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BRIDGING EVIDENCE AND PRACTICE: RECOMMENDED PHYSICAL ACTIVITY TYPES FOR OLDER ADULTS WITH HYPERTENSION

Nurma Afiani[1*], Neni Fidya Santi[1], Kurniawan Erman Wicaksono[2], Yuli Wahyuni[3], Sri Haryuni[4], Novita Ana Anggraini[5], Abdurahman Wahid[6]

[1]Departement of Nursing, Faculty of Medicine, Universitas Negeri Malang, Indonesia*
[2]Health Information Management Vocational Study Program, Jember State Polytechnic, East Java, Indonesia
[3]Department of Computer Engineering, Faculty of Vocational School, Pakuan University, West Java, Indonesia
[4]Faculty of Health Science, University of Kadiri, East Java, Indonesia
[5]Faculty of Nursing, Universitas STRADA Indonesia, East Java, Indonesia
[6]School of Nursing, Faculty of Medicine and Health Science, Universitas Lambung Mangkurat, South Kalimantan, Indonesia

*e-mail: *nurma.afiani.fk@um.ac.id*

ABSTRACT

It is evident that physical activity has a significant impact on blood pressure levels in older adults diagnosed with hypertension. However, the type of physical activity among older adults with hypertension remains insufficiently studied. The objective of the present study was to investigate the proposed type of physical activity for older adults suffering from hypertension. The present study was a review, 1280 publications were identified through database searches conducted using ScienceDirect, PubMed, Google Scholar, EBSCO, and Springer Link. PRISMA guidelines were used to report this review. Ten articles met the inclusion criteria, including studies evaluating the effects of physical activity or exercise training on blood pressure; research involving participants diagnosed with hypertension; research reporting findings pertaining to blood pressure; investigations employing an experimental design, written in English, published between 2019-2024. The findings demonstrated that a combination of exercises (aerobic, resistance, and stretching exercises) yielded superior outcomes in comparison to other forms of physical activity in older adults. The findings of this study indicate that resistance training should be performed prior to aerobic exercise in order to achieve optimal results.

Keywords: Aged, Blood pressure, Exercise, Hypertension, Sport medicine

INTRODUCTION

Physical activity constitutes a non-pharmacological intervention for individuals diagnosed with hypertension. Physical activity is defined as any physiological movement produced by skeletal muscle contraction that increases energy expenditure beyond resting levels and includes routine daily behaviors. The management of hypertension is a multifaceted endeavor that encompasses both non-pharmacological and pharmacological therapeutic approaches. The primary treatment modality for patients diagnosed with hypertension is non-pharmacological intervention, encompassing lifestyle modification (Whelton et al., 2017). The efficacy of nonpharmacological interventions is optimised through combination with pharmacological therapies, either concurrently or in sequence. There is a robust correlation between a sedentary lifestyle and hypertension.

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Hypertension remains a major global burden, affecting 30-34% of adults worldwide; in Indonesia, national data reported 32.6% among elderly. The present body of research suggests that physical activity has the potential to delay the onset of hypertension (Henkin et al., 2023). It is evident that consistent physical activity constitutes the most efficacious non-pharmacological intervention for reducing blood pressure in older adults (Gargallo et al., 2022). Recent research findings have indicated that a combination of pharmacological therapy and physical activity is the most effective method of achieving a low blood pressure reading in individuals diagnosed with hypertension (Hayes et al., 4).

Engaging older persons with hypertension in regular physical activity poses a significant challenge due to the ongoing degenerative processes associated with this condition. A considerable number of elderly individuals diagnosed with hypertension remain sedentary as a consequence of misinformation and a trepidation regarding physical exertion, compounded by the presence of comorbidities (Lee et al., 2022), (Viera et al., 2024). The aetiology of hypertension in older adults is likely to be more multifactorial than in younger individuals. Hypertension in older persons is often the result of a combination of age-related changes, which can result in differences in blood pressure between younger and older adults (Sardeli et al., 2022). Consequently, the management of hypertension in older adults differs, with non-pharmacological interventions, particularly physical activity, playing a pivotal role. Whilst there is a strong consensus in favour of recommending physical activity as the primary treatment for hypertension, there is a paucity of research in this area, particularly in relation to specific recommendations for older adults with hypertension. The objective of this study was to examine the most suitable types of physical activity for older people suffering from hypertension.

