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A HOLISTIC APPROACH TO LOWERING BLOOD PRESSURE

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ABSTRACT

Introduction: Hypertension affects over 1.28 billion adults worldwide and is a leading global health concern due to its strong association with heart disease, stroke, and other complications, with nearly half of affected individuals unaware of their condition. Effective management strategies, including the promotion of sports activities to lower blood pressure, are essential to reduce the significant health risks and disease burden linked to high systolic blood pressure. The aim of the work is to present the latest reports on lowering blood pressure through sports activities.
Material and methods: For this work, we conducted a search in January 2025 in the PubMed and Google Scholar databases using the keywords: "blood pressure," "sport," "hypertension," followed by an analysis of the selected materials.
Aim of the study: The aim of the work is to present the latest reports on lowering blood pressure through sports activities.
Conclusion: The integration of diverse exercise modalities, such as isometric exercise training, sprint interval training, moderate-intensity continuous training and tai chi into public health strategies could significantly enhance hypertension management. Only five minutes of training a day can result in blood pressure reduction and can benefit patients with hypertension.

KEYWORDS

Blood Pressure, Sport, Hypertension, Exercise

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Introduction

Hypertension is a significant global health concern due to its association with increased risks of heart disease, stroke, and other complications. In 2019, the number of adults aged 30-79 with hypertension doubled since 1990, reaching approximately 1.28 billion worldwide. Notably, nearly half of these individuals were unaware of their condition, and only a minority had their blood pressure adequately controlled.(F. Liu & Lu, 2024; Zhou et al., 2021)

High systolic blood pressure is identified as the leading risk factor for global disease burden, accounting for 10.4 million deaths and 218 million disability-adjusted life years (DALYs). This underscores the critical need for effective hypertension management strategies to mitigate associated health risks.(A.-B. Liu et al., 2024; Stanaway et al., 2018)

The aim of the work is to present the latest reports on lowering blood pressure through sports activities what can help to take a holistic approach to the treatment of patients with hypertension.

Mechanisms of hypertension-induced organ damage

Recent studies have uncovered mechanisms by which elevated blood pressure impacts the body. Chronic hypertension leads to structural changes in blood vessels, often called vascular remodeling, where the walls of blood vessels become thicker and less flexible, disrupting normal blood flow. Additionally, it interferes with the production of nitric oxide, a compound vital for blood vessel relaxation, resulting in endothelial dysfunction, which contributes to inflammation and clot formation.(Drożdż et al., 2023; Gallo et al., 2022)

Hypertension is also linked to an overactive immune response. Immune cells, such as T lymphocytes, infiltrate organs, leading to inflammation and scarring (fibrosis), which worsens the condition. Furthermore, high blood pressure increases the production of reactive oxygen species (ROS), causing oxidative stress. This oxidative damage exacerbates inflammation and accelerates organ injury.(Norlander et al., 2018; Wenzel et al., 2021)

In the kidneys, hypertension raises pressure in the glomeruli, the filtering units, leading to damage and reduced kidney function. This, in turn, creates a vicious cycle, as kidney impairment further increases blood pressure. Understanding these pathways helps in designing strategies to protect organs from hypertension-related damage.(Yu et al., 2019)

Effect of exercise on blood pressure

Sweating

Exercise has been widely explored as an intervention for reducing high blood pressure, with one proposed mechanism being the induction of sweating. This process facilitates the loss of sodium and water, which is thought to contribute to blood pressure reduction. Numerous studies, both clinical and epidemiological, have investigated this relationship, aiming to understand how sweating during exercise impacts hypertension.

The mechanisms by which exercise lowers blood pressure are multifaceted and not yet fully understood. However, several key pathways have been identified. Sweating leads to a decrease in sodium and water levels, reducing blood volume, which can lower blood pressure. Additionally, exercise improves endothelial function in the blood vessels and reduces peripheral resistance. This reduction in resistance is believed to be mediated by the activation of the nitric oxide synthase pathway and the release of vasodilatory substances, such as prostacyclin and bradykinin. These substances relax blood vessels, promoting vasodilation and further contributing to decreased blood pressure.(Barnes & Charkoudian, 2021; Gambardella et al., 2020; Hoseini & Raed Hamid, 2024; Krassioukov et al., 2021; Kumar et al., 2020; Ziemssen & Siepmann, 2019)

Isometric Exercise Training

While traditional aerobic and dynamic resistance exercises are widely recommended for blood pressure control, isometric exercise training (IET) has gained attention for its potential to achieve superior BP reductions compared to conventional exercise modalities.

