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Stability Ball Exercises In Type 2 Diabetic Patients

Authors:
Subramanian SS[1] and Venkatesan P[2].

Institution:
1. Principal, Sree Balaji College of Physiotherapy, Chennai -100, India.

2. UGC Professor Emeritus in Zoology, Loyola College, Chennai -34, India.

Corresponding author:
Subramanian SS.

ABSTRACT:

Number of people with diabetes in India is 40.9 million and is expected to get rise to 69.9 million by 2025. Proper management can improve health of individuals with diabetes and minimize many complications that may occur among diabetic patients, along with due medications and regular physical exercises. Exercises using Stability ball were quite effective in improving the glycemic control among Type 2 diabetic patients.

Keywords:
Type 2 Diabetes, Stability ball

Abbreviations:
Stability Ball Exercises (SBE)
Fasting Blood Sugar (FBS)
HbA1C - Glycocelated Haemoglobin

Note:
Stability ball is also called physio ball, swiss ball / gym ball, which is an air inflated ball of 55cm size widely used as a rehabilitation tool in physiotherapy.

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INTRODUCTION

The prevalence of Diabetes is rapidly rising all over the globe at an alarming rate (Huizinga MM and Fothman, 2006). Last three decades, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people (Wild *et al.,* 2004). India leads the world with the largest number with (40.9 million) diabetic patients (Sicree *et al.,* 2006). The most disturbing trend is the shift in age of onset of diabetes to a younger age in recent years, which could have long lasting adverse effect on nation's health and economy (Suresh *et al.,* 2005).

Reduced physical activity, changes in dietary pattern, and sedentary occupational habits are the major causes for concern(Misra, Pandey *et al.,* 2001). The American diabetes association (ADA) recommends that individual with Type 2 diabetes perform at least 150 minutes of moderate intensity aerobic exercises or at least 90 minutes of vigorous aerobic exercises per week (American Diabetes Association, 2002). Resistance exercise training is effective in improving glycaemic control and can be used as an adjunct to standard care of Type 2 diabetic patients (Carmen Castaneda 2002). Vibration exercises are an effective, low time consuming tool to enhance glycaemic control in Type 2 diabetic patients (Klans Banm 2007).

The objective of the study was to assess the effects of 12 weeks of moderate intensity resistance exercises using stability ball on glycaemic control on male Type 2 diabetic patients was analysed, which is the first of its kind study among Indian population.

MATERIALS AND METHODS

Subjects were recruited through diabetic camp organized during May 2010 through advertisements given in regional news paper, The Hindu and Velachery times respectively. The study was conducted at Sree Balaji College of Physiotherapy, Chennai, India between May 2010 and July 2010.

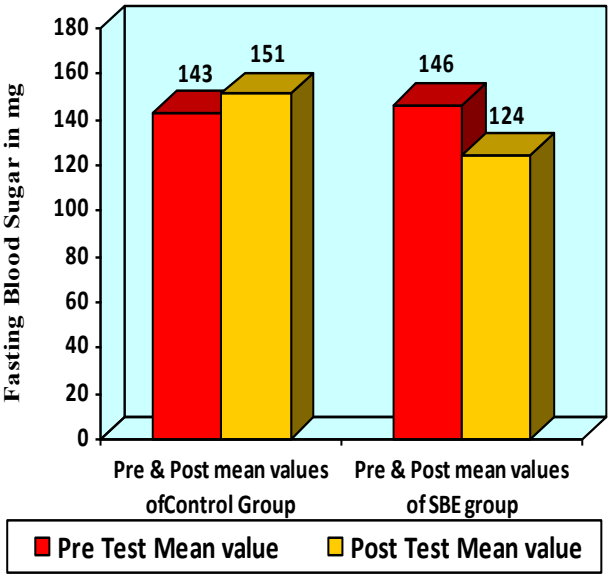
80 male Type 2 diabetic subjects between 30 - 60 years were randomly assigned to 12 weeks supervised control group (n=40) or moderate intensity resistance exercises using stability ball (n=40). Fasting blood sugar, Post prandial sugar, Glycocelated haemoglobin and Waist circumference were measured before training (i.e., 0 week) and after 12 weeks of training.