METHODS

Search strategy

The investigation was executed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA is a comprehensive guide for systematic reviews across various study types that emphasises the reporting of findings from randomised trials. The Population-Intervention-Comparison-Outcome (PICO) strategy was employed to identify the pertinent keywords (see Table I). The investigation for this study was executed using the following databases: The following bibliographic databases are to be consulted for this study: ScienceDirect, PubMed, Google Scholar, EBSCO and Springer Link. The search strategy employed a comprehensive approach that included a diverse range of keyword variations ("physical activity for the hypertensive older adults" OR "exercise training of the hypertensive older adults" AND "reduce blood pressure" OR "reduce systolic diastolic blood pressure" OR "post-exercise hypotension").

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Table 1. PICO framework and algorithms employed for review

Population	Older adults people who have been diagnosed with hypertension, whether they receive antihypertensive therapy or not.
Intervention	Physical activity (such as endurance exercise, strenght exercise, balance exercise, flexibility exercise, or a combined training) only or combine with pharmacological treatment.
Comparison	The treatment for hypertension do not incorporate physical activity or lifestyle modifications alongside pharmacological treatment.
Outcome	Clinical parameters indicating improved vascular condition, such as post-exercise hypotension, reduced blood pressure, reduced systolic and diastolic blood pressure, reduced arterial stiffness.

Inclusion criteria

The following criteria were employed for the purpose of inclusion in this study: studies evaluating the effects of physical activity or exercise training on blood pressure; research involving participants elderly diagnosed with hypertension; research reporting findings pertaining to blood pressure; investigations employing an experimental design (e.g. randomised clinical trials, cohort studies) or quasi-experimental design that facilitates the assessment of physical activity treatments; and research published in peer-reviewed scientific journals.

Exclusion criteria

The exclusion criteria that were applied in the present investigation were as follows: firstly, research that was unrelated to physical exercise in elderly individuals with hypertension; secondly, research that did not assess the effect of physical activity on arterial pressure; thirdly, studies with non-older adult participants; fourthly, articles in languages other than English; and fifthly, articles published beyond the last five years, specifically between 2019 and 2024.

Data extraction

The articles selected for inclusion underwent rigorous review to ensure their relevance and quality. Each article was obtained for the purpose of a comprehensive evaluation. The data screening process was conducted independently by two reviewers. The retrieval of articles was conducted in accordance with a systematic procedure that encompassed the acquisition of both their titles and abstracts, in addition to their complete textual contents. The Rayyan platform (https://www.rayyan.ai/) was utilised to facilitate the systematic review procedure. Each item excluded from the analysis was supported by documented rationale for its exclusion. The methodology employed, referred to as "prioritization and sequential exclusion," has been discussed in extant literature.

RESULTS AND DISCUSSION

Search results

A comprehensive search has been performed in a number of databases, including PubMed, ScienceDirect, SAGE, Taylor & Francis, EBSCO, and Google Scholar. Initially, 1280 publications were identified through database searches

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(i.e. PubMed: 112 articles; ScienceDirect: 210 articles; SAGE: 80 articles; Taylor & Francis: 511 articles; EBSCO: 36 articles; and Google Scholar: 331 articles). In order to maintain the integrity of the systematic review, the authors cite a number of ethical factors. These include the prevention of duplicate publications, the avoidance of plagiarism, the preservation of transparency, and the guarantee of correctness. Consequently, a total of 797 articles were deemed to be eligible for title and abstract screening. A total of 646 articles were excluded on the basis of their irrelevance to the subject under discussion, their authorship in a language other than English, and their publication date prior to 2019. Subsequently, a comprehensive evaluation of the 151 articles was conducted. In the course of the present study, research that did not focus on physical activity among older adults with hypertension was excluded from consideration. Furthermore, studies that involved participants outside the older adult population, and studies that did not include blood pressure as one of the clinical parameters assessed, were also excluded. A total of ten complete papers satisfied the criteria for inclusion in this research study. The research selection procedure was depicted via a PRISMA flowchart (see Fig.1).