IET involves sustained muscle contractions without altering the muscle's length. These contractions create significant cardiovascular and vascular stimuli, making IET an effective intervention for reducing blood pressure (BP). Commonly employed protocols include handgrip exercises, wall squats, and bilateral leg extensions, with handgrip and wall squats being particularly favored due to their simplicity and minimal equipment requirements. Sessions are time-efficient, typically lasting 11–20 minutes, making them accessible for individuals with limited time or physical capacity for traditional exercise.

Research highlights that IET can achieve BP reductions comparable to those of antihypertensive medications, with systolic and diastolic BP decreasing by 5–10 mmHg. This effect is particularly notable as it surpasses reductions reported in many traditional exercise regimens. The BP-lowering impact of IET is linked to several physiological mechanisms. IET improves endothelial function by increasing the bioavailability of nitric oxide, a potent vasodilator, which helps relax blood vessels and lower vascular resistance. Additionally, IET influences autonomic balance by reducing sympathetic activity and enhancing parasympathetic tone, further contributing to BP reduction.(Carlson et al., 2014; Chapman et al., 2023; Edwards et al., 2024; Edwards, Jalaludeen, et al., 2023; Lea et al., 2024; Loaiza-Betancur & Chulvi-Medrano, 2020; Somani et al., 2017)

Sprint Interval Training (SIT) and Moderate-Intensity Continuous Training (MICT)

Sprint Interval Training (SIT) involves short bursts of very high-intensity exercise (e.g., sprinting or cycling) performed at near-maximal effort, interspersed with periods of low-intensity recovery or rest. Moderate-Intensity Continuous Training (MICT) involves sustained exercise performed at a steady, moderate intensity for a longer duration, such as walking, jogging, or cycling at a consistent pace. The effects of Sprint Interval Training and Moderate-Intensity Continuous Training on blood pressure (BP) have been examined through systematic reviews and meta-analyses.

SIT was shown to significantly reduce SBP by an average of 2.82 mmHg. However, it did not produce statistically significant changes in DBP. The analysis highlighted that specific SIT protocols—particularly those lasting eight weeks or longer or involving sprint durations of less than 30 seconds—were most effective in achieving reductions in SBP.

MICT demonstrated reductions in both SBP and DBP, with mean decreases of 3.00 mmHg and 2.11 mmHg, respectively. These changes were statistically significant, suggesting that MICT may provide broader benefits for blood pressure regulation compared to SIT.

While both SIT and MICT effectively reduce SBP, MICT showed additional benefits in lowering DBP. SIT, on the other hand, offers a more time-efficient option, potentially appealing to individuals with limited time for exercise. These findings suggest that either modality could be incorporated into personalized exercise plans depending on individual needs and preferences.(Cao et al., 2019; Cuddy et al., 2019; Liang et al., 2024; Lora-Pozo et al., 2019)

Tai Chi

Tai Chi, a traditional Chinese mind-body exercise, has been widely studied for its health benefits, including its potential to reduce blood pressure. This practice involves slow, intentional movements combined with deep breathing and meditation, promoting relaxation and physical well-being. Recent research has explored its efficacy in lowering BP, particularly in individuals with hypertension or prehypertension.

Studies indicate that regular practice of Tai Chi can lead to significant reductions in both systolic and diastolic blood pressure. For instance, systematic reviews and meta-analyses have demonstrated reductions in systolic BP ranging from 7–12 mmHg and diastolic BP reductions of 4–8 mmHg in hypertensive individuals following Tai Chi interventions lasting 8–12 weeks. A randomized clinical trial compared the effects of Tai Chi and aerobic exercise on systolic blood pressure in patients with prehypertension. Participants were assigned to either a Tai Chi group or an aerobic exercise group, each engaging in their respective activities for a specified duration. The study found that Tai Chi was more effective than aerobic exercise in reducing SBP, with a mean difference of −2.40 mm Hg.

The mechanisms underlying Tai Chi's BP-lowering effects are multifaceted. First, the meditative aspect of Tai Chi induces a relaxation response, which reduces stress hormone levels, such as cortisol, that are associated with increased BP. This response also promotes vasodilation, improving blood flow and reducing peripheral resistance. Additionally, Tai Chi enhances autonomic nervous system regulation, shifting the balance toward parasympathetic dominance. This shift lowers heart rate and improves overall cardiovascular function, contributing to sustained BP reductions.

