

Effect of Selected Vestibular Exercise on Metabolic Parameters and Anthropometry in Type 2 Diabetic Patients

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 29 Nov 2023	Background: Diabetes Mellitus is a rapidly growing disease among the population of India. Type 2 Diabetes have close association with life style. Proper diet and adequate exercise are the vital components for diabetic management. Vestibular exercise is a simple, non- invasive physical activity that plays a role in maintenance of posture and equilibrium. Vestibular exercise has beneficial effect on Type 2 Diabetic management. With this background, we took up this study on the effect of vestibular exercise on metabolic parameters and anthropometry among Type 2 diabetic patients. Aim and objectives: The objective of the present study was to investigate the beneficial effect of vestibular exercise on metabolic parameters and anthropometry among Type 2 Diabetic patients before and after 3 months. Materials and Methods: 120 male and female Type 2 diabetic patients in the age group between 40-55 years, with history of Diabetes mellitus for 5-10 years. They were divided in to two groups. Ie, Control group (Group A) , Vestibular exercise group (Group B). Vestibular exercise were given to Group B for 3 months. Height, weight, Body fat percentage, BMI, Waist circumference, Hip circumference, Arm circumference, Thigh circumference, FBS, PPBS, HbA1c, Total cholesterol, Triglycerides, LDL, HDL, Systolic and Diastolic BP were recorded before and after the intervention in both the groups. Results: The analyzed values were significantly improved in the interventional groups (Group B. ie, vestibular exercise group) when compared with the control group. Mean Diabetic patients were significantly fewer after 3 months in Group B when compared with both A and B groups. Conclusion: Vestibular exercise can manage Type 2 Diabetes and associated complications. Keywords: Vestibular exercise, Metabolic parameters, Anthropometry, Type 2 diabetes
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1. Introduction

The term diabetes is derived from the Greek words dia, bainein and mellitus. Dia means “through”, bainein means “to go” and the mellitus means “sugar”, therefore diabetes mellitus literally means flow of sugar.^{1,2} Diabetes describes a group of metabolic complications in which the body is unable to make proper use of glucose, mainly because the body insulin fails to convert the glucose into energy resulting in hyperglycemia and glycosuria.³ It is usually associated with the insulin antagonistic hormones like glucagon, growth hormone and glucocorticoids.⁴ Diabetes is fast becoming a chronic health complication in all countries. The latest studies show that about 387 million people are affected with this chronic health problem and in coming years its range is expected to increase by 592 million people. Studies revealed that about 175 million people are affected with undiagnosed type II diabetics. About 6.7 million deaths occurred in the year of 2014 only because of diabetics. The number of deaths may increase in the fourth coming years.^{5,6,7} Since the disaster of diabetes is spreading world-wide

mainly because of our food habits and changing life style, it is advisable to have a commitment to exercise and healthy meal plan.⁸

Inner ear has a long bony labyrinth and a membranous labyrinth. It has sense organs called maculae, cristae and otoliths. Alterations in straight movement is ascertained by otoliths and that of rotatory and angular changes are detected by the sensory end organs of semi-circular canals.⁹ The vestibulocochlear nerve is the eighth cranial nerve, which have vestibular nerve and cochlear nerve. The vestibular nerve is mainly responsible for maintaining body balance, equilibrium and eye movements.¹⁰ Through the vestibular nerve stimulation by applying an electrical current behind the ears, the otoliths of vestibular apparatus get stimulated. Continuous stimulation of the apparatus enhances glycemic regulation in type 2 diabetic patients.¹¹ Vestibular workout results in remarkable change in postural stability in aged women.¹²

The vestibular system is considered, sixth sense as it performs extensive functions including cognitive as well as coordinative.¹³ vestibular stimulation methods are used for management of pain disorders, psychiatric disorders, post lesional disorders and other neurological disorders. But over stimulation may cause some side effects.^{14,15,16} Studies has been revealed that, the complications of type 2 diabetes can be treated with vestibular nerve stimulation as it has a good and safety profile.¹⁷ Vestibular stimulation can manage diabetes through increasing insulin secretion, through food intake regulation, through hypothalamo-pituitary-adrenal (HPA) axis inhibition and through sleep promotion^{18,19}. Vestibular stimulation can be performed by vestibular exercise.²⁰ The present study aimed to observe the effectiveness of vestibular exercises on 2 diabetes.

2. Materials And Methods

Subjects:

120 patients of both genders with a history of Type 2 diabetes for 5-10 years, in the age group of 40 – 55 years, were selected. They were allocated in to two groups based on their age, gender, medication and history of DM, with 60 members in each group. Age, gender, medication and history of DM are equal in both the groups.

Group A: Control (Diabetic patients without any exercise)

Group B: Vestibular exercise (Diabetic patients with vestibular exercise for 3 months.