Inclusion criteria were as follows:

- Established Type 2 diabetes,
- An inactive life style,
- Not Insulin dependant,
- Male between 30 - 60 years.

The eligible subjects underwent a medical screening and physical evaluation to exclude individuals with subjective or objective evidence of Uncontrolled hypertension, Coronary artery disease, Advanced retinopathy, Neuropathy and severe orthopaedic conditions restricting physical activity.

Subjects were assigned at random to one of the two groups: - Stability ball exercises (n=40) or Control group (n=40). All the subjects gave their written



Graph 1 showing pre & post mean values of control group & stability ball exercises group on fasting blood sugar

informed consent to participate in the study.

Outcome measures

The subjects were tested on two occasions by using same protocols. Baseline measurement was taken before the intervention and after the study all the measurements were taken again.

Venous blood sample of all subjects were taken for analysis of Fasting blood sugar, Post prandial and Glycocelated haemoglobin.

Anthropometric measures

Waist circumferences were measured in centimetres around iliac crest before and after the study.

Intervention

Stability Ball Exercise (SBE) Group

Subjects allotted to this group have performed systemic supervised resistance training in line with (American Diabetic Association) ADA and ACSM (American College of Sports Medicine) guidelines. Subjects exercised for three times per week. Each session comprises of 10 exercises for major muscle groups of lower extremities including Lumbar spine extensors, Abdominals, Gluteus Maximus, Quadriceps femoris, Hamstrings, Gastrocnemius. For a period of 12 weeks subjects have performed 3 sets of 5 repetitions of each exercise per session. Progressive increase in intensity was designed in such a way that up to 4 weeks no holding of each physical activity, from 4 - 8 weeks. 5 seconds hold of each exercises and 10 seconds hold of each exercise during the period from 8 - 12 weeks.

Concept of technique

All the exercises performed were in the nature of isometric contraction of major muscle groups and closed kinematic chain exercises of both lower extremities. Hence body weight of the subjects providing resistance to each activity and the peak torque produced with every physical activity done using stability ball.

Care points

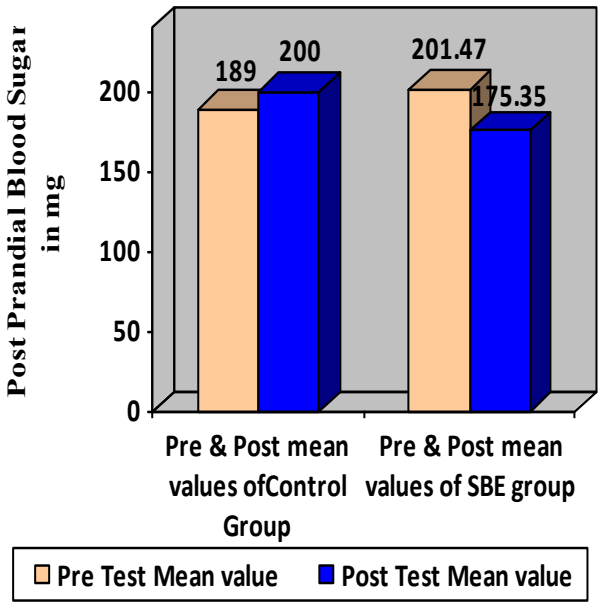
Subjects were advised not to hold breath during exercises. Two hypoglycaemic incidents had occurred and due medical treatment was given. All the subjects completed the training schedule of 12 weeks.

Control Group (CG)

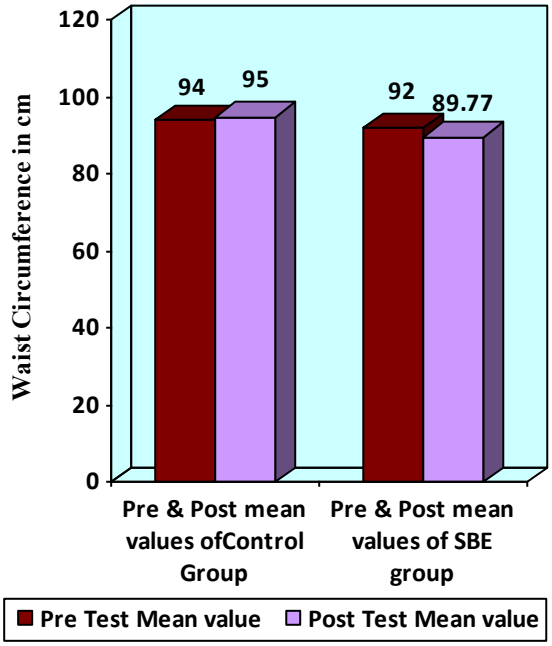
Subjects underwent no specific training other than their day to day routine physical activities. All the subjects in Control Group and Stability Ball Exercise Groups continued their prescribed medication and daily routine activities.

