

## INFLUENCE OF A STRUCTURED EXERCISE PROGRAM ON BLOOD PRESSURE AMONG ADULTS WITH MILD HYPERTENSION

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DOI: <http://doi.org/10.5281/zenodo.19216319>

Received  
25 January 2026

Accepted  
06 March 2026

Published  
25 March 2026

### ABSTRACT

**Background:** Hypertension remains a leading global health concern, particularly in low- and middle-income countries where access to treatment is limited. Lifestyle interventions such as exercise are increasingly recognized as cost-effective strategies for blood pressure control.

**Objective:** This study aimed to evaluate the influence of a structured six-week exercise program on resting blood pressure (BP) and resting heart rate (RHR) among adults with mild (Grade 1) hypertension.

**Methods:** An experimental design was employed with 15 hypertensive adults. Participants engaged in supervised sessions combining aerobic and resistance training, lasting 45 minutes, five times per week. Baseline, mid-point (3 weeks), and post-intervention (6 weeks) measurements of systolic BP (SBP), diastolic BP (DBP), and RHR were recorded. Data were analyzed using paired t-tests, with significance set at  $p < 0.05$ .

**Results:** Mean SBP and DBP decreased progressively, with reductions of  $-2.1/-1.1$  mmHg after 3 weeks and  $-4.6/-3.4$  mmHg after 6 weeks. These changes were statistically significant at 6 weeks (SBP  $p < 0.001$ ; DBP  $p < 0.05$ ). RHR declined by  $-3.9$  bpm at 3 weeks and  $-6.9$  bpm at 6 weeks, both significant ( $p < 0.05$ ).

**Conclusion:** A structured exercise program of moderate intensity effectively reduced blood pressure and resting heart rate in adults with mild hypertension. These findings highlight the potential of exercise as a practical, non-pharmacological intervention for hypertension management, particularly in resource-limited settings.

**Keywords:** Hypertension, blood pressure, exercise program, resting heart rate, lifestyle intervention

### INTRODUCTION

Hypertension is a major global health challenge, affecting approximately 20% of the adult population worldwide and contributing significantly to cardiovascular morbidity and mortality (1). Defined as systolic and diastolic

blood pressure  $\geq 140/90$  mmHg, hypertension is particularly burdensome in low- and middle-income countries where access to treatment is limited and the economic impact is severe (2). In Pakistan, for example, the age-adjusted prevalence

of raised blood pressure among adults is estimated at 21.1%, with individuals aged 30–70 years facing a 15–19% risk of premature death from hypertension-related complications (3).

Lifestyle modifications, particularly regular physical activity, are widely recommended as non-pharmacological interventions for blood pressure control (4). Evidence suggests that structured exercise programs can reduce systolic blood pressure (SBP) by 5–20 mmHg acutely and by approximately 7 mmHg chronically after several weeks of consistent training (5,6). Mechanisms proposed for these reductions include decreased sympathetic nervous system activity, improved vascular remodeling, enhanced nitric oxide-mediated vasodilation, and reduced renin activity (7,8).

Despite these findings, there remains limited and conflicting evidence regarding the comparative effectiveness of combined aerobic and resistance training (concurrent training) versus single-modality exercise programs. Given the rising prevalence of hypertension and the need for cost-effective interventions, further research is warranted to evaluate the impact of structured exercise regimens on blood pressure among adults with mild hypertension.

### Methodology

This study employed an experimental research design to evaluate the effects of a structured exercise program on resting blood pressure (BP) and resting heart rate (RHR) in adults with mild (Grade 1) hypertension. A total of 15 participants were recruited, all of whom met the inclusion criteria of systolic BP between 140–159 mmHg and diastolic BP between 90–99 mmHg.

Participants engaged in a supervised exercise regimen consisting of 45-minute sessions, five times per week, for six weeks. The program combined aerobic and resistance training components, with intensity maintained at 40–60% of  $VO_2$  max. Baseline, mid-point (3 weeks), and post-intervention (6 weeks) measurements of SBP, DBP, and RHR were recorded.

Data analysis was conducted using SPSS version 25 (IBM, UK, 2017) and Microsoft Excel 2013. Normality of data distribution was assessed using the Shapiro-Wilk test, while homogeneity of variance was tested with Levene's test. As data was parametric, paired t-tests were applied to compare mean differences across time points. Statistical significance was set at  $p < 0.05$ .

### Results

#### Blood Pressure Response to Exercises

Changes in BP (SBP and DBP) after a 6-week exercise program are presented below in Figure 1.

