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Effect of Static Stretching on Random Blood Sugar Levels in Type 2 Diabetes Mellitus: A Randomized Clinical Trial

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ABSTRACT

According to the International Diabetes Federation's Diabetes Atlas 2006, the number of diabetics will top 70 million by next mid-decade. Type I and type II are the two variations diabetes that exist. 90-95% of diabetics have type 2 DM. Recent studies have shown that exercise and physical activity reduce blood sugar levels. Yoga, aerobics, swimming, stretching, and resistance training improve insulin sensitivity. As type II diabetes can cause neuropathies, hypertension, and amputations, static stretching may help those who can't do regular exercise. People who have been bedridden for a long time or who are too old to do other types of exercise may benefit from static stretching. Earlier research was done to compare the immediate effects of static stretching vs. resistance exercises on blood sugar levels after a meal in people with type II diabetes mellitus. Long-term consequences of static stretching on type II diabetes unpredictable blood sugar levels are unknown. This study examined the effect of static stretching on type II diabetics' random blood sugar levels.

Keywords: Diabetes, Stretching, exercises, aerobic exercise, blood glucose level.

INTRODUCTION

In India, more than 61.3 million people have been diagnosed with diabetes.(1) According to the International Diabetes Federation's Diabetes Atlas 2006, the number of diabetics is projected to climb to 69.9 million by 2025 unless prompt reasonable precautions are adopted.(2) Diabetes mellitus (DM) is a long-term metabolic illness marked by high blood sugar, insulin resistance, and a relative shortage of insulin, which results in symptoms such as frequent urination, thirst, and hunger.(3)

It is caused primarily by obesity and a lack of exercise. Type I diabetes and type II diabetes are the two types of diabetes mellitus. Type 2 diabetes affects 90 percent to 95 percent of patients with diabetes. (4)Adult-onset diabetes, commonly known as type 2 diabetes, is defined by a combination of three key metabolic problems: diminished beta cell function with decreased insulin secretion, insulin resistance in peripheral tissues, and increased hepatic glucose production.(5) Aim for a blood sugar level of 70-130 mg/dl before meals and 180 mg/dl one to two hours after meals, according to the American Diabetes Association.(6)

Recent research has effectively demonstrated that a variety of exercises and physical activities can assist lower blood sugar levels.(7) Yoga, aerobic exercise, swimming, muscle stretching, and strength training increase tissue insulin sensitivity. (8) Glucose absorption in striated muscles rises during stretching, lowering glucose levels in the body strategically. (9)

Static stretching entails creating long-lasting tension in the muscles in a convenient position for 30 seconds without moving the extremity. Static stretching is a type of stretching in which the limb is moved into a new posture by an external force.[10] Static stretching might be helpful for people who are unable to engage in regular physical activities because type 2 diabetes mellitus involves secondary problems like neuropathies, hypertension, and limb amputation. [11] When static stretching is provided by the use of an external force, the muscle experiences sustained tension.[12] In people with type 2 diabetes mellitus, stretching enhances cellular glucose uptake. [13] As a result, after a programme of repeated continuous muscular stretching, blood sugar levels may drop. [14] Static stretching may be helpful for people who have been bedridden for an extended length of time or who fall into the elderly age group and are unable to engage in other forms of exercise. [15]

Before, research was done to compare the immediate effects of static stretching vs. resistance exercises on blood sugar levels after a meal in people with type 2 diabetes mellitus. [16] No research has been done on how static stretching affects random blood sugar levels in people with type 2 diabetes for a longer time. So, this study was done to find out what happens to random blood sugar levels in people with type 2 diabetes mellitus when they do static stretching. This study examined the impact of static stretching on type 2 diabetics' random blood sugar levels.

