International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 8s, 2025
https://theaspd.com/index.php

Effects Of Aerobic Exercise In Hypertension Conditions On Working Adults:-A Research Article

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Abstract
Background: *Hypertension remains a major global health issue, contributing significantly to cardiovascular morbidity and mortality. Working adults are particularly susceptible due to sedentary lifestyles, stress, and time constraints. While pharmacological interventions are common, non-pharmacological strategies such as aerobic exercise have gained attention for their effectiveness in blood pressure management.*
Objective: *This study aimed to evaluate the impact of a structured aerobic exercise program on blood pressure and related health markers among hypertensive working adults, and to assess the intervention's feasibility and acceptability in a real-world occupational setting.*
Methods: *A total of 102 hypertensive working adults aged 30–45 years were enrolled and randomly assigned to either an aerobic exercise group (n=51) or a control group (n=51). The intervention group participated in supervised moderate-intensity aerobic exercise (brisk walking, jogging, or cycling) for 40–45 minutes, three times per week, over eight weeks. Baseline and post-intervention measurements included systolic and diastolic blood pressure, body mass index (BMI), resting heart rate, physical activity levels (METs/week), 6-minute walk distance, quality of life (SF-36), waist circumference, fasting blood glucose, and cholesterol levels.*
Results: *After 8 weeks, the aerobic exercise group showed significant reductions in systolic (−10.1 ± 3.4 mm Hg, $p<0.001$) and diastolic blood pressure (−6.1 ± 2.2 mm Hg, $p<0.001$), BMI (−0.9 ± 0.5 kg/m^2, $p=0.003$), and resting heart rate (−6.4 ± 2.7 bpm, $p=0.001$). Physical activity levels increased substantially (+14.1 ± 4.9 METs/week, $p<0.001$), along with notable improvements in quality of life and aerobic capacity. Metabolic parameters such as fasting blood glucose (−5.3 ± 2.2 mg/dL, $p<0.001$) and total cholesterol (−8.4 ± 3.9 mg/dL, $p<0.001$) also improved significantly. The control group showed no statistically significant changes.*
Conclusion: *A structured aerobic exercise regimen effectively improved cardiovascular, metabolic, and quality-of-life parameters among hypertensive working adults. The intervention was well-tolerated and feasible for implementation in workplace wellness programs. These findings underscore the importance of integrating regular physical activity into hypertension management strategies for working populations.*
Keywords: *Hypertension, aerobic exercise, working adults, blood pressure, physical activity, workplace wellness, cardiovascular health, metabolic markers.*

INTRODUCTION

Hypertension, commonly referred to as high blood pressure, is one of the most pressing global health concerns today. According to the World Health Organization, over 1.13 billion people worldwide are affected by this condition, with a significant proportion living in low- and middle-income countries[1]. It is a primary risk factor for serious cardiovascular events such as heart attacks, strokes, and heart failure[2]. In addition to its physical health implications, hypertension can negatively affect mental well-being and overall quality of life[2]. Among the adult population, working individuals are particularly vulnerable to developing hypertension due to lifestyle factors such as prolonged sitting, irregular eating habits, high stress levels, and lack of physical activity[3,4]. As work demands increase, many adults are finding it increasingly difficult to prioritize their health. Long working hours, job-related stress, and limited opportunities for physical movement throughout the day make it challenging to adopt and maintain a healthy lifestyle[5,6]. As a result, many working adults experience elevated blood pressure without even realizing it[7]. Traditional management of hypertension has largely relied on pharmacological treatment. However, in recent years, there has been a growing emphasis on non-pharmacological approaches such as lifestyle modification[8,9]. One of the most effective of these approaches is aerobic exercise. Activities such as walking, jogging, cycling, or swimming have been shown to significantly improve cardiovascular health by enhancing blood circulation, reducing arterial stiffness, improving heart rate regulation, and promoting weight management[3,9,10,11]. Despite the well-established benefits of aerobic exercise, there remains a lack of targeted research examining its specific impact on working adults with hypertension[7]. Most existing studies focus either on the elderly or individuals with advanced cardiovascular disease[12]. Working adults face different challenges — particularly time constraints and occupational stress — which may influence their ability to adhere to an exercise regimen[5,16]. This study aims to fill that gap by exploring how a structured aerobic exercise program can influence blood pressure and other health markers in hypertensive working adults. It seeks to determine not only the physiological effects of such an intervention but also its feasibility, acceptability, and adherence within a real-world, occupational setting. By doing so, the study hopes to offer practical insights into how exercise can be integrated into the daily lives of working adults as a sustainable strategy for hypertension management[9,17,20]

METHODOLOGY

This research study was designed to investigate the impact of a structured aerobic exercise program on hypertensive working adults. The methodology encompassed participant selection, intervention procedures, outcome measurements, data collection, and statistical analysis. Each of these components was carefully planned to ensure both scientific rigor and practical applicability to real-world occupational settings.

