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Research Article

Effectiveness of Twenty Minutes Walk Training With and Without High-Intensity Interval Training (HIIT) on Cardiovascular Endurance Among Healthy Individuals - A Randomised Controlled Trial

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A B S T R A C T

Introduction: Body, mind, and emotions change as we age, and signs include hair loss, hair greying, elasticity loss in the skin, weight gain, and decreases in physical strength and endurance. In the third and fourth decade of life, maximum aerobic capacity (maximum volume of O_2) declines gradually from 3% to 6% in adults who live in communities. The ability of the cardiovascular system to transport and use oxygen is influenced by both central and peripheral factors. Of the central parameters influencing endurance performance, cardiac output shows the greatest ageing-related reductions. This study evaluates healthy individuals' cardiovascular endurance using 20-minute walk training with and without high-intensity interval training.

Material and Method: A total of 80 adults who participated were randomly assigned to 2 groups: Group A (40 samples) performed 20-minute walk training with high-intensity interval training, and Group B (40 samples) performed 20-minute walk training only for the duration of 4 days per week for 4 weeks. The pre-test and post-test values are measured based on cardiovascular endurance level using the outcome measure of the 6-Minute Walk Test.

Results: Results showed that 20-minute walk training with and without high-intensity interval training significantly improved cardiovascular endurance levels ($p < 0.001$). Moreover, the improvements obtained in Group A seen to be greater than those of Group B in cardiovascular endurance.

Conclusion: 20-minute walk training with high-intensity interval training seemed to be more beneficial to improve cardiovascular endurance than 20-minute walk training without high-intensity interval training.

Keywords: High-Intensity Interval Training, 20 Minutes Walk Training, Cardiovascular Endurance, 6 Minute Walk Test

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Introduction

Endurance, which typically with a combination of physiological and psychological variables refers to aerobic capacity, is the capacity to continue an activity for long periods of time.[1] Endurance is frequently confused with the term stamina; however, the two are fundamentally different. Stamina frequently refers to how long a person can execute a specific activity at their best or without becoming exhausted. Contrarily, endurance focuses on a person's capacity to carry out a task; unlike stamina, it does not regard performing to one's fullest potential.

Performance during long periods of exertion depends on the cardiovascular system's capacity to consume and distribute