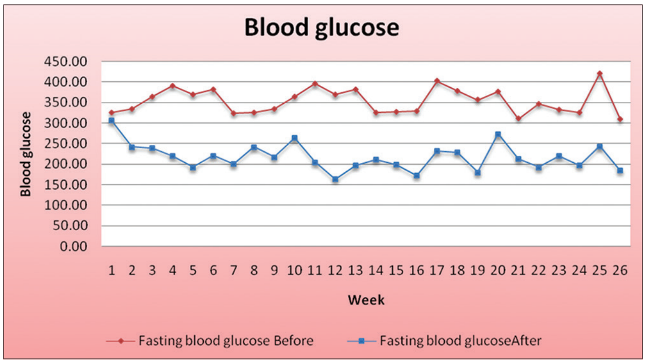

Fig. 1: Mean fasting blood glucose levels (mg/dl) before and after vestibular stimulation. (p<0.001* statistically significant)

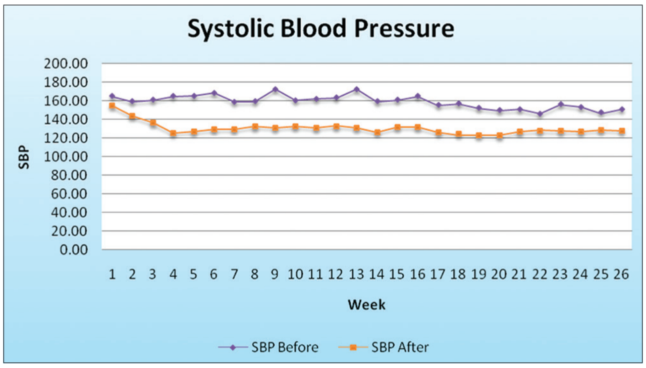

Fig. 2: Mean systolic blood pressure (mmHg) before and after vestibular stimulation. (p<0.001* statistically significant)

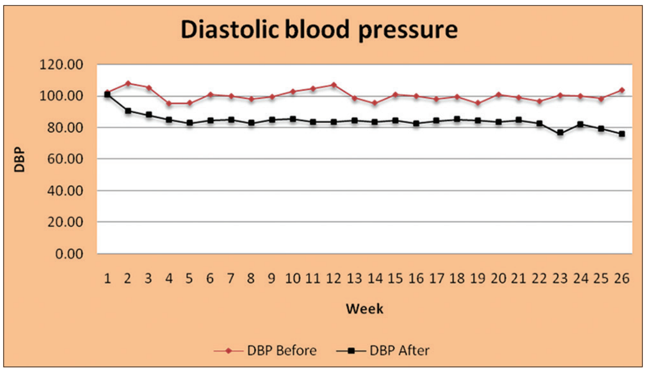

Fig. 3: Mean diastolic blood pressure (mmHg) before and after vestibular stimulation. (p<0.001* statistically significant)

Laboratory studies

His mean value of fasting blood glucose prior to the intervention was 355.43±47.31 mg/dl. His fasting blood glucose was 444.75±42.57 mg/dl with intake of protein rich high meals. An electrocardiogram was performed and was normal.

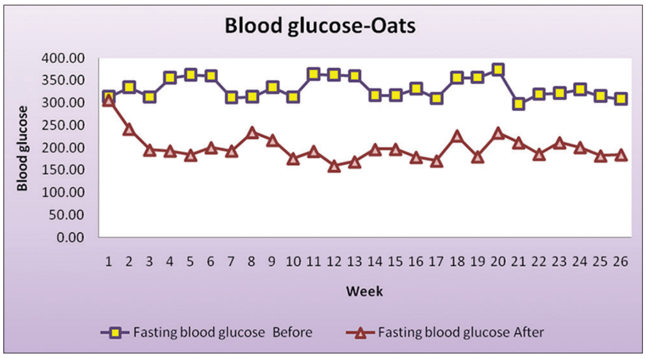

Fig. 4: Mean fasting blood glucose levels (mg/dl) before and after vestibular stimulation with consumption of oats. (p<0.001* statistically significant)