Selection of subjects:

The diagnosis of Type 2 Diabetes Mellitus (NIDDM) patients were done according to the WHO criteria. The scope and objectives of the present study was explained to all the subjects. The consent was taken from the subjects. The study was approved by the institutional Ethical committee. (IEC study no: IEC/2021/06/217)

Study setting:

The present study was conducted at Believers Church Medical College Hospital, Kuttappuzha, Thiruvalla, Kerala, India.

Inclusion criteria:

- Type 2 Diabetic patients with age between 40-55 years.
- Duration of DM 5 -10 years.

Exclusion criteria:

- DM patients with vertigo
- Patients who have been doing exercise already.
- DM patients with history of ear surgery.

VESTIBULAR EXERCISE PROTOCOL

Sl.No	Vestibular exercise	Duration
Sitting		
1	Move head to right and left	1 min

2	Move head to up and down	1 min
3	Head rotation clockwise and anti-clockwise	1min
Standing		
4	Lean forward and backward	1min
Walking		
5	Each step. Head turns right, left, up and down	1 min

- 3 minutes interval in between each exercise
- Repeated this cycle again after 1 minute interval. (2 cycles per day)
- One cycle – 17 minutes. Total 35 minutes (including 1 minute interval between two cycles)
- 3 days in a week for 3 months
- Time : 30 minutes in between morning 08.30 to 9.00 am

Before the onset of intervention, the subjects were instructed by a qualified physical educator, physiotherapist and a diabetologist.

PARAMETERS:

METABOLIC PARAMETERS

- Fasting Blood sugar (FBS)
- Post Prandial Blood Sugar (PPBS)
- HbA1C
- Total Cholesterol
- Triglycerides
- LDL
- HDL
- BP

ANTHROPOMETRIC PARAMETERS

- Body fat percentage
- BMI
- Waist circumference
- Hip circumference
- Waist Hip Ratio
- Arm circumference
- Thigh circumference

Collected data were analyzed using SPSS with t-test & ANOVA $P < 0.05$ was considered as statistically significant.

3. Results and Discussion

185 subjects of both male and female were selected for this study. Subjects with more than 85% were selected for the final analysis. 13 subjects dropped out of the study due to personal reasons. Finally, 120 subjects were selected for final analysis. where 60 subjects constituted the control group (Group A) and 60 subjects constituted the Vestibular exercise group (group B). There was no statistically significant difference observed in the metabolic parameters between pre-test and post-test score in the control group (Table 1) other than FBS, PPBS, HbA1C and BP. There was no statistically significant difference observed in the Anthropometric Parameters other than Thigh circumference between pre-test

and post-test score in the control group (Table 2) a statistically significant difference between pretest and post-test was observed in all the measured metabolic parameters and anthropometric parameters except waist hip ratio among Vestibular exercise group (Group B).

Table: 1-Baseline metabolic parameters and after three months among Control group and vestibular exercise groups.

PARAMETERS	CONTROL (BEFORE) (n=60)	CONTROL (AFTER) (n=60)	T value	P value	VESTIBULAR EXERCISE (BEFORE) (n=60)	VESTIBULAR EXERCISE (AFTER) (n=60)	T value	P value
FBS	156.97± 17.69	155.95 ± 17.85	2.55	<0.05	157.75 ± 19.33	151.12 ± 17.69	8.81	<0.01
PPBS	276.32 ± 36.10	277.22 ± 35.93	2.31	<0.05	276.52 ± 36.12	257.67 ± 36.19	14.22	<0.01
HBA1C	9.14 ± 0.33	9.12± 0.34	2.08	<0.05	9.13 ± 0.339	9.05 ± 0.337	5.07	<0.01
CHOLESTEROL	230.27 ± 23.05	228.95 ± 23.74	1.09	>0.05	250.57 ± 23.44	216.58 ± 22.40	13.21	<0.01
TRIGLYCERIDE	166.85 ± 20.76	165.93 ± 20.89	3.44	<0.01	167.03 ± 20.96	158.53 ± 20.17	15.63	<0.01
LDL	166.85 ± 22.85	115.93 ± 22.77	2.42	<0.05	117.33 ± 22.85	114.45 ± 22.40	7.68	<0.01
HDL	36.47 ± 5.23	35.93 ± 5.66	2.65	<0.05	36.63 ± 5.66	35.90 ± 5.22	2.89	<0.01
SBP	133.27 ± 9.22	132.18 ± 9.39	1.97	<0.05	133.53 ± 9.53	130.43 ± 9.02	7.94	<0.01
DBP	86.57 ± 7.13	85.73 ± 6.01	3.05	<0.01	86.60± 7.15	85.73 ± 6.71	6.71	<0.01

