

ORIGINAL ARTICLE

A study to compare the effect of Handgrip Strengthening exercise on Systolic and Diastolic Blood Pressure between normotensive and Hypertensive patients - A comparative interventional study

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ABSTRACT

Hypertension exerts a substantial public health burden on India's cardiovascular health status and healthcare systems. In India, hypertension accounts for 10.8% of mortality. A blood pressure response to physical exercise depends on various factors such as gender, body mass index, and resting blood pressure. Lifestyle modifications like increased physical activity, salt restriction, and weight reduction are effective for the prevention and treatment of hypertension. This study was carried out to evaluate blood pressure reactivity by handgrip exercise in hypertensive and normotensive subjects. This study aims to compare the effectiveness of handgrip strengthening exercise on blood pressure in normotensive and hypertensive patients. This study was carried out among 70 participants between the age group of 45-75 years. Subjects were taken from clinics in and around Rajkot based on random sampling. Patients with the following conditions were excluded (yogic, athletes, alcoholics, upper limb fracture, cervical radiculopathy, and other musculoskeletal disorders disease that would restrict the application of hand force). subjects were divided into two groups. Groups -A: 35 patients with hypertension have received hand grip strengthening exercises. Group -B: 35 subjects with normal blood pressure have received hand grip strengthening exercises for 4 weeks. systolic and diastolic blood pressure were measured on the 1st day of exercise and after the 1st week, after the 2nd week, and the 3rd week, the 4th week of exercise. Reduction in systolic blood pressure (SBP) and diastolic blood pressure (DBP) was observed after handgrip strengthening exercise in normotensive and hypertensive subjects. SBP response to handgrip strengthening exercise significantly differed between the normotensive subject (Δ SBP = 7mmHg) and hypertensive subject (Δ SBP = 9mm Hg.). However, DBP response to handgrip strengthening exercise was not significantly differed between the normotensive subject (Δ DBP= 9 mm Hg) and hypertensive subjects (Δ DBP= 9 mm Hg). SBP and DBP were decreased after handgrip strengthening exercises in normotensive and hypertensive subjects.

Keywords: handgrip strengthening Exercise; systolic and diastolic Blood Pressure; Hypertension

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INTRODUCTION

Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure [1]. Blood is taken from the heart to all parts of the body in the vessels. heart beats and it pumps blood into the vessels. Blood pressure is produced by the force of blood that is pushed against the walls of blood vessels (arteries) as it is pumped by the heart. The greater the pressure, the heart has to pump. (According to WHO) [2].

High blood pressure (BP) is ranked as the 3rd most important risk factor for the accreditable burden of disease in South Asia. Hypertension exerts a substantial public health risk on cardiovascular health status and healthcare systems in India. Hypertension is the leading cause of cardiovascular mortality according to the World health organization. Hypertension is one of the most preventable risk factors for premature

death. Rates of hypertension in children and adolescents have increased in the last 20 years [3]. one-third of urban adult Indians and close to one-fourth of rural adult Indians are hypertensive. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India [4]. An early and regular screening to detect underlying hypertension is necessary to prevent any future complications. The prevalence of hypertension is increasing rapidly among Indians. Rapid urbanization, a sedentary lifestyle, junk food, and stress are powerful environmental risk factors for the increasing prevalence of hypertension, especially in the younger age group [5]. Hypertension is a major risk factor for cardiovascular diseases like myocardial infarction, and stroke. Hypertension is a controllable disease, early diagnosis and control can prevent cardiovascular disease in India. Lifestyle modifications like increased physical activity, salt restriction, and weight reduction are effective for the prevention and treatment of hypertension. Exercise is an integral component of therapy [6]. Regular exercise is effective in reducing the risks of hypertension. exercise is an important intervention to prevent and treat hypertension.

Hypertension is a serious medical condition. It markedly increases the risk of cardiovascular diseases and overall mortality. Lifestyle modifications, such as increased levels of physical activity, are recommended as the first line of antihypertensive treatment [7].