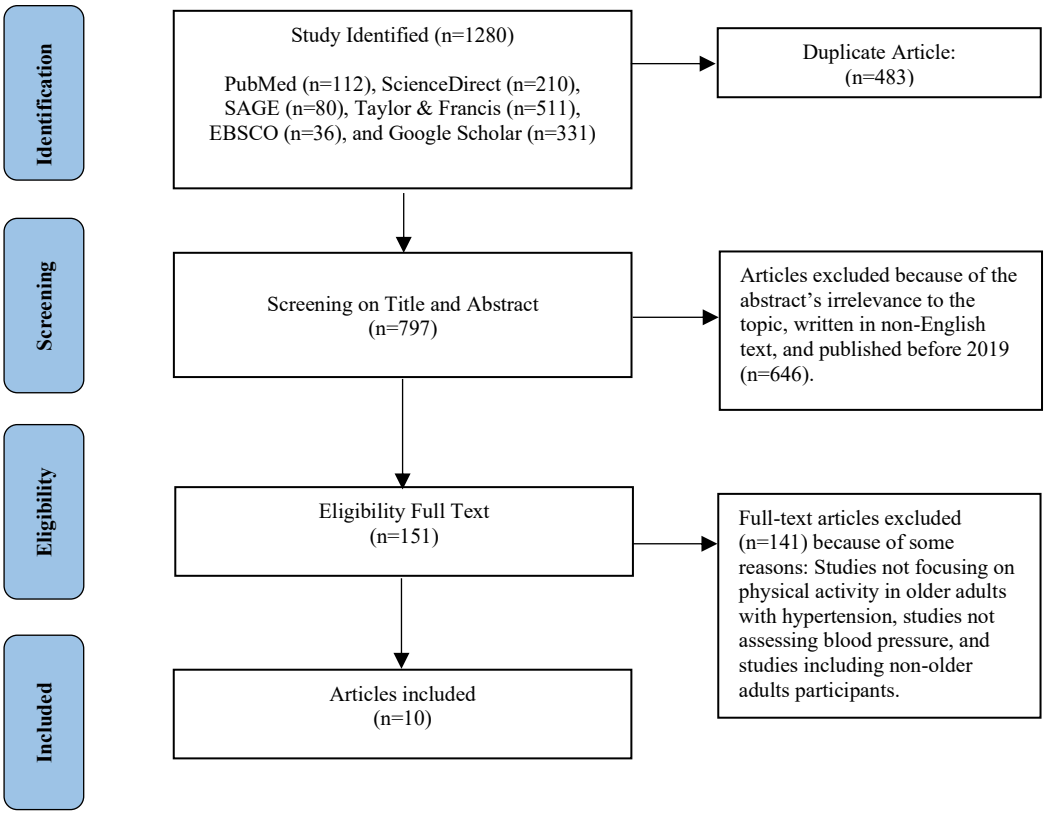

Fig.1 Flow Chart for Study based on PRISMA

Study characteristics

Following the application of the research inclusion criteria, a total of ten articles were deemed to be relevant to the study. The present ten papers investigate the influence of physical exercise modality on blood pressure in hypertensive older adults. The majority of these articles are grounded in the paradigm of randomized control trials. The study's participants comprised individuals aged 55 years and over who had been diagnosed with hypertension, irrespective of their antihypertensive medication status. The measurement of

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blood pressure was a fundamental aspect of the research, with the objective being to evaluate the efficacy of physical activity interventions. The complete description is presented in Table II.