Table:2- Baseline anthropometric parameters and after three months among Control group and vestibular exercise

PARAMETER S	CONTRO L (BEFORE) (n=60)	CONTRO L (AFTER) (n=60)	T valu e	P value	VESTIBULA R EXERCISE (BEFORE) (n=60)	VESTIBULA R EXERCISE (AFTER) (n=60)	T valu e	P value
BMI	27.40 ± 2.73	27.32 ± 2.54	1.21	>0.05	27.43 ± 2.57	27.13 ± 2.62	8.08	<0.01
Body fat %	28.11 ± 3.49	27.95 ± 3.47	0.479	>0.05	29.32 ± 4.41	27.95 ± 3.47	2.57	<0.01
Waist circumference	100.14 ± 6.47	99.99 ± 6.51	1.48	>0.05	100 ± 6.56	99.70 ± 6.29	2.65	<0.01
Hip circumference	103.63 ± 5.20	103.52 ± 5.15	1.49	>0.05	103.66 ± 5.19	102.86 ± 5.23	6.86	<0.01
Waist Hip Ratio	0.966 ± 0.035	0.965 ± 0.035	0.37	>0.05	0.967 ± 0.0359	0.969 ± 0.0346	- 0.952	>0.05
Arm Circumference	13.94 ± 3.40	13.79 ± 3.45	1.19	>0.05	13.87± 3.417	13.32 ± 3.285	11.90	<0.01
Thigh Circumference	22.22 ± 4.12	22.02 ± 4.16	2.11	<0.05	22.08 ± 4.183	21.01 ± 4.189	5.72	<0.01

This study was designed to inspect the physiological effects of vestibular exercise metabolic parameters and anthropometry in Type 2 Diabetic patients. From this study, it was found that vestibular exercise have beneficial effect for diabetic patients with a $P < 0.05$. (Table 1 and 2) The control group also showed a significant beneficial effect on some values like FBS, PPBS, BF%, and BMI. (Table 1 and 2). This result may be due to the medication. The final results of this study suggest that the group that practiced vestibular exercise showed significant improvement in metabolic parameters and anthropometry in comparison to that of the control group. Vestibular exercise may effectively stave off the development of diabetes through triggering the vestibular nerve through vestibular exercise.²¹ Several investigations have worked to disclose the association between the vestibular system and diabetes.²² Vestibular stimulation can manage diabetes through harmonizing autonomic activity, sympathetic obstruction, controlling food intake, inhibiting the hypothalamo-pituitary-adrenal axis, and encouraging sleep.²³ A study reveals that the anti- diabetic effect of vestibular stimulation may be

mediated through AMP- activated protein kinase.²⁴ Elevation in BMI, Body Fat percentage, Abdominal obesity, Blood glucose level, HbA1C, Total Cholesterol, etc. are the usual complications observed in the group of diabetic patients.²⁵ Caloric vestibular stimulation can manage the blood glucose level in alloxan induced Wistar albino rats.²⁶ Vestibular stimulation is able to control energy regulation and glucose metabolism during excess energy depletion. Then it can handle obesity. Vestibular stimulation is a therapeutic perspective for the clinical management of obesity and diabetes.²⁷

To our knowledge, beneficial effects of vestibular exercise among adults with type 2 diabetes are rare. Previous studies have looked at the effects of vestibular stimulation on diabetic patients. Here, we used vestibular exercise as a method for vestibular stimulation, which is the easiest technique for vestibular stimulation.

4. Conclusion

Vestibular exercise is a non-invasive possibility for the management of diabetes. Vestibular exercise may have a good scientific backdrop to be applied as an effective intervention in the handling of type 2 DM. Vestibular exercise has also shown significant beneficial effects, so this can be suggested as a key method in the diabetes management procedure for bedridden patients because it is an easy practice.

Future Scope:

The Present study proved that vestibular exercise have significant effect on diabetic patients. It a simple method. So even bedridden patients also can do this. It will be a blessing for bed-ridden diabetic patients.

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Conflict Of Interest:

Nil

Author's Contribution:

Athira Mullayil Sivan- conceptualization, data curation, investigation, methodology, project administration, visualization, writing—original draft, writing—review and editing; **Dr.Mohan Varughese** -conceptualization, methodology, writing—original draft, writing—review and editing; **Dr.Sheela Joice Paravanavilayil Paul** - methodology, writing—original draft, writing, review and editing. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. All authors have read and agreed to the published version of the manuscript.

Iec Approval:

The study was approved by the institutional Ethical committee from Believers Church Medical College Hospital, Thiruvalla, kerala. (IEC study no: IEC/2021/06/217)

Data Availability:

All datasets generated or analyzed during this study are included in the manuscript.

Informed Consent:

Written informed consent was obtained from the participants before enrolling in the study.

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