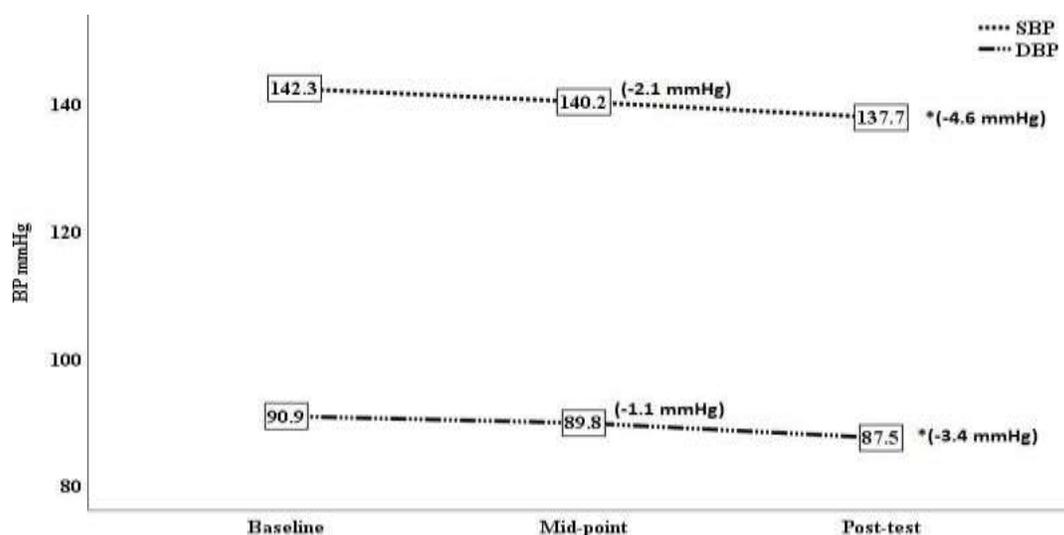


Figure 1: BP changes after 6 weeks of exercise in adults with grade 1 hypertension

There was no significant difference observed at baseline for mean SBP and DBP within the EX-group ( $p > 0.05$ ). The EX-group had a mean SBP and DBP of  $142.3 \pm 7.4$  mmHg and  $90.9 \pm 3.9$  mmHg at baseline. Following an exercise regimen conducted for 45 minutes 5 times a week the mean SBP and DBP reduced by  $-2.1 \pm 4.2$  mmHg and  $-1.1 \pm 4.8$  mmHg respectively after 3 weeks and reduced further by  $-4.6 \pm 3.1$  mmHg and  $-3.4 \pm 3.9$  mmHg after 6 weeks. These changes were not statistically significant ( $p > 0.05$ ) after 3 weeks for

SBP and DBP respectively, however they were significant after 6 weeks for both SBP ( $p < 0.001$ ) and DBP ( $p < 0.05$ ). Therefore, the study rejected the null hypothesis because there was a statistically significant ( $p < 0.05$ ) reduction in resting BP (SBP and DBP) following a 6-week exercise regimen in adults with grade 1 hypertension.

#### Heart Rate Response to Exercises

Changes in RHR after a 6-week exercise program are presented below in Figure 2.

