

Stretching Exercise as a Rehabilitation Modality for Cardiovascular Disorders: A Brief Review

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ABSTRACT

India is amid a rapid epidemiological transition due to increasing prevalence of diabetes and hypertension. Static stretching of the skeletal muscles accrues the benefits of exercise without its accompanying physical stress as in case of aerobic exercise and resisted exercises. It is advantageous treatment for those with reduced physical capabilities and can be done without any additional equipment, facilities, or other expenses. Recent studies have indicated that stretching can reduce arterial stiffness resulting in reduced blood pressure in hypertensive patients and also supported that stretching could results in better glycaemic control and muscle function in diabetic patients. GLUT-4 is the glucose transport protein and is the main mediator for glucose transport into the skeletal muscles which is increased following exercise. Studies conducted till date on use of stretching exercises have limitations and there is dearth of literature on suggesting use of stretching exercise in patients who are suffering from both hypertension and diabetes. Hence, there is need for further research to be conducted.

Keywords: Diabetes mellitus, hypertension, stretching, aerobic training.

INTRODUCTION

India is amid a rapid epidemiological transition due to increasing prevalence of diabetes and hypertension. The estimated proportion of disability-adjusted life-years (DALYs) attributable to these

noncommunicable diseases (NCDs) in India has risen from 31% of total DALYs in 1990 to 55% in 2016. The prevalence of both conditions is likely to increase in future due to continuous urbanization of population and also increasing sedentary lifestyle associated with obesity and other cardiovascular disease risk factors, including diabetes and hypertension.¹

After China, India ranks second with 65.1 million diabetes cases being estimated in 2013, 77 million diabetes cases in 2019 and the incidence rate is expected to go beyond 134 million by 2045.² Also, the gross prevalence of hypertension has been reported to be was 30.7% with prevalence increasing with age.³

Physical exercise activities including muscle stretching, aerobic training and resistance training help in improving glycaemic control and can also help with management of blood pressure, quality of life and cardiovascular complications. Recent studies have indicated that stretching can reduce arterial stiffness resulting in reduced blood pressure in hypertensive patients and also supported that stretching could results in better glycemic control and muscle function in diabetic patients.^{2,4}

Static stretching of the skeletal muscles gives the benefits of exercise without its accompanying physical stress as in case of other forms of exercise as aerobic exercise and resisted exercises. Studies have supported that stretching results in blood pressure control and in lowering the blood glucose level in hypertensive patients and in patients with type 2 diabetes mellitus (T2DM) (Table 1).

Table 1: Summary of studies conducted on diabetic patients and hypertensive patients using stretching as an exercise intervention.

Authors	Objective	Design	Characteristics of the participants	Methods	Variables	Results	Limitations
Ko J Deprez D et al 2021 ⁴	Stretching is Superior to brisk walking for reducing blood pressure in people with high- normal blood pressure or stage-I hypertension	Experimental study	N=40 (16 males and 24 females) having stage-I Hypertension and those who were capable of walking.	Participants were randomized to either of two groups using online random number generator method: a stretching exercise program group and brisk walking exercise group; exercise was given for: 30minutes/day for 08 weeks	Pre and post Blood pressure measurement including systolic blood pressure, diastolic blood pressure and mean arterial blood pressure were measured in sitting and supine positions and for 24h using a portable monitor.	The stretching program elicited greater Reductions in systolic blood pressure and mean arterial blood pressure blood than the walking program	Insufficient sample size.
da Silva Araujo G et al ⁶	Order Effects of Resistance and Stretching Exercises on Heart Rate Variability and Blood Pressure in Healthy Adults	Within-subject Experimental study	Twenty normotensive subjects	Subjects performed 5 sessions in a random order: (a) SE followed by RE no rest (SE + RE), (b) RE followed by SE no rest (RE + SE), (c) SE between RE sets (SBE), (d) SE isolated, and (e) RE isolated. RE= resistance exercise; SE= Stretching exercise	Heart rate variability, SBP, and DBP were collected for before and after each experimental session	SE either before or between RE promotes a reduction in cardiac load and promotes safety.	Post intervention measurement should be taken beyond 60 minutes time period also, and study should be done on hypertensive individuals also.
Silva G.C, Costa P.B. et al 2019 ⁷	Acute effects of different static stretching exercises orders on cardiovascular and autonomic responses.	Cross over study	Total 17 normotensive subjects were enrolled in study	Subjects underwent two different stretching sessions with order as: - larger to smaller muscle group; smaller to larger muscle group.	Heart rate, blood pressure: - systolic and diastolic blood pressure, and heart rate variability were measured before and after intervention	Larger muscles groups generated higher overload as compared to smaller muscles groups, suggesting that the order of stretching exercise interferes in cardiac overload.	Insufficient sample size and done on normotensive individuals needs to be done on hypertensive individuals.
Farinatti	Cardiovascular	Cross over	N=22, normotensive	Subjects performed two	Measurement of	The cardiovascular	Dosimetry of