Tai Chi's low-impact nature makes it accessible to diverse populations, including older adults or those with limited physical capacity. It offers a gentle form of exercise that minimizes joint stress while improving flexibility, strength, and balance. This accessibility is particularly beneficial for hypertensive patients who may struggle with high-intensity workouts or those with coexisting conditions limiting physical activity.

Evidence also suggests that Tai Chi may improve other cardiovascular risk factors alongside BP. Regular practice has been associated with improved lipid profiles, reduced inflammation, and enhanced endothelial function. These additional benefits make Tai Chi a comprehensive intervention for cardiovascular health.(Guan et al., 2020; Li et al., 2024; Rodrigues et al., 2022; Zhao et al., 2024)

Five minutes is all it takes

A 2024 study investigated how reallocating time spent on various daily movement behaviors impacts blood pressure, using data from 14,761 participants. It explored six behaviors: sleep, sedentary behavior, standing, slow walking, fast walking, and exercise-like activities (e.g., running, cycling). Movement was tracked using thigh-worn accelerometers, while blood pressure measurements were taken to assess associations.

Key findings reveal that small increases in exercise-like activity are strongly associated with lower blood pressure. A mere five-minute daily reallocation to exercise-like activity resulted in an estimated reduction of 0.68 mm Hg in systolic blood pressure (SBP) and 0.54 mm Hg in diastolic blood pressure (DBP). Clinically meaningful reductions—2 mm Hg in SBP and 1 mm Hg in DBP—could be achieved by substituting 20–27 minutes and 10–15 minutes of other activities, respectively, with exercise-like activity. Sedentary behavior was adversely associated with blood pressure, while standing and walking showed minimal impact compared to exercise.

Interestingly, additional sleep was also linked to lower blood pressure, but substantial time shifts from other behaviors were needed for significant effects. For instance, replacing sedentary time with nearly three hours of sleep yielded a 2 mm Hg reduction in SBP.(Blodgett, Ahmadi, Atkin, Chastin, et al., 2024; Blodgett, Ahmadi, Atkin, Pulsford, et al., 2024; Chastin et al., 2021; Edwards, Deenmamode, et al., 2023; Holtermann et al., 2021; Janssen et al., 2020; Kelley et al., 2022; Lee et al., 2021; Saco-Ledo et al., 2020; Zhu et al., 2022)

Discussion

The findings collectively highlight the significant impact of various exercise modalities in managing hypertension, a condition that remains a critical global health concern due to its association with elevated risks of cardiovascular disease, stroke, and organ damage. Exercise has consistently been shown to play a central role in lowering blood pressure and improving overall cardiovascular health, making it a cornerstone of non-pharmacological strategies.

Among the highlighted methods, isometric exercise training (IET) stands out for its time efficiency and efficacy. IET sessions, lasting as little as 11–20 minutes, provide BP reductions of 5–10 mmHg, comparable to pharmacological interventions. Its accessibility, requiring minimal equipment, makes it an appealing option for individuals with time constraints or physical limitations.

Similarly, Tai Chi offers unique advantages as a low-impact, meditative exercise that combines physical activity with relaxation techniques. It achieves significant BP reductions while improving vascular function and reducing stress-induced hormonal activity. Its adaptability to diverse populations, including older adults and those with limited mobility, underscores its utility in hypertension management strategies.

High-intensity interval exercises, such as Sprint Interval Training (SIT) and Moderate-Intensity Continuous Training (MICT), also demonstrate notable benefits. MICT effectively lowers both systolic and diastolic BP, while SIT provides a time-efficient alternative, particularly for systolic BP reduction. These methods cater to individuals with different fitness levels and time availability, highlighting the importance of personalized exercise plans.

A particularly interesting finding is the impact of reallocating short durations of daily activities to moderate or vigorous exercise-like activities. As little as five minutes of such adjustments can lead to measurable BP reductions. These results reinforce the feasibility of integrating exercise into daily routines, offering population-wide benefits and reducing cardiovascular risks.

Summary

In conclusion, the integration of these diverse exercise modalities into public health strategies could significantly enhance hypertension management. Future research should focus on standardizing protocols and exploring long-term effects to optimize their clinical application. Promoting these exercises as part of a holistic approach to cardiovascular health has the potential to address the global burden of hypertension effectively.

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