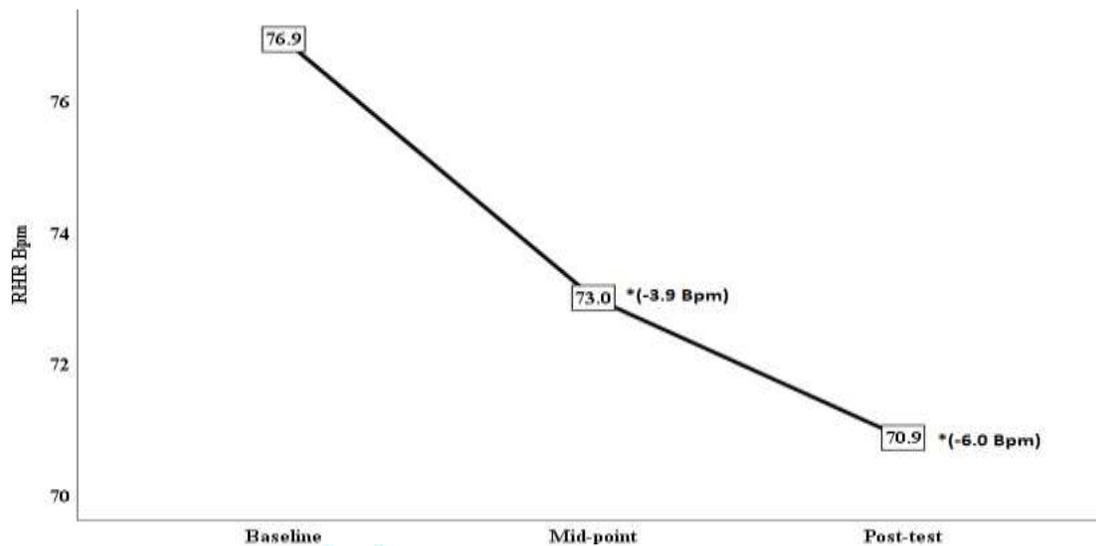


Figure 2: RHR changes after 6 weeks of exercise in adults with grade 1 hypertension.

There was no significant difference observed at baseline for RHR within the EX group ( $p > 0.05$ ). The EX group has a RHR of  $76.9 \pm 12.6$  bpm at baseline. Following an exercise regimen conducted for 45 minutes 5 times a week the RHR reduced by  $-3.9 \pm 4.9$  bpm after 3 weeks and reduced further by  $-6.9 \pm 4.9$  bpm after 6 weeks. The changes were statistically significant ( $p < 0.05$ ) after 3 weeks and 6 weeks respectively. Therefore the study rejected the null hypothesis because there was a statistically significant ( $p < 0.05$ ) reduction in resting RHR following a 6 week exercise regimen in adults with grade 1 hypertension.

#### Discussion

The present study demonstrated that a structured six-week exercise program produced significant reductions in both systolic and diastolic blood pressure among adults with mild hypertension.

Specifically, mean SBP decreased by 4.6 mmHg and DBP by 3.4 mmHg, while resting heart rate declined by 6.9 bpm. These findings support the growing body of evidence that regular physical activity is an effective non-pharmacological intervention for blood pressure control (1,2).

The magnitude of reduction observed in this study is consistent with prior systematic reviews and meta-analyses, which reported average decreases of 3.5–11 mmHg in SBP and 2.5–6 mmHg in DBP following exercise interventions (3,4). Although the reductions in our study were modest, they reached statistical significance after six weeks, highlighting the importance of sustained adherence to exercise regimens. The delayed significance compared to earlier time points suggests that cumulative physiological adaptations—such as vascular remodeling, improved endothelial function, and reduced

sympathetic activity—require several weeks to manifest (5,6).

The reduction in resting heart rate aligns with previous studies showing improvements in autonomic regulation and cardiovascular efficiency after moderate-intensity exercise (7,8). Interestingly, the decline in RHR was evident as early as three weeks, indicating that cardiac adaptations may occur more rapidly than vascular changes. This supports the notion that exercise exerts multifaceted benefits, with early improvements in autonomic tone followed by longer-term reductions in blood pressure.

Comparisons with studies employing higher intensities or longer durations suggest that greater reductions in blood pressure may be achieved with extended or more vigorous programs (9). However, given that hypertensive individuals are often restricted to moderate intensities for safety reasons, the present findings underscore the value of accessible, structured programs that balance efficacy with safety.

The concurrent training approach used in this study combining aerobic and resistance exercise adds to the limited literature on multimodal interventions. While some evidence suggests concurrent training may be superior to single-modality exercise (10), further research is needed to clarify optimal combinations of frequency, intensity, and duration.

Overall, the results reinforce the role of structured exercise as a cost-effective and practical strategy for managing mild hypertension, particularly in resource-limited settings where access to medication may be constrained. Future studies should explore larger sample sizes, longer intervention periods, and safe methods of gradually increasing exercise intensity to maximize cardiovascular benefits.

### Conclusions

The study concluded that exercise (45 min, 5 times a week) is an effective method of reducing RHR in individuals with hypertension after 6 weeks. Therefore, the study rejects the null hypothesis because there was a statistically significant ( $p < 0.05$ ) reduction in resting RHR following a 6-week

exercise regimen in adults with grade 1 hypertension.

### Recommendations

Since this study was only undertaken over a short period of time (6 weeks) with a small sample size ( $n=15$ ) future study should focus on having the investigation done over a longer period with a larger sample size. This is since it does not take the same time for changes in BP to occur when exercising.

Since there is limited and conflicting research on the effects of combined aerobic and resistance training (concurrent training) on BP, future research needs to focus on determining whether it is superior to aerobic or resistance training.

Future studies on hypertensive individuals should investigate safe methods of increasing exercise intensities. This is because increased exercise intensities have been shown to increase the amount BP reduction. However, individuals with hypertension are restricted to lower intensities.

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