Grip strength is an anthropometric measurement that indicates muscle health in the hands and forearms. It is also known as hand strength. Grip strength is also an indicator of an adult's overall well-being [8]. It is usually measured with the use of a hand-held dynamometer. The patient squeezes the dynamometer with all of their strength, 3 times with each hand. After that average score is calculated [9].

The handgrip strength test is a quick and inexpensive way to measure an individual's muscle strength. The Jamar dynamometer is the most widely reported device used to measure handgrip strength [10]. The Jamar dynamometer presents good inter-rater reliability and test-retest reliability [11]. The American Society of Hand Therapists (ASHT) have recommended the Jamar dynamometer as the gold standard, leading to its extensive use in research and clinical practice. The Jamar handheld dynamometer displays grip force in both pounds and kilograms. Jamar hand dynamometer has a peak needle that automatically retains the highest reading until reset. The handle of Jamar can be adjusted for a different size to fit individual use [12].

Grip strength becomes weak with advancing age, which affects our day-to-day activities like opening jars, carrying groceries, and turning doorknobs are made more or less difficult depending on the strength of the hands. Poorer grip strength has been associated with greater mortality from any cause among older adults in several different studies and is often used as a proxy for overall muscle strength.¹³

Heart rate is the number of times the heart pumps blood within 60 seconds. The best place to take heart rate is at the wrist, side of the neck, and other places in the body where an artery is close to the skin. Resting heart rate is the heart pumping the lowest amount of blood you need because the subject is not exercising. If a person is in sitting or lying and relaxed and is not ill, then the heart rate is normally between 60 -100 (beats per minute) [14].

Blood pressure is the force of blood moving through blood vessels, and heart rate is the number of times heart beats per minute. Evaluation of blood pressure is used in assessing cardiovascular health, screening for hypertension, and in monitoring the effectiveness of treatment [15].

Blood pressure is measured as systolic and diastolic blood pressure. Systolic pressure indicates how much pressure blood is exerting against artery walls when the heart beats. Diastolic pressure indicates how much pressure blood is exerting against artery walls while the heart is resting between beats [16]. Either an elevated systolic or an elevated diastolic blood pressure reading is used to make a diagnosis of high blood pressure. According to studies, the risk of death from ischemic heart disease and stroke doubles with every 20 mm Hg systolic or 10 mm Hg diastolic increase among people from age 40 to 89 [17].

Blood pressure measurement is indicated in a situation that requires assessment of cardiovascular health, including screening for hypertension and monitoring the effect of treatment in patients with hypertension. In the routine outpatient setting blood pressure measurement is obtained indirectly, thus proper techniques must be used to produce consistent and reliable measurements. Blood pressure can be measured with a digital blood pressure monitor or with a sphygmomanometer. Digital sphygmomanometer can sometimes give inaccurate results and produce unreliable readings. Manual measurement of blood pressure with a sphygmomanometer is a highly reliable method to measure blood pressure [18].

Recent guidelines for the prevention of hypertension suggest that adults perform muscle-strengthening exercises 2-5 days a week, at least 150 min/week of moderate-intensity or 75 min/week of vigorous-

intensity aerobic physical activity [23]. Evidence indicates that isometric resistance training is an effective exercise modality to lower resting BP in both normotensive and hypertensive populations [19].

The typical treatment for high blood pressure is pressure-reducing drugs such as beta-blockers, intensive aerobic exercise total of 70 minutes a week, or both. But side effects of medication, and/or not having the time for a long workout. Aerobic exercise like jogging and cycling has been proven to reduce resting blood pressure [20]. but, this exercise requires good strength of the lower extremities, and more surface area is required to perform this exercise. This exercise needs to perform outdoors. An alternative to traditional aerobic exercise is handgrip exercise which is easily accessible and requires less time to perform the exercise. Also, this exercise can be performed indoors. simple handgrip activities you can do every day at home also [21].

The purpose of the study was to see the effect of handgrip strengthening exercise on blood pressure between normotensive and hypertensive patients. The primary objective of the study was to find out the effect of handgrip strengthening exercise on systolic and diastolic blood pressure in normotensive subjects and hypertensive subjects.