Table 1: Baseline charecteristics of all the subjects

Parameters		Group I Control Group (n-40)	Group II Stability Ball Exercise Group (n-40)
Age in years	30-40	7	11
	41-50	18	13
	51-60	15	16
Family History	Mother	12	11
	Father	7	7
	Both Parents	12	17
	Nil	0	2
	Unknown	9	3
Cigarette Smoking	Smokers	25	30
	Non-Smokers	15	10
Hypertension	Hypertensive	17	17
	Normotensive	23	23



Graph 2 showing pre & post mean values of control group & Stability ball exercises group on post prandial blood sugar



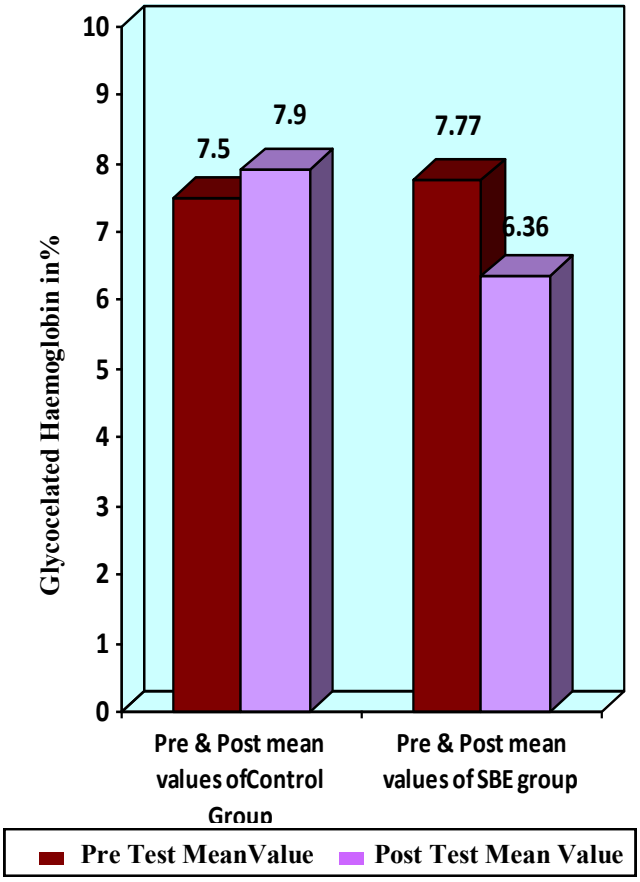
Graph 3 showing pre & post mean values of control group & Stability ball exercises group on waist Circumference in cm

The interactions of nine single nucleotide polymorphisms and cigarette smoking on blood pressure levels were detected (Rui-Xing Yin *et al.,* 2012)

An association of insertion / deletion polymorphism of alpha-adrenoceptor gene in essential hypertension with or without Type 2 Diabetes mellitus was proven (Vasudevan *et al.,* 2008).

Among stability ball exercise group, Fasting blood sugar post mean value has decreased by 22 and $P < .05$, Post prandial blood sugar post mean value lowered by 36 and is significant at $P < .05$. Glycocelated Haemoglobin post mean value lowered by 1.41, and is statistically significant at $P < .001$. Waist circumference post mean value lowered by 2.33 and with statistical significance of $P < .001$.

Initial measurements and post training changes were analysed using paired t test. Statistical tests were performed using SPSS software (Table 2). As displayed in the above table Fasting blood sugar has reduced by a mean value of 22 among the pre and post test mean scores among Stability Ball Exercise group, hence is statistically significant at 5% probability level as $P < .05$.