REVIEW OF LITERATURE

1. Study was done to identify and compare the immediate effects of passive static stretching versus resistance training on blood glucose levels in individuals with type 2 diabetes mellitus.51 participants between the age group of 40-65 years were included. Fasting, postprandial and immediately after exercise regimen blood sugar level was taken. Results showed both interventions are equally effective in reducing blood glucose levels in type 2 diabetes mellitus.
2. Experimental study was done to see whether twenty minutes of passive stretching lowers glucose levels in an at-risk population. 22 participants at increased risk of Type 2 diabetes mellitus were selected. Four muscles of bilateral upper limb and lower limb stretches were given. Pre and post random blood sugar level was taken. Stretching resulted in a significantly greater drop in blood glucose at 20 min.
3. Twenty minutes of passive stretching lowers glucose levels in an at-risk population. 30 participants were selected. Four muscles of bilateral upper limb and lower limb stretches were given. Pre and post treatment HbA1c was taken after 6 week. The results were glycated haemoglobin levels decreased significantly in the passive static stretching group.
4. Passive stretching versus active stretching on immediate blood glucose in subjects with type II diabetes mellitus. 20 subjects with history of diabetes of more than 10 years with glycosylated haemoglobin (6-8) %were included. Subjects in group A underwent 40 minutes of active stretching of lower limb and group B subjects underwent passive stretching of the same muscle groups for 40 minutes. Blood glucose levels were measured before and after 40 minutes of stretching. The results were compared to active stretching; passive stretching resulted in significantly greater reduction in the blood glucose level.
5. The effect of 8 weeks aerobic exercises on insulin resistance in type 2 diabetes mellitus. 53 participants with type 2 mellitus were randomly divided into two groups as exercise (n=27) and control (n=26). The exercise protocol included warm-up by stretching and flexibility exercises for 10 m, followed by walking for 30 m with maximum intensity 60% increase in heart rate and

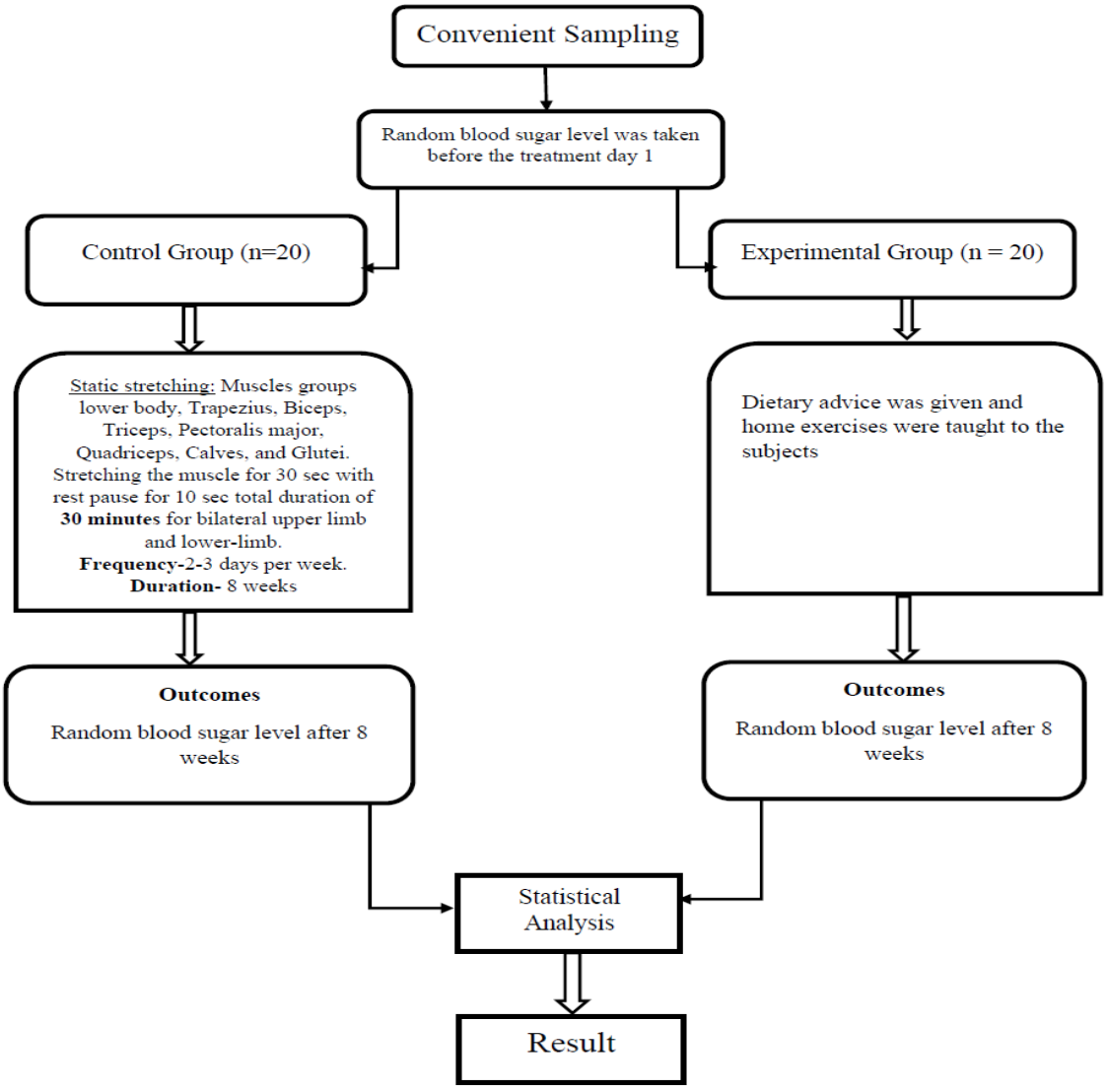
then stretching in the seated position for 10 m, 3 times a week for 8 weeks. The results were there was reduction in blood sugar levels in experimental group after 8 weeks of resistance training as compared to control group.