MATERIAL AND METHODS

Study design: Experimental comparative study

Sample size:

The study was conducted on 70 subjects between the age group of 45-75 years. Subjects were taken from clinics in and around Rajkot based on random sampling. Before participation aims and objectives of the study were explained. all subjects were screened and detailed medical history were taken to exclude any serious illness. Informed consent was signed by the subjects for their voluntary participation. Then the following information was recorded for each patient: name, age, sex, address, height, weight, BMI, handgrip strength, heart rate, and systolic and diastolic blood pressure. Subjects were requested to continue their normal activities and avoid any other form of exercise for the duration of the study.

PROCEDURE:

35 Subjects were selected and the study was explained to them. The subjects were then divided into 2 groups.

1. Groups -A: 35 patients with hypertension will receive hand grip strengthening exercise
2. Group -B: 35 subjects with normal blood pressure will receive hand grip strengthening exercise

In each Group subject received 5 minutes of general warm-up finger movement exercise and 20 - 30 minutes of strengthening exercises hand grip strengthening exercises and the last 5 minutes of cool-down.

EXERCISE PROTOCOL:²²

Immediately after 5 minutes of warm-up, the subjects received hand grip strengthening exercise training for 20- 30 minutes, 1 session per day, 5 days a week, for 4 weeks. After spending 1 week becoming familiar with the movement, the participants performed exercises every morning at home.

Hand grip exercises are the following:

1. POWER GRIP:

Squeeze the ball with your fingers and thumb, as if making a fist. Squeeze, then release the ball completely, opening your fingers as wide as you can.

2. FINGER SQUEEZE:

Place the therapy ball between two fingers and squeeze your fingers together. Squeeze and release. Perform this exercise for all fingers.

3. FINGER SPREAD:

Place the rubber band over all four fingers. Do not include the thumb. Now spread your fingers apart as far as you can, hold for 5 seconds then relax. Repeat 10-20 times. Wrap the rubber around two fingers and spread your fingers apart.

4. FINGERTIP PINCH:

Pinch the ball with your fingers and thumb extended. And by extension mean to keep all your fingers straight.

5. TABLE ROLL EXERCISE:

Place the ball on a table and place your hand on top of it. Then, while keeping a flat hand, roll the ball from the base of your palm up to your fingertips.

Start with a set of 10 repetitions of each exercise, then build up your strength to aim for 2-3 sets of 10 repetitions.

Handgrip strength was measured by Jamar’s hand dynamometer before and after the exercise. SBP and DBP were recorded on the 1st day of exercise and after the 1st week, after 2nd week, and the 3rd week, the 4th week of exercise.

RESULTS

The study was undertaken on 70 participants of the 45–75 years of age group. The values of baseline systolic SBP and diastolic blood pressure (DBP) as well as pulse pressure were significantly higher in hypertensive subjects as compared to normotensive subjects as shown in Table 1. The systolic and diastolic blood pressures before and after handgrip exercise training are depicted in table - 1. The hypertension group exhibited a greater decrease in systolic blood pressure (from 134.77± 3.24 to 125.77±2.81mmHg) than the normotensive group (from 124.05 ± 1.94 to 117.27 ± 1.59mmHg). intergroup difference in systolic BP P < 0.000, and intergroup difference in diastolic BP P < 0.29 as shown in Table-3. SBP and DBP were decrease significantly after the handgrip strengthening exercise. A decrease in SBP and DBP after handgrip strengthening exercise was higher in hypertensive subjects than normotensive subjects and was statistically significant (P > 0.05). However, the reduction in SBP after handgrip strengthening exercise was significantly higher in hypertensive subjects as compared to normotensive.