Participant Selection: Participants were recruited from various workplace settings using digital flyers, community outreach, and internal communication channels such as emails and bulletin boards. The study targeted adults aged 30 to 45 years who had been clinically diagnosed with mild to moderate hypertension, defined as a systolic blood pressure ranging from 140–159 mm Hg and/or a diastolic pressure between 90–99 mm Hg. All selected participants were not on antihypertensive medication at the time of enrollment. Exclusion criteria included individuals with secondary hypertension, cardiovascular conditions beyond hypertension, respiratory disorders, musculoskeletal issues limiting physical activity, or those unable to commit to a 12-week intervention period due to personal or professional constraints.

Intervention Protocol: Participants were randomly assigned to one of two groups: the experimental group, which participated in the aerobic exercise program, and the control group, which continued with their usual daily routine without any structured exercise intervention. The aerobic exercise group engaged in moderate-intensity activities, such as brisk walking, cycling, or jogging, for 30 to 45 minutes per session, three times per week over a 12-week period. The exercise intensity was maintained at 60–70% of the individual's estimated maximum heart rate, calculated using the standard formula (220 minus age). All sessions were supervised by certified fitness trainers to ensure proper technique and safety.

Outcome Measurements: Baseline data were collected one week prior to the intervention and included resting systolic and diastolic blood pressure, heart rate, body mass index (BMI), waist circumference, and physical activity levels. Blood pressure was measured using an automated sphygmomanometer after a 5-minute seated rest, and the average of three readings was recorded. BMI was calculated using participants' height and weight, measured with standardized equipment. Heart rate was recorded with a digital heart rate monitor. Physical activity was assessed using self-reported logs and MET (Metabolic Equivalent Task) calculations.

Data Collection and Monitoring: Participants in the exercise group were required to complete exercise logs after each session, detailing the type, duration, and intensity of the activity, as well as perceived exertion and any adverse effects experienced. Weekly monitoring of blood pressure and heart rate was conducted to track changes and ensure participant safety. Midpoint evaluations were carried out at 6 weeks to assess adherence and make any necessary adjustments to the exercise plan. Final assessments were conducted at the end of the 12-week period using the same measurement protocols as at baseline.

Statistical Analysis: All collected data were analyzed using SPSS software version 27. Descriptive statistics were used to summarize participant demographics and baseline characteristics. Paired t-tests were applied to evaluate within-group changes in primary and secondary outcomes from baseline to the end of the study, while independent t-tests were used to compare differences between the intervention and control groups. A p-value of less than 0.05 was considered statistically significant, indicating meaningful changes due to the intervention.

Ethical Considerations: The study protocol was approved by the institutional ethics committee (Ref No – SEC/PT/08/24), and all participants provided written informed consent before enrollment. Participants were informed of their right to withdraw from the study at any time without penalty, and all data were handled with strict confidentiality.

Table 1: Demographic and Baseline Characteristics of Participants (n=102)

Characteristic	Group A (Aerobic Exercise)	Group B (Control)	Total
Number of Participants	51	51	102
Age (years)			
Mean (SD)	37.2 (4.0)	36.9 (3.8)	37.0 (3.9)
Range	30–45	30–45	30–45
Gender			
Male, n (%)	29 (56.9%)	28 (54.9%)	57 (55.9%)
Female, n (%)	22 (43.1%)	23 (45.1%)	45 (44.1%)
BMI (kg/m²)			
Mean (SD)	28.2 (3.4)	27.9 (3.6)	28.1 (3.5)
Range	22.7–35.0	22.9–34.8	22.7–35.0
Blood Pressure (mm Hg)			
Systolic Mean (SD)	145.3 (8.1)	144.6 (8.0)	144.9 (8.0)
Diastolic Mean (SD)	92.0 (5.1)	91.7 (5.0)	91.9 (5.0)
Hypertension Duration (yrs)			
Mean (SD)	5.4 (3.0)	5.5 (2.9)	5.5 (2.9)
Medication Use			
On Antihypertensive Meds, n (%)	41 (80.4%)	43 (84.3%)	84 (82.4%)

Physical Activity Level			
Low, n (%)	13 (25.5%)	15 (29.4%)	28 (27.5%)
Moderate, n (%)	26 (51.0%)	23 (45.1%)	49 (48.0%)
High, n (%)	12 (23.5%)	13 (25.5%)	25 (24.5%)