Table 2. Summary of articles on physical activity for older adults with hypertension

Author, Title	Method Design	Content	Sample size	Aim	Results
(Prasertsri et al., 2022) (8)	Pretest-posttest designed experimental study	Long-term regular continous and intermittent walking	43	To evaluate the effects of sustained continuous walking versus intermittent walking in older persons with hypertension.	Both regular long-term walking and intermittent walking in elderly hypertensive effectively lower systolic blood pressure.
(Alzahrani, Alqahtani, & Vennu, 2023) (9)	Pilot randomized controlled trial	Low-to-moderate intensity aerobic activity	27	To investigate the impact of aerobic activity on the blood pressure in immobile older adults with hypertension.	Low to moderate exercise training is statistically significant in lowering resting blood pressure.
(Adriano et al., 2020) (10)	Crossover clinical trial	Bodyweight-based strenght training	11	To assess the immediate impact of bodyweight strength training on blood pressure in hypertensive elderly individuals.	The systolic blood pressure is lower 30 minutes after bodyweight-based strenght training session.
(Rodrigues et al., 2019) (11)	Randomized controlled trial	Isometric handgrip training	33	To examine the vascular consequences of isometric handgrip exercise in individuals with hypertension.	Isometric handgrip training over 12 weeks has diminished blood pressure and stiffness of the arterial wall while enhancing endothelial function indicators in hypertensive individuals.
(Gargallo et al., 2022) (3)	Randomized crossover design	Resistance exercise	19	To ascertain the ideal exercise volume that elicits a hypotensive response following the performance of a single strength exercise in older individuals with hypertension.	A solitary resistance exercise of at least six sets of 20 repetitions maximum elicited a significant post-exercise antihypertensive response that persisted for 60 minutes in older persons with managed hypertension.
(Ko et al., 2021) (12)	Randomized controlled trial	Stretching and brisk walking	40	To assess the impact of eight weeks of stretching compared to walking exercises on blood pressure.	An 8-week stretching programme was more effective than brisk walking in lowering blood pressure in patients with hypertension.
(Addis, Alemayehu, & Teferi, 2023) (13)	Randomized controlled trial	Aerobic, resistance, and a combination of both	60	To evaluate the efficacy of aerobic exercise, resistance training, and a combination of both on arterial pressure, composition of the body,	A 12-week regimen of combined exercise (aerobic plus resistance training) may offer more

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Author, Title	Method Design	Content	Sample size	Aim	Results
				and cardiorespiratory fitness.	comprehensive advantages.
(Sardeli et al., 2022) (7)	Randomized controlled trial	Combined training	52	To ascertain if 16 weeks of combination training decreases blood pressure in hypertensive elderly individuals.	Training increased strenght, reduce body mass and blood pressure.
(Junior et al., 2020) (14)	Controlled clinical trial	Land-based exercise and aquatic-based exercise	40	To compare resting blood pressure between two groups of participants trained in land activity and aquatic exercise.	Older adults hypertensive people trained in aquatic exercise had lower blood pressure and their post exercise hypotension was more rapid and longer lasting.
(Pires et al., 2020) (15)	Randomized crossover trial	Aerobic, resistance, and combined exercises	20	Comparing the short-term impacts of resistance, aerobic, and mixed exercise on blood pressure.	Combined exercise showed longer hypotension periods in hypertensive people.

The categorisation of physical activities is based on the National Heart, Lung, and Blood Institute (NHLBI) classification system, with the objective of facilitating analysis and addressing the research questions in this systematic review. In this article, the concept of physical activity for the elderly is categorised into the following five distinct types: endurance exercises, strength exercises, balance exercises, flexibility exercises, and combination exercises. A total of ten articles that satisfied the stipulated inclusion criteria were identified, and these articles subsequently determined the various categories of physical activity that are recommended for hypertension in elderly individuals. The following categories were determined: The following categorisation of articles has been determined: two articles concerning endurance exercises, three articles concerning strength exercises, one article concerning balance exercises, zero articles concerning flexibility exercises, and four articles concerning combination exercises. As illustrated in Table III, the data set is comprehensive in nature, encompassing the physical activity dosages that have been demonstrated to be efficacious in reducing blood pressure among older persons diagnosed with hypertension.