METHODOLOGY

Figure showing Glucometer

Figure showing Stretching exercises given

Figure showing RBS testing done



The aim of our study was to investigate the effect of static stretching on random blood sugar levels in persons with type 2 diabetes. We hypothesised that static stretching is useful for lowering blood sugar levels in type II diabetes.

Study design was experimental study. Subjects with type two diabetes mellitus.

Residential society in Nerul, Navi Mumbai area were included. Sample size was deduced to forty (40) using formula $n=2(z\alpha+z\beta)\ 2 \times S2\ /d2$ $z\alpha$ = z value for α error that is 1.96 $z\beta$ =0.84 with power 80%. S2 is the average standard deviation of blood sugar level d is the mean difference.

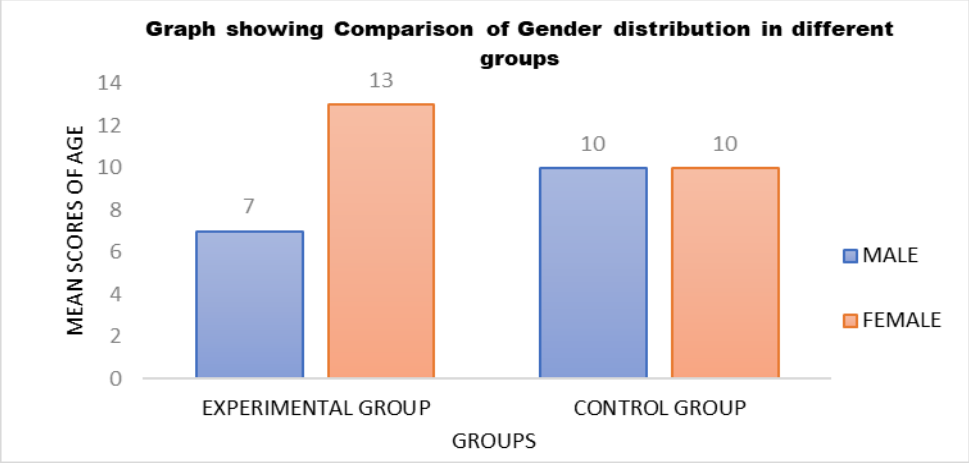
Convenient sampling was adopted. Various materials used were Glucometer, Blood glucose strips, disposable lancets, sterilized cotton and spirit. Ethical approval was obtained from Institutional ethics committee.