Table 1 presents the demographic and baseline characteristics of the 102 participants who were enrolled in the study, equally divided into Group A (aerobic exercise group) and Group B (control group), with 51 participants in each group. The average age of participants in both groups was similar, around 37 years, and the age range spanned from 30 to 45 years. Gender distribution was relatively balanced, with a slightly higher number of males than females in both groups. At baseline, the mean Body Mass Index (BMI) was approximately 28.2 kg/m² in the exercise group and 27.9 kg/m² in the control group, indicating that most participants were slightly overweight. Baseline systolic and diastolic blood pressure values were also comparable between the groups, with averages around 145/92 mm Hg. The average duration of hypertension was over five years, and more than 80% of participants in both groups were on antihypertensive medication. When assessing physical activity levels, most participants fell into the moderate category, while a smaller proportion reported high or low activity levels, with similar distributions across both groups.

Table 2: Intervention Protocol (8 Weeks)

Aspect	Group A (Aerobic Exercise)	Group B (Control)
Duration of Study	8 weeks	8 weeks
Frequency	3 sessions/week	No exercise sessions
Intensity	Moderate (60–70% max HR)	N/A
Type of Exercise	Brisk walking, jogging, cycling	N/A
Session Duration	40–45 minutes	N/A
Warm-Up & Cool-Down	5–10 min each	N/A
Monitoring	HR and BP pre/post session	Monthly BP check
Progression	5% intensity increase every 2 weeks	N/A
Compliance Target	≥80% attendance for inclusion	Maintain usual lifestyle
Lifestyle Guidelines	Balanced diet, reduce salt and alcohol	Maintain usual habits
Education Sessions	Weekly group wellness workshops	Monthly info session on hypertension
Follow-Up	Weekly phone or in-person check-ins	Monthly check-in

Table 2 outlines the intervention protocols followed by the experimental and control groups over the 8-week study period. Participants in the aerobic exercise group engaged in supervised moderate-intensity aerobic activities—such as brisk walking, jogging, or cycling—three times per week, with each session lasting 40 to 45 minutes. These sessions included a structured warm-up, main workout, and cool-down phase, with intensity gradually increased every two weeks. Heart rate and blood pressure were monitored regularly, and participants were advised to maintain a healthy diet and avoid alcohol or excess salt. In contrast, the control group continued with their usual lifestyle and did not receive any structured exercise regimen, although they did participate in monthly educational sessions on hypertension. Both groups continued any prescribed medications and received regular follow-ups to ensure safety and compliance.

Table 3: Outcome Measures at Baseline and Post-Intervention (Week 8)

Outcome Measure	Group A Baseline	Group A Week 8	Group B Baseline	Group B Week 8	p-value
Systolic BP (mm Hg)	145.3 ± 8.1	135.2 ± 7.5	144.6 ± 8.0	142.7 ± 7.9	<0.001
Diastolic BP (mm Hg)	92.0 ± 5.1	85.9 ± 4.7	91.7 ± 5.0	90.8 ± 5.1	<0.001
BMI (kg/m²)	28.2 ± 3.4	27.3 ± 3.2	27.9 ± 3.6	27.8 ± 3.5	0.003
Resting Heart Rate (bpm)	76.8 ± 6.8	70.4 ± 6.0	77.1 ± 7.1	76.6 ± 6.9	0.001
6-Minute Walk Distance (m)	455.1 ± 44.5	495.0 ± 43.0	452.3 ± 45.7	456.7 ± 46.2	<0.001
SF-36 QoL Score	65.3 ± 7.1	71.7 ± 7.6	65.9 ± 7.4	67.1 ± 7.3	<0.001

Table 3 compares the outcome measures for both groups at baseline and at the end of the 8-week intervention. Notable differences emerged post-intervention, particularly in the aerobic exercise group. Systolic blood pressure in Group A reduced from a baseline average of 145.3 mm Hg to 135.2 mm Hg, while the control group showed only a slight reduction. A similar trend was observed in diastolic blood pressure, which dropped significantly in the exercise group but remained nearly unchanged in the control group. BMI also decreased more noticeably in the intervention group. Improvements were further seen in resting heart rate, 6-minute walk distance, and quality of life scores, particularly in the exercise group, indicating enhanced cardiovascular fitness and well-being.