Table III. Types and dosages of physical exercises and their effects on reducing blood pressure

Physical activity type		Physical-activity dosage	Blood pressure reduction
Endurance exercises	Low-intensity exercise	Walking: At a cadence of 1 step per second or 60 steps per minute, corresponding to 30 minutes of daily activity, akin to slow walking (<3 km/h) at roughly 2.0 metabolic equivalents (METs), for 30 minutes, three days per week over a duration of 12 weeks.	SBP: -4.18 mmHg
	Low-to-moderate exercise	Stationary cycling: Twenty-four sessions, each lasting forty-five minutes, conducted three times per week for a duration of eight weeks.	SBP: -2.75 mmHg DBP: -0.83 mmHg
Strenght exercises	Bodyweight-based strenght training	Seated and standing exercises, bar-supported push-ups, step-ups and downs, rowing with an elastic tube, single-leg hip raises, and stomach exercises. Three sets, each lasting 30 seconds, with 90-second rest intervals between sets and exercises, aiming for the maximum number of repetitions.	SBP: -2.18 mmHg

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Physical activity type		Physical-activity dosage	Blood pressure reduction
	Isometric handgrip training	A total of 12 weeks, with each session comprising four sets of 2-minute isometric contractions (alternating hands) at 30% of maximal voluntary contraction, followed by a 1-minute rest interval.	SBP: -16±2 mmHg DBP: -9±2 mmHg
	A single resistance exercise	A solitary resistance exercise including at least six sets of a maximum of 20 repetitions; execute resistance training for the upper limbs with either 6 or 9 sets utilising readily available equipment such as elastic bands.	SBP: -9 mmHg DBP: -3 mmHg
Flexibility exercises	Streching program	An 8-week regimen comprising 21 stretching exercises targeting the lateral neck, inferior and posterior shoulder, shoulder protraction and extension, chest, gastrocnemius, soleus, latissimus dorsi, quadratus lumborum, quadriceps, hamstrings (two distinct stretches), upper back, lower back, spinal rotators, hip flexors, hip extensors, hip adductors, hip abductors, and gluteus. Each stretch was performed twice, held for 30 seconds, with a 15-second rest interval between stretches.	SBP: -7 mmHg DBP: -3 mmHg
Combination exercises	Combined training	A 12-week regimen of combined exercise consisting of thirty minutes of weight training and thirty minutes of aerobic activity.	SBP: -17.75 mmHg DBP: -12.5 mmHg
	Combined training	Strength training was conducted twice weekly for 15 minutes, followed by aerobic training for 50 minutes. Additionally, aerobic training was done alone once a week for 50 minutes, utilising continuous walking and/or jogging on a treadmill. Strength training comprised one set of 15 repetitions for each of seven exercises targeting the major muscle groups: leg extension, leg flexion, leg press, heel lift, bench press, pulley, and abdominal movements.	SBP: -3.2 mmHg DBP: -1.6 mmHg
	Aquatic combined-exercise	Aquatic mixed exercises (five minutes of preparation activity, twenty minutes of aerobic exercise, twenty minutes of resistance training, five minutes of stretching).	SBP: -31±11 mmHg DBP: -23±8 mmHg

DISCUSSION

Physical activity

Engaging in regular physical activity represents an efficacious non-pharmacological approach for the management of hypertension in elderly individuals (Hayes et al., 2022). The efficacy of this method is twofold: it has been demonstrated to reduce blood pressure and to enhance cardiovascular health and physical fitness (Banks et al., 2023). Regular participation in physical activity provides a wide range of health benefits for older adults. These include improvements in physical health, psychological well-being, and social interaction (Aditya et al., 2024). It has been demonstrated that even a minimal amount of physical exertion of a moderate to vigorous nature can result in a reduction in premature mortality rates among the elderly population (Hupin et al., 2015). It is recommended that elderly individuals suffering from hypertension engage in regular physical exercise in order to achieve optimal health benefits. It is important to note that individuals suffering from hypertension are able to engage in physical activities, even when confined to a wheelchair (Yunus et al., 2024). Irrespective of age, physical activity can engender significant benefits (Hupin et al., 2015). It has been demonstrated that physical exertion can enhance the release of nitric oxide (NO) from the endothelium (Facioli et al., 2021). The primary function of nitric oxide (NO) is to regulate vasodilation, platelet activity, and other processes that contribute to blood pressure control (Bryan, 2022). The

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present study elucidates the underlying mechanism responsible for the occurrence of hypotension subsequent to physical exertion (Facioli et al., 2022).