P.T.V, Soares P.P.S et al 2011 ⁸	responses to passive static flexibility exercises are influenced by the stretched muscle mass and the Valsalva maneuver.	study	individuals.	different types of exercises: - Participants performed four sets of passive static stretching of gastrocnemius and ischio-tibialis with and without Valsalva maneuver (VM).	SBP and HR, and RPP was calculated before and after intervention	response is affected by both the type of stretched muscle mass and the influence of Valsalva maneuver.	stretching exercise and valsalva maneuver was not quantified; also done on normotensive
Park, 2015 ⁹	Effects of passive static stretching on blood glucose levels in patients with T2DM	Experimental study	N=15, Participants diagnosed with T2DM and evidenced by HbA1c level 6.5% or higher.	Control group (n=7)-dietary instructions+ medication, passive static stretching group (n=8)-passive static stretching of lower body and upper body muscles for 40 min.	HbA1c value before and after 8 weeks of treatment	HbA1c level decreased significantly in the passive static stretching group after the treatment.	Small sample size and short intervention period.
Taheri et al, 2018 ¹⁰	The effects of passive stretching on blood glucose levels of patients with type 2 diabetes	Experimental study	N=50, diabetic patients with history of more than 6 months of diabetes.	Subjects randomly divided into two groups: - Passive stretch group (n=25)-passive stretching of upper body and lower body muscles for 20 minutes, passive movement group (n=25)- passive movement of upper and lower extremity.	Blood glucose level before and after intervention.	Blood glucose levels were significantly lower in passive stretching group as compared to the passive movement group.	Insufficient sample size and duration of intervention was short.
Elgayar, 2019 ¹¹	Active versus passive stretching exercises on blood glucose and functional capacity in elderly diabetic patients: comparative study	Comparative study	N=50 Type 2 diabetic men, diagnosed with T2DM with HbA1c value from 6.5% to 8.0%.	Patients randomly divided into 3 groups, group A (n=20)-treated with active stretching exercises, group B (n=20)-treated with passive stretching exercise, group C (n=10)-control group - no treatment,	HbA1c level and 6 minutes' walk test before and after intervention, Postprandial blood glucose level at beginning, immediately after and the end of the treatment session.	Active and passive stretching exercises- Both improved glycemic control and functional capacity in elderly diabetic patients.	Only male gender patients included in study and small sample size.

				stretching exercise protocol given 3 times per week for 12 weeks.			
Tanwar Manisha et al ⁵ , 2024	Comparison of the effect of passive static stretching exercise of upper and lower extremity on blood glucose levels, functional capacity and lipid profile in patients with type 2 diabetes mellitus	Randomized control trail	N= 100; patients clinically diagnosed with type 2 diabetes mellitus were randomly divided into four groups with 25 patients in each group.	Group1= control group; group2= upper limb passive static stretching; group3= lower limb passive static stretching; group 4= combined passive static stretching of upper and lower limb; stretching given for 4 days/week for eight weeks.	HbA1c level, Postprandial blood glucose level (PPBGL), lipid profile and 6 minutes' walk test were recorded before intervention, after 4 weeks and eight weeks on intervention.	After 8 weeks of passive static stretching training, HbA1c levels and Postprandial blood glucose levels (PPBGL) reduced in upper limb stretching group compared to lower limb stretching and control group. No significant improvement in lipid profile and 6-minute walk test within and between groups 1,2,3 and 4.	Longer duration of exercise intervention, more than 2 months should be given to see the effects on lipid profile and functional capacity.

DISCUSSION

Physical activities including muscle stretching, aerobic training, resistance training, high intensity interval training, yoga etc. help in improving glycemic control and blood pressure in all types of diabetes mellitus and in hypertensive individuals. Physical exercise produces short term and long terms effects which affect the level of HbA1c, blood glucose level, blood pressure, and serum lipid profile.^{4,5}

Studies proved that passive static stretching is an effective intervention that can be prescribed for patients of both diabetes and hypertension. Static stretching of the skeletal muscles accrues the benefits of exercise without its accompanying physical stress as in case of aerobic exercise and resisted exercises. It is advantageous treatment for those with reduced physical capabilities and can be done without any additional equipment, facilities, or other expenses.⁴⁻⁷

Blood glucose level decreases following passive stretching as the mechanical stimuli received through stretching increases glucose transport and glycogen metabolism in skeletal muscle and the glycogen content of stretched muscles decreases as compared to muscle groups which are not stretched. GLUT-4 is the glucose transport protein and is the main mediator for glucose transport into the skeletal muscles which is increased following exercise.⁴⁻¹²

Also, when the muscle is stretched, blood vessels are also stretched and this may induce the structural changes within blood vessels and these structural changes within blood vessels lead to decrease in arterial stiffness and hereby reduces resistance to blood flow which, reduces blood pressure.^{13,14}

Studies conducted till date on use of stretching exercises have limitations and there is dearth of literature on suggesting use of stretching exercise in patients who are suffering from both hypertension and diabetes. Hence, there is need for further research to be conducted.

CONCLUSION

Stretching exercises are beneficial in reduction of blood pressure in hypertensive individuals and effective in reduction of blood glucose levels in patients with type 2 diabetes mellitus.

Declaration by Authors

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