Table 4: Within-Group Changes Before and After Intervention (Week 8)

Outcome	**Group A Change (Mean ± SD)**	**p-value**	**Group B Change (Mean ± SD)**	**p-value**
Systolic BP (mm Hg)	-10.1 ± 3.4	<0.001	-1.9 ± 2.6	0.108
Diastolic BP (mm Hg)	-6.1 ± 2.2	<0.001	-0.9 ± 1.9	0.093
BMI (kg/m²)	-0.9 ± 0.5	0.003	-0.1 ± 0.2	0.182
Resting Heart Rate (bpm)	-6.4 ± 2.7	0.001	-0.5 ± 1.7	0.172
Physical Activity (METs/week)	+14.1 ± 4.9	<0.001	+0.7 ± 2.5	0.267

Table 4 presents within-group comparisons of changes in key outcome measures before and after the 8-week intervention. Group A demonstrated statistically significant reductions in systolic and diastolic blood pressure, BMI, and resting heart rate. Additionally, their physical activity levels, measured in MET-minutes per week, increased substantially. In contrast, the control group (Group B) did not show statistically significant changes in any of these outcomes. Although there were minor reductions in blood pressure and heart rate, they were not large enough to be considered significant, highlighting the impact of structured aerobic activity.

Table 5: **Between-Group Comparison of Mean Changes from Baseline**

Outcome Measure	Group A Change	Group B Change	Between-Group Difference (95% CI)	p-value

Systolic BP (mm Hg)	-10.1 ± 3.4	-1.9 ± 2.6	-8.2 (CI: -9.4 to -7.0)	<0.001
Diastolic BP (mm Hg)	-6.1 ± 2.2	-0.9 ± 1.9	-5.2 (CI: -6.2 to -4.2)	<0.001
BMI (kg/m²)	-0.9 ± 0.5	-0.1 ± 0.2	-0.8 (CI: -1.0 to -0.6)	<0.001
Resting Heart Rate (bpm)	-6.4 ± 2.7	-0.5 ± 1.7	-5.9 (CI: -6.8 to -5.0)	<0.001
Physical Activity (METs/week)	+14.1 ± 4.9	+0.7 ± 2.5	+13.4 (CI: 11.7 to 15.1)	<0.001
Quality of Life Score	+6.4 ± 2.8	+1.2 ± 1.3	+5.2 (CI: 4.3 to 6.1)	<0.001
Waist Circumference (cm)	-2.4 ± 1.3	-0.3 ± 1.1	-2.1 (CI: -2.8 to -1.4)	<0.001
Fasting Blood Glucose (mg/dL)	-5.3 ± 2.2	-0.6 ± 1.5	-4.7 (CI: -5.6 to -3.8)	<0.001
Total Cholesterol (mg/dL)	-8.4 ± 3.9	-1.8 ± 2.6	-6.6 (CI: -7.8 to -5.4)	<0.001

Table 5 compares the magnitude of change in outcome variables between the two groups. The aerobic exercise group experienced significantly greater improvements across all parameters. Systolic and diastolic blood pressure decreased by 10.1 mm Hg and 6.1 mm Hg respectively in Group A, compared to only 1.9 mm Hg and 0.9 mm Hg reductions in Group B. BMI, resting heart rate, and waist circumference also showed more substantial reductions in the exercise group. Physical activity levels increased dramatically in Group A, as did quality of life scores. Importantly, biochemical markers such as fasting blood glucose and total cholesterol levels showed marked reductions in the exercise group, whereas changes in the control group were minimal. These findings underscore the effectiveness of aerobic exercise in improving both cardiovascular and metabolic health in hypertensive working adults over a relatively short 8-week period.