The selection of appropriate physical activity for the elderly is of paramount importance. In the elderly population, the engagement in inappropriate forms of physical activity has been associated with the onset of various maladaptive conditions (Izquierdo et al., 2021). These include, but are not limited to, exercise-induced joint pain, persistent palpitations or arrhythmias, chest constriction or shortness of breath, and even incidents of ischemia, which can impede future physical activity (Prasertsri et al., 16). The establishment of a precise exercise prescription for older adults suffering from hypertension remains challenging (Izquierdo et al., 2021). It is imperative that the selected physical activity is adapted to suit older individuals suffering from hypertension, with due consideration for their specific medical conditions. Individuals who have been inactive for a prolonged period should gradually increase their activity levels and refrain from strenuous activities initially. It is recommended that elderly individuals with hypertension consult a physician prior to commencing any physical activity.

Endurance exercises

Endurance exercise, otherwise referred to as aerobic exercise, is defined as rhythmic physical activity that enhances the strength of the heart and lungs. Aerobic exercise is defined as any physical activity that raises the heart rate and increases the respiration rate, such as walking, jogging, cycling, and swimming (National Heart, Lung, and Blood Institute) (NHLBI, 2022). It is recommended that older adults suffering from chronic diseases participate in low-intensity physical activity (Tan et al., 2022). Walking is considered to be a paradigm of low-intensity physical activity. A comprehensive analysis of randomised controlled trials has demonstrated that continuous walking for a duration of 30 minutes, three times per week for a period of 12 weeks, results in a significant decrease in blood pressure in individuals diagnosed with hypertension. Nevertheless, intermittent walking, which involves dividing 30 minutes of walking into three consecutive 10-minute sessions with one-minute intervals of rest between each session, three days per week for 12 weeks, has also been shown to be an effective approach. The present body of research demonstrates that walking, whether in a consistent or intermittent manner, has the potential to reduce arterial pressure in hypertensive patients (Prasertsri et al., 2022).

It is evident that physical activity of a moderate intensity, such as cycling, can be undertaken with minimal risk of adverse effects. Stationary cycling has been shown to be a viable and efficacious alternative physical activity option for elderly adults suffering from hypertension (Alpsoy, 2020). A plethora of studies have demonstrated the efficacy of aerobic exercise of a moderate to high intensity, encompassing 24 sessions of 45 minutes each, administered thrice weekly over a period of eight weeks. The present study examined the efficacy of a stationary cycling regime in promoting calorie and body fat reduction, whilst concomitantly enhancing cardiovascular, pulmonary, and muscular health outcomes, in comparison to alternative forms of cardiovascular exercise. A stationary bicycle imposes a reduced strain on the joints when compared with other forms of exercise, whilst offering the benefits of a vigorous aerobic workout. The present study demonstrated that physical activity significantly reduced blood pressure in older adults diagnosed with hypertension (Alzahrani et al., 2023).

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Strength exercises

A substantial body of research suggests that resistance exercise can lead to a considerable reduction in resting blood pressure, often to a greater extent than aerobic exercise. The decrease in systolic blood pressure was particularly noticeable among individuals with normal blood pressure and those with controlled hypertension. It was also noticeable among participants with uncontrolled hypertension (Macdonald et al., 2016). It is strongly recommended that older adults engage in this form of exercise as a strategy to counteract the adverse effects associated with ageing, particularly the decline in strength, bone density, and muscle mass and functionality (Fragala et al., 2019). The optimal volume of exercise required to achieve a hypotensive response following a single-strength training session in older adults with hypertension is not well understood. In a recent study, a resistance exercise session was conducted, which involved performing a minimum of six sets with a focus on the 20-repetition maximum (20RM) load. This particular method of resistance training led to a significant reduction in blood pressure after exercise, referred to as an immediate post-exercise antihypertensive response. The beneficial effects of the exercise were observed to persist for a duration of 60 minutes following the completion of the workout. The participants comprised older adults as well as individuals who had controlled hypertension, thus emphasising the potential for such exercise regimens to function as a supplementary intervention for managing blood pressure levels in these demographics (Gargallo et al., 2022).