Table: 1 Hypertensive subjects Within-group analysis of Group A

Group A				
Outcome measures	Pre (mean ± SD)	Post (mean ± SD)	Z value	P value
Handgrip Strength	4.13 ± 2.40	12.27 ± 2.85	- 5.267	0.000
Systolic BP	134.77 ± 3.24	125.77± 2.81	- 5.313	0.000
Diastolic BP	85.27 ± 2.98	76.94 ± 2.59	- 5.316	0.000

TABLE: 2 Normotensive subjects Within-group analysis of Group B

Group B				
Outcome measures	Pre (mean ± SD)	Post (mean ± SD)	Z value	P value
Handgrip Strength	3.41 ± 0.93	11.41 ± 1.42	-5.266	0.000
Systolic BP	124.05 ± 1.94	117.27 ± 1.59	-5.317	0.000
Diastolic BP	82.55 ± 3.08	73.33 ± 1.72	-5.318	0.000

TABLE: 3 Between-group analysis

Outcome measures	Z value	P value
Handgrip Strength	-0.405	0.685
Systolic BP	-4.549	0.000
Diastolic BP	-1.052	0.293

DISCUSSION

The present comparative interventional study was conducted on 70 patients with essential hypertension in the age group of 45-75 years and was selected by purposive sampling method from various are as in Rajkot. Patients were randomly assigned into two groups. Group – A and **Group B** received handgrip strengthening exercise training, for 20 -30 minutes, once a day for 5 days/week for 4 weeks. Measurements of Systolic Blood Pressure and Diastolic Blood Pressure were taken pre-and post-treatment intervention in both groups.

From the above study handgrip strengthening exercise is effective to reduce blood pressure. In Group-A, subjects with hypertension had reduced systolic and diastolic blood pressure. In the present study, a reduction of SBP and DBP was observed after handgrip strengthening exercises in both groups [23]. The previous study revealed that this reduction in blood pressure after handgrip strengthening exercise may be due to a decrease in cardiac output, and a reduction in the pulmonary vascular resistance in both groups [24].

The same guidelines are given by Rinku Garg and Varun Malhotra postulated that the study also reported that there is a decrease in the concentrations of metabolites such as lactic acid and adenosine after exercise, which decrease the discharge of Group IV (metaboreceptors) afferent fibers, initiating a potent reflex that decreases sympathetic nerve activity. This leads to vasodilatation, which contributes to the reduction in BP. In the present study, SBP and DBP reactivity after handgrip strengthening exercise did not significantly differ between normotensive subjects and hypertensive subjects [25].

Handgrip exercises increase the flexibility, improves the function of blood vessels, and reduces high blood pressure. The handgrip strengthening exercises helped significantly lower systolic and diastolic blood pressure [26].

Ultrasound measurements were done in the previous study after isometric hand grip strengthening exercise and it shows that the carotid artery, one of the main arteries of the body became more flexible and less rigid after practicing the hand exercises. More flexible vessels are an indication of healthy blood vessels [27].

The results of the previous study indicate that isometric handgrip exercise improves resting systolic blood pressure and carotid artery distensibility, and handgrip training improves systolic blood pressure and endothelial [blood vessel] function in persons medicated for hypertension [28].

Aerobic exercise has also been used as a treatment modality to decrease blood pressure in hypertensive individuals. handgrip exercise has also been shown to be effective in decreasing blood pressure in hypertensive individuals. cardiovascular responses to handgrip exercise can also differentiate individuals with hypertensive parents from individuals with normotensive parents [29].

The results of the study, showing a blood pressure response in hypertensive subjects, are seemingly paradoxical to reports that handgrip exercise training acts as an antihypertensive treatment strategy. This can be explained by the methodological differences between the results of the study because the exaggerated blood pressure response was to a single bout of isometric handgrip exercise, not to exercise training. The studies demonstrating a significant reduction in blood pressure resulting from a handgrip exercise training regimen were usually of at least 4 weeks in duration.

CONCLUSION

The present study showed that handgrip strengthening exercises have a significant effect on reducing SBP and DBP in patients with Primary Hypertension.

LIMITATION OF STUDY:

- Sample size was small.
- Result of this study cannot be generalized to patients with secondary hypertension.
- The duration of essential hypertension was not taken into consideration in the present study.
- Result of the present study could not consider the effects of medications on hemodynamic parameters.

FURTHER RECOMMENDATIONS:

- Larger sample size can be taken to do future study.
- The study duration or the training protocol can be longer.
- Study can be done on secondary hypertension.

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Conflict of Interest: None

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