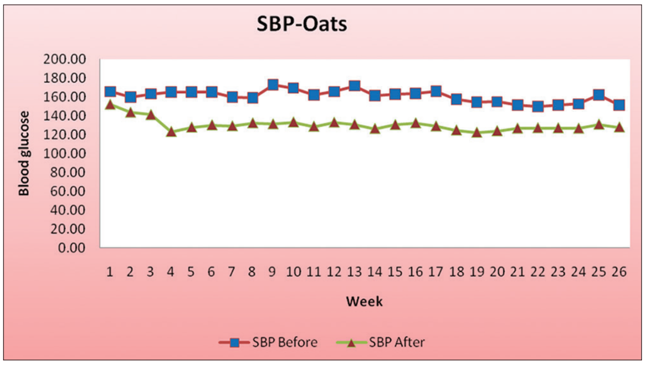

Fig. 5: Mean systolic blood pressure (mmHg) before and after vestibular stimulation with consumption of oats. (p<0.001* statistically significant)

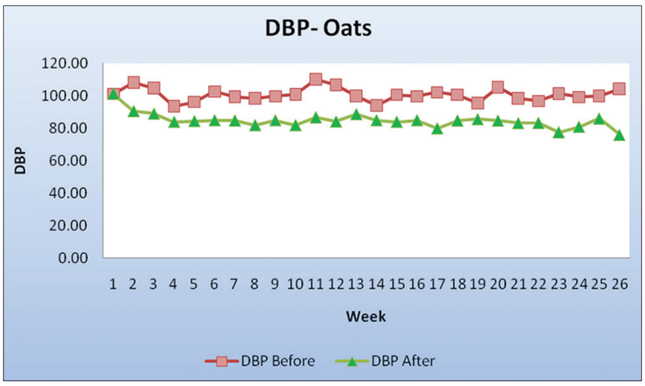

Fig. 6: Mean diastolic blood pressure (mmHg) before and after vestibular stimulation with consumption of oats. (p<0.001* statistically significant)

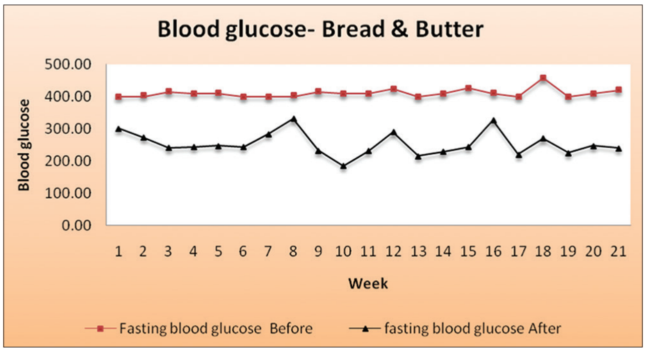

Fig. 7: Mean fasting blood glucose levels (mg/dl) before and after vestibular stimulation with consumption of bread and butter. (p<0.001* statistically significant)

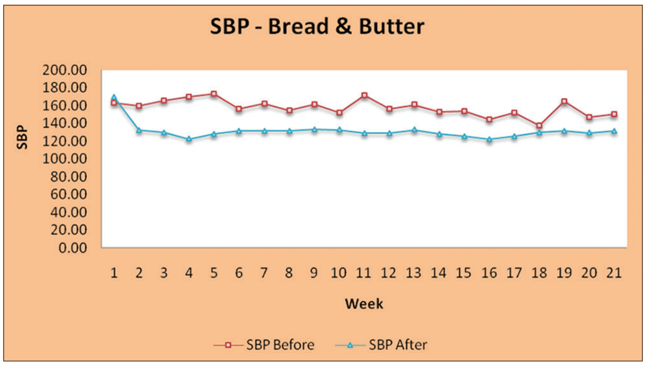

Fig. 8: Mean systolic blood pressure (mmHg) before and after vestibular stimulation with consumption of bread and butter. (p<0.001* statistically significant)

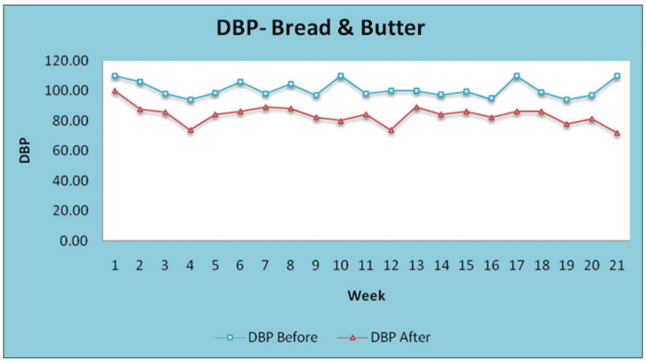

Fig. 9: Mean diastolic blood pressure (mmHg) before and after vestibular stimulation with consumption of bread and butter. (p<0.001* statistically significant)