Graph 4 showing Pre & Post values of control group & Stability ball exercises group on HbA1C %

Post prandial blood sugar was reduced following stability ball exercises by a mean value of 36 among the pre and post mean scores of Stability ball Exercise group, so is significant statistically at 5% probability level as $P < .05$.

Glycocelated haemoglobin mean values have decreased by 1.41% among pre and post mean values of Stability ball exercise group, so that is highly significant at 0.1% probability level with $P < .001$. Waist circumference has decreased in the mean values of pre and post mean scores of Stability Ball Exercise group by 2.33, indicating of high statistical significance at 0.1% probability level with $P < .001$. Whereas among the control group subjects, Fasting Blood sugar, post prandial blood sugar, Glycocelated haemoglobin and waist circumference level were statistically insignificant among their pre and post test scores.

Table 2: Results of paired "t" test among Stability Ball Exercises group:

		Mean	S.D	Significance
Fasting Blood Sugar (mg)	Pre Test	146.25	45.56	P < .05
	Post Test	124.2	23.56	
Post Prandial Blood Sugar (mg)	Pre Test	201.47	58.85	P < .05
	Post Test	175.35	43.58	
HbA1C	Pre Test	7.77	1.21	P < .001
	Post Test	6.36	1.26	
Waist Circumference	Pre Test	92	6.73	P < .001
	Post Test	89.77	6.28	

DISCUSSION

This study confirms that following Stability Ball Exercises significant improvement in Glycocelated Haemoglobin, Fasting Blood Sugar, Post Prandial Blood Sugar and Waist circumference measures compared to control group. Moderate intensity resistance training results in a mean reduction of Glycocelated Haemoglobin by 1% to 2% (Dustan *et al.,* 1998). 0.5 to 1% reduction of Glycocelated Haemoglobin in response to resistance exercises among women Type 2 Diabetes (Cuff *et al.,* 2003). In this study Glycocelated Haemoglobin among Stability Ball used moderate resistance exercises has decreased by 1.41%. 1% decrement in glycocelated haemoglobin following therapies to lower Glycocelated Haemoglobin can reduce the risk of diabetic complications such as myocardial infarction and microvascular disease (Patel *et al.,* 2008 & Stratton *et al.,* 2006).

Leg exercises accelerate insulin absorption from the leg, than arm exercises (Koiviste VA and Fligp 1978). As the Glycaemic control of this study with reduction of Glycocelated Haemoglobin by 1.41 used only exercises of lower extremity hence supports better glycaemic control among Type 2 Diabetic subjects. Glycaemic control improves with resistance training (University of Calgary 2007). Resistance training involving major muscle groups have been shown to improve glycaemic control and reduced Fasting Blood glucose levels (Baldi JC and Snawling N, 2003). A better glucose control was observed due to improvement in Insulin sensitivity and effects of glucose transporters due to muscular hypertrophy and blood flow (Ploug and Ralston 2002 & Rattigan *et al.,* 2001).

Obesity is a most powerful determinant and a risk factor for developing diabetes (WHO 2004). Increase in waist circumference was demonstrated to increased risk to complications in Type 2 diabetic patients among Asian (Ramachandran, 1999). Among Indian diabetic patients higher Body Mass Index and Waist circumference were recorded (chandalia, 1999). Waist circumference measurements may be a stronger predictor than Body Mass Index for the identification of metabolic and cardiovascular disease- associated risk factors (Baik *et al.,* 2000). In this study where waist circumference has decreased by a mean value of 2.33cm, indicating that SBE can be used to prevent many obesity related diabetic complications.

CONCLUSION

Along with diabetic medications, dietary restrictions, physical activities such as aerobic exercises, vibration exercises, resisted exercises using dumbell, bands. This study using stability ball to provide a new form of resisted exercises in the comprehensive management of diabetic type 2 patients can be considered. Exercises using stability ball were effective

in glycaemic control of male, diabetic patients as well in body weight reduction, which can be used in the comprehensive diabetic care, which is time conserving and cost effective.

Limitations and recommendations

With longer study period, more sample to be studied and a combination of Aerobic and stability ball exercises may provide further evidence.

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