Bodyweight strength training constitutes an economically viable and pragmatic option for elderly individuals afflicted with medical conditions (da Silva AL et al., 2021). It has been demonstrated that this approach is more effective than traditional methods. The exercises can be performed in any location, at any time, and in any weather conditions, and do not require the use of equipment. A substantial body of research has reported favourable outcomes in relation to body composition, functional capability, muscle strength and power following the adoption of bodyweight-based strength training. The activity can be performed in a seated position and then repeated in an upright stance. The programme also incorporates push-ups with bar support, ascending and descending stairs, rows with elastic tubes, single-leg hip lifts, and abdominal exercises. Each set consists of three repetitions, with a 30-second duration for each set and a 90-second interval allocated for rest between sets and exercises. The objective is to achieve the maximum number of repetitions. A decline in systolic blood pressure has been observed in elderly individuals with hypertension, with a mean decrease of 12 mmHg, 30 minutes following the termination of an exercise session (Adriano et al., 2020).

It has been demonstrated that isometric handgrip training has the capacity to significantly reduce blood pressure in hypertensive persons. The systolic and diastolic blood pressures exhibited a substantial decrease following isometric handgrip training. The programme was designed to be completed over a period of 12 weeks, with each session comprising four sets of two-minute isometric contractions (with the hands alternating between sides) at 30% of the subject's maximal voluntary contraction, followed by a one-minute rest interval. The findings of the present study indicate that isometric handgrip training is associated with enhancements in vascular functionality, accompanied by a reduction in blood pressure. Notable enhancements in central artery stiffness and shear area under the curve post-occlusion were recorded. The enhancements in

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vascular function were sustained throughout a 12-week period of isometric handgrip training (Rodrigues et al., 2019).

Flexibility exercises

It has been demonstrated that stretching exercises have the capacity to enhance flexibility and augment the complete range of motion at joints. A recent study has indicated that a programme of eight weeks' duration incorporating stretching exercises was more efficacious than brisk walking in reducing blood pressure among patients diagnosed with stage 1 hypertension. In comparison with ambulation, the stretching regimen resulted in a reduction in systolic and mean arterial pressures in the seated position, as well as in diastolic and mean arterial pressures in the supine position. Furthermore, the stretching regimen led to a reduction in nocturnal diastolic and mean arterial blood pressures (Ko J et al., 2021). The research indicated that flexibility is a crucial determinant of decreased arterial stiffness and blood pressure. Regular short-term stretching exercises have been shown to reduce arterial stiffness in hypertension, suggesting that even brief flexibility training can significantly enhance vascular health. Moreover, the findings of the study demonstrated that flexibility training exhibited superiority over strength training and combined strength and aerobic exercises in terms of enhancing artery health. This observation underscores the importance of integrating flexibility routines into physical activity for achieving optimal cardiovascular health outcomes (Nishiwaki M. et al., 2015).

A number of physiological mechanisms have been identified that may provide a scientific explanation for the manner in which stretching contributes to lower blood pressure. During flexibility training, muscles are stretched, which also causes blood vessels to stretch. This can result in structural alterations to the blood vessels, affecting their diameter and rigidity. Consequently, resistance to blood flow is reduced, which in turn leads to a decrease in blood pressure. Moreover, it is conceivable that stretching may result in transient ischemia, that is to say, a diminution in blood flow, within the muscles. This, in turn, has the potential to instigate advantageous vascular adaptations (Jackson et al., 2002). It is hypothesised that stretching may affect blood pressure via the process of vasodilation, which is defined as the widening of blood vessels. This response is initiated by the release of various metabolites by endothelial cells, which line the interior surface of blood vessels, in response to the stretching of the vascular walls. The metabolites in question, which include nitric oxide and prostacyclin, have been demonstrated to induce a state of relaxation in the smooth muscle cells that are located in the proximity of blood vessels, thereby resulting in a reduction in vascular resistance. The increased diameter of the blood arteries has been demonstrated to facilitate enhanced blood flow, which may result in a decrease in blood pressure. This process elucidates the intricate relationship between mechanical stimuli and cardiovascular health, as well as endothelial function (Hotta et al., 2018). Stretching may affect blood pressure via influencing the sympathetic and parasympathetic nerve systems. Following a stretching session, the activation of the sympathetic nervous system diminishes, whilst the stimulation of the parasympathetic nervous system escalates. This alteration leads to less vasoconstriction and enhanced vasodilation, hence decreasing resistance to blood flow and subsequently lowering blood pressure (Bisconti et al., 2020).