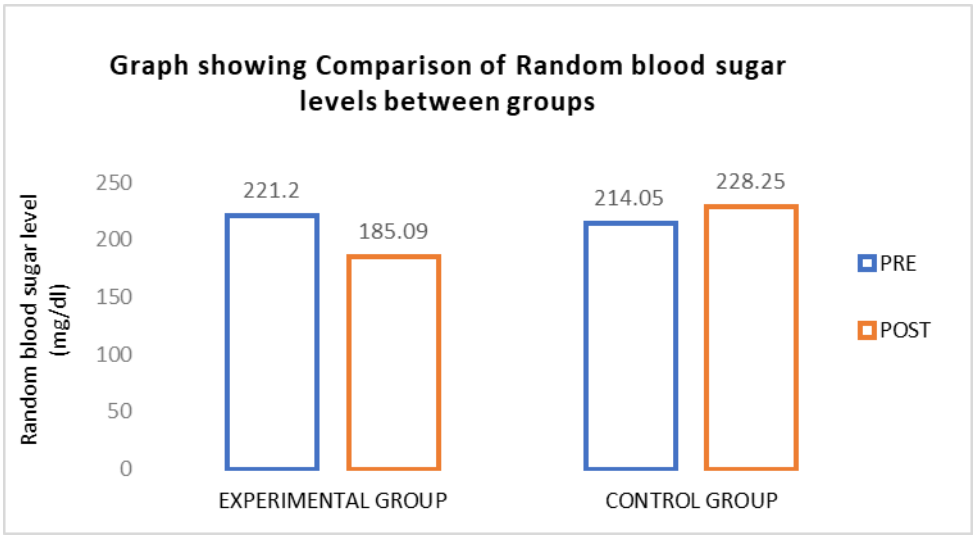
We included patient between the age group of 40-55 years. Diagnosed with type II diabetes mellitus for more than 4 years, on oral hypoglycaemic drugs. People who have sedentary lifestyle and had recent baseline HbA1c value of greater than 6.6%. We excluded patients having restricted physical activity due to any recent fracture of the limb, Pre-existing or medical condition that made their participation inadvisable and patients who were insulin therapy or any other exercise program. Normality of the data was checked by using Shapiro-Wilk test, which indicated the data doesn't follow normal distribution. So non-parametric test was used. Non parametric test-Wilcoxon test was used to compare intragroup that is pre and post values of experimental and control group. Mann Whitney test to compare intergroup that is post values of experimental and control group. Value of P <0.05 was considered statistically significant.

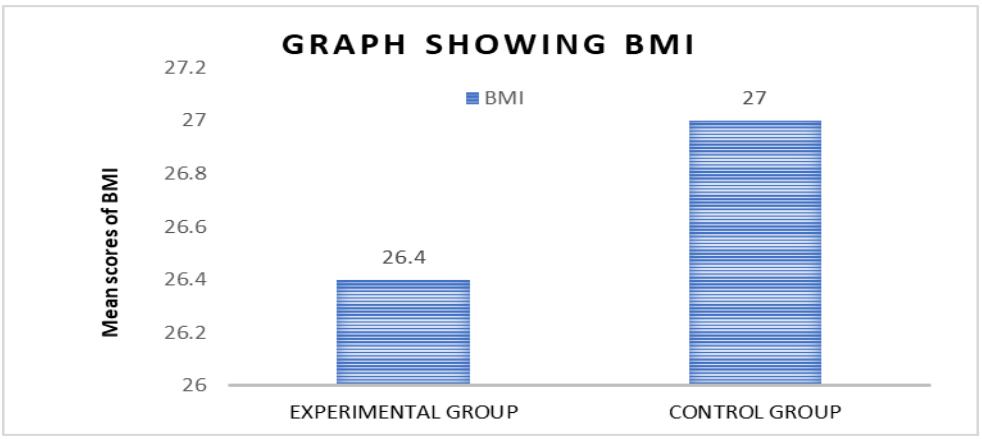
PROCEDURE

Experimental group were given static stretching for four muscles of upper body and lower body bilaterally which included trapezius, biceps brachi, triceps brachi, pectoralis major muscle and quadriceps, hamstrings and calf muscles, glutei respectively for twenty (24) minutes. Stretching was done for 30 sec with rest pause of 10 sec. Total duration session was 30 minutes. Frequency-2-3 days per week duration of treatment was 8 weeks. For rest of the day's patient was instructed to perform self-stretching as taught by therapist for each muscle group. First Session of self-stretching was supervised by the therapist. Rest of the sessions per week was done by the subjects itself. In Control group, where no treatment was given. Dietary advice was given and home exercises were taught to the subjects. Baseline random blood sugar levels were taken at week one and week eight of both the groups and then compared.

Graphical Representation







RESULTS

In experimental group, the random blood sugar levels at week 1 was 221.2 mg/dl and week 8 was 185.09 mg/dl so there was reduction in random blood sugar levels over the duration of 8 weeks and the p value was statistically significant. Hence, static stretching is effective in reducing the blood sugar levels.