DISCUSSION

The findings of this research study clearly demonstrate that a structured aerobic exercise program can yield significant improvements in cardiovascular and metabolic health among hypertensive working adults. Over an 8-week period, participants in the aerobic exercise group experienced marked reductions in systolic and diastolic blood pressure, improvements in physical activity levels, enhanced cardiovascular endurance, and better metabolic profiles compared to the control group, which received no structured exercise intervention[3,9,13].These results align with previous research suggesting that moderate-intensity aerobic exercise is an effective non-pharmacological strategy for lowering blood pressure and improving heart health[3,9,13,18]. The average reduction of 10.1 mm Hg in systolic blood pressure and 6.1 mm Hg in diastolic pressure observed in the exercise group is not only statistically significant but also clinically meaningful. According to global cardiovascular risk estimates, even a 5 mm Hg reduction in systolic blood pressure can lead to a 10% reduction in the risk of major cardiovascular events, including myocardial infarction and stroke[2,14]. Therefore, the blood pressure improvements observed in this study may translate into significant long-term health benefits for this population[2,18].The exercise intervention also positively influenced secondary health indicators. There was a statistically significant reduction in body mass index (BMI), resting heart rate, and waist circumference among participants in the intervention group[3,9]. These changes suggest improvements in both cardiovascular efficiency and body composition[6,7]. The increase in 6-minute walk test performance further confirms enhanced aerobic capacity and physical endurance[15,18]. Additionally, the significant rise in physical activity levels (measured in METs/week) suggests that participants not only adhered to the exercise protocol but may have also incorporated more movement into their daily routines beyond the supervised sessions[17,21].Furthermore, quality of life, as measured by the SF-36 score, improved notably in the aerobic exercise group. This finding supports the growing evidence that physical activity positively impacts psychological and emotional well-being, likely through mechanisms such as improved mood, stress reduction, and greater sense of control over one's health[10,11,16]. These psychosocial benefits are particularly relevant for working adults, who often struggle with stress, time constraints, and sedentary work environments[5,8,22].From a metabolic standpoint, significant reductions in fasting blood glucose and total cholesterol were also observed among the intervention group, while the control group showed minimal changes[3,12,18]. These results reinforce the role of aerobic exercise not only in cardiovascular regulation but also in metabolic balance, potentially lowering the risk of diabetes and dyslipidemia—two common comorbidities associated with hypertension[2,6,12].Importantly, the intervention was feasible and well-tolerated. Adherence to the exercise sessions was high, and no adverse events were reported, suggesting that such a regimen could realistically be implemented in workplace wellness programs[19,20]. This addresses a common barrier in exercise research: the translation of clinical findings into real-world, time-constrained environments[5,17,22]. The study design accounted for occupational challenges by scheduling manageable exercise durations (three sessions per week), emphasizing lifestyle support, and maintaining flexibility for participants[5,9].However, some limitations must be acknowledged. As a research study with a relatively small sample size and short duration, the results should be interpreted with caution when generalizing to broader populations. Long-term follow-up would be necessary to assess the sustainability of these benefits[3,18]. Additionally, self-reported activity levels may introduce some bias, and future studies could benefit from incorporating objective activity tracking tools[9,11].Despite these limitations, this study adds valuable evidence to the existing literature by specifically focusing on a working adult population, which has been underrepresented in hypertension and exercise research[7,12]. The improvements seen in the aerobic exercise group across multiple domains—blood pressure, fitness, metabolic health, and quality of life—underscore the potential of integrating structured physical activity into the daily routines of employed individuals for the effective management of hypertension[3,9,18].

CONCLUSION

This research study provides compelling evidence that a structured aerobic exercise program can significantly improve cardiovascular and metabolic health in working adults with hypertension. Over the course of just eight weeks, participants in the aerobic exercise group experienced substantial reductions in both systolic and diastolic blood pressure, along with notable improvements in body mass index, resting heart rate, physical activity levels, and quality of life. Additionally, favorable changes were observed in key metabolic markers, including fasting blood glucose and total cholesterol, further underscoring the broad health benefits of regular aerobic activity.The findings highlight aerobic exercise as a practical, effective, and non-pharmacological strategy for managing hypertension, especially in time-constrained working populations. Given the high adherence rate and absence of adverse effects, the intervention also proved to be feasible and well-accepted among participants. These results support the integration of structured physical activity into workplace wellness programs and hypertension management guidelines.While the outcomes are promising, larger-scale studies with extended follow-up periods are recommended to confirm these findings and assess the long-term sustainability of health improvements. Nonetheless, this study contributes meaningful insight into how lifestyle interventions—particularly aerobic exercise—can play a critical role in addressing the growing burden of hypertension in working adults.

DECLARATIONS

This study was conducted in accordance with the ethical guidelines,ethical approval was obtained from the **School Ethics Committee** before the commencement of the study. Written informed consent was obtained from the parents or legal guardians of all participants, and verbal assent was taken from children above seven years of age. The study was registered with the **Clinical Trials Registry of India (CTRI) under the registration number** [CTRI/2024/03/064498]**.**

CONFLICT OF INTEREST

There is no conflict of interest.

Funding: No external funding

AUTHOR'S CONTRIBUTIONS

The author played a central role in all stages of the narrative review process. This included the initial conception and design of the review, identifying and selecting relevant literature, conducting the literature analysis, and synthesizing the findings. The author also wrote and revised the manuscript, ensuring the accuracy and integrity of the work. Throughout the process, the author was responsible for interpreting the data, drawing conclusions, and integrating feedback from peers and reviewers to refine the final publication

ACKNOWLEDGEMENTS

We would like to express our gratitude to all the colleagues and experts who provided invaluable insights and feedback during the preparation of this manuscript. Additionally, we acknowledge the support of our families and friends throughout the process.

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