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Combined exercises

The combination of training produced the most significant benefits for body composition and blood pressure. A study conducted in Ethiopia revealed that, in comparison with aerobic or resistance exercise alone, this combination intervention resulted in greater decreases in both systolic and diastolic blood pressure. The findings of other research endeavours have indicated that the implementation of combined exercises has been demonstrated to exert a substantial impact on systolic blood pressure, while the impact on diastolic blood pressure has been found to be non-significant (Gao and Huang, 2023). The participants engaged in a 12-week programme, which comprised 30 minutes of resistance training and 30 minutes of cardiovascular exercise per session (Addis, Alemayehu, Teferi, 2023). It has been demonstrated that regular participation in aerobic exercise and resistance training is correlated with substantial decreases in body composition, as indicated by alterations in body weight, body mass index, and body fat percentage. In the context of integrated training methodologies, the sequence of activities is typically recommended as follows: firstly, resistance training, and subsequently, aerobic training (Caminiti et al., 2021). A study conducted in Japan demonstrated that the combination of aerobic exercise and resistance training significantly reduces arterial stiffness in older males. Conversely, the study demonstrated that the incorporation of aerobic exercise prior to weight training did not result in any significant alterations in arterial stiffness. Furthermore, it was evident that both training protocols were equally efficacious in reducing waist circumference, enhancing grip strength, and improving walking capability, irrespective of the sequence in which the exercises were performed (Shiotsu et al., 2018). The combination of exercise and treatment also demonstrated that hypotensive episodes were prolonged in individuals with resistant hypertension (Pires et al., 2020).

Combined exercise encompasses a variety of modalities, including aerobic, resistance, and stretching exercises, which can be performed on land or in a aquatic environment. Research findings indicate that aquatic exercise exerts a more pronounced and sustained effect on reducing blood pressure compared to exercise on land. Hypertension has been shown to be associated with higher blood pressure levels in older adults. However, the present study found that those who engaged in physical activity in an aquatic environment exhibited lower blood pressure levels throughout the day when compared with those who engaged in physical activity on dry land. The aquatic combined training programme is comprised of the following sequence of activities: firstly, a five-minute preparatory activity; secondly, a 20-minute aerobic exercise session; thirdly, a 20-minute resistance exercise period; and finally, a five-minute stretching exercise (Junior et al., 2020). It is evident that aquatic exercise offers distinct advantages in comparison to its terrestrial counterpart for elderly individuals. The reduced risk of injury associated with water buoyancy, as well as the decreased weight-bearing loads and joint loads that result from aquatic exercise, help to guard against the degradation of joints that can occur with land-based exercise. Furthermore, it has been demonstrated that aquatic exercise can induce physiological adaptations due to immersion, influencing both blood pressure and heart workload. This phenomenon is particularly evident in the decline of sympathetic activity and the redistribution of abdominal fat to the upper body.

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CONCLUSION

It is recommended that older adults engage in physical activity. Research has demonstrated that the consistent practice of physical activity is associated with a reduction in blood pressure in elderly individuals diagnosed with hypertension. The selection of types of physical activities that can provide a hypotensive effect post-exercise must consider the condition of the elderly with hypertension. There are five primary categories of physical activity: endurance exercises, strength exercises, flexibility exercises and combination exercises. The combination of exercises has been demonstrated to yield superior outcomes in comparison to other forms of physical activity. It is recommended that weight training be performed prior to aerobic training.

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