In control group, random blood sugar levels at week 1 was 214.05 mg/dl and week 8 was 228.25 mg/dl so there was no reduction in random blood sugar levels over the duration of 8 weeks and the p value was not significant.

DISCUSSION

An eight week, randomised clinical experiment was done to examine the impact of static stretching on people with Type II diabetes mellitus' blood sugar levels. The investigation's findings showed that patients in the experimental group who received static stretching showed statistically significant improvement in outcome measures (random blood sugar level). Age, height, weight, and BMI were the baseline demographic characteristics collected. The majority of the study's subjects had a higher BMI, or one that was above 26 kg/m2, according to the demographic information collected. Previous research revealed a direct link between high BMI and DM. [17] It might happen as the proportion of insulin-resistant fat cells in the body grows, which lowers cellular glucose uptake. Static stretching improves insulin sensitivity, which leads to an increase in glucose uptake at the cellular level and the use of extra fat stored as energy, both of which contribute to a decrease in body mass index.

The research revealed that in Group1, random blood sugar levels were decreased. The outcome was shown to be highly

significant. When compared to the control group, the experimental group (Group 1) showed a significant improvement (Group 2). According to studies, the most likely explanation is that static stretching of the skeletal muscles provides an alternative to exercise that helps diabetes people control their blood sugar levels. Static stretching increases the amount of heat and oxygen consumed by muscles, according to a study. Due to the integration of the glucose transporter type-4 (GLUT-4) into the stretched muscles, it enhances metabolic activity in these muscles and lowers blood glucose levels.

Nitric oxide levels rise by 20% after a single static stretch during stretching. Nitric oxide also affects GLUT-4's inclusion, which supports its activity. It is also known that static stretching reduces tissue oxygen exchange by changing the microcirculation. The ischemia that results make it easier for GLUT-4 to go into the sarcolemma. Additional research on static stretching shows an increase in glycogen breakdown at the cellular level and back up its ability to lower blood sugar levels by promoting protein kinase B activity, which enhances glucose uptake by stretched muscle cells. These pathways offer a potential justification for the beneficial impact static stretching has on blood sugar levels.

A prior study compared the effects of active and passive stretching exercises in people with type 2 diabetes. It came to the conclusion that passive stretching produced superior outcomes to active stretching. This resulted from the passive stretch maintaining a steady tension throughout as opposed to the active stretch, most likely. By the above-mentioned method, the stress created enhanced the muscles' metabolic activity, which in turn decreased blood glucose levels. [(7)] The experimental group decreased its random blood sugar level following the exercise programme, according to the findings of the current study. This could be the reason why the static stretching intervention strategy helps individuals with type 2 DM lower their blood sugar levels. The study's findings, which support the aforementioned conclusion, show that patients with Type 2 diabetes mellitus can receive static stretching, which will lower their sporadic blood sugar levels. We would like to address the limitations Random blood sugar level has been used as an outcome measure for the above study. This outcome measure can be influenced by various other factors for e.g. Diet and lifestyle difficult for the therapist to ensure that subjects perform self-stretching regularly. No follow up of the subjects was done. HbA1c or Glycosylated Haemoglobin is a form of haemoglobin that is measured primarily to identify the average plasma glucose concentration over prolonged periods of time. As the average amount of plasma glucose increases, the fraction of glycosylated haemoglobin increases in a predictable way. Hence, HbA1c could be considered as a more reliable outcome measure.

Future scope for study HbA1c or Glycosylated Haemoglobin test is more reliable outcome measure which can be used over a period of 2 month. More number of sessions can be done per week. More than three sessions will give better results. Long term follow up of the subjects can be done. This study has clinical application, Static stretching can be given to patients who are bed ridden for longer period of time and has high blood sugar level which is difficult to control, people of geriatric age group who are unable to perform aerobic or resistance exercise stretching will help them to reduce blood sugar level, static stretching can be given as adjunct with other treatment which will overall help to reduce high blood sugar level, could be used clinically for hospitalised patients.

We conclude that that static stretching was effective in reducing blood sugar levels and it improves the quality of life in subjects with Type II diabetes mellitus. Therefore, static stretching can be used as successful non–pharmacological intervention program

in patients with Type II diabetes mellitus.

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Ethical Approval: Approved

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