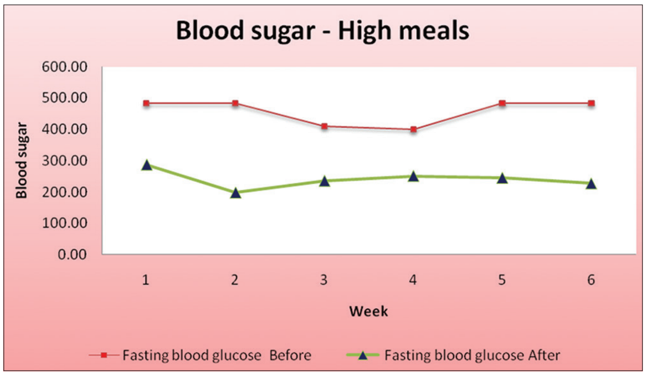

Fig. 10: Mean fasting blood glucose (mg/dl) levels before and after vestibular stimulation with consumption of high meals. (p<0.001* statistically significant)

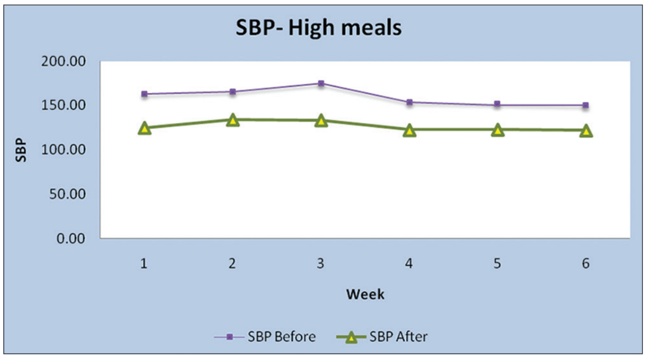

Fig. 11: Mean systolic blood pressure (mmHg) before and after vestibular stimulation with consumption of high meals. (p<0.001* statistically significant)

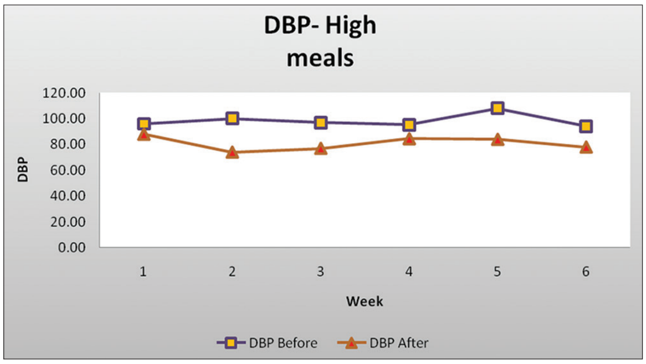

Fig. 12: Mean diastolic pressure levels (mmHg) before and after vestibular stimulation with consumption of high meals. (p<0.001* statistically significant)

Current medical treatment

His hyperglycemia has been treated with a combination of metformin 1000 mg twice daily, insulin injections, 20 units in the morning, and 18 units at night. After a follow-up of the participant with the current medical treatment, we have given traditional intervention (controlled vestibular stimulation) as a supplementary therapy along with the medications for 26 weeks (Table 1). He reported that he was comfortable and willing to continue for a long period. We have observed better control of blood glucose levels and blood pressure when compared with his earlier values (Figs. 1-12).

DISCUSSION

T2DM has become a major public health challenge in India [9]. A large number of elderly population in Kerala was suffering with chronic non-communicable diseases including diabetes. This may be due to enforcement of unhealthy lifestyle [9]. Vestibular stimulation by swing is affordable and can be incorporated in our routine day lifestyle. In our previous study, we have observed a significant decrease in blood glucose levels followed by caloric vestibular stimulation in alloxan induced a diabetic model of wistar albino rats [24]. We agree with our previous study as we have observed better control on blood glucose with vestibular stimulation and medications when compared with medications alone.

CONCLUSION

The present study confirmed the useful role of vestibular stimulation in the control of DM. Fasting blood glucose and blood pressure levels came down significantly. We recommend a further detailed study to elucidate the therapeutic value of controlled vestibular stimulation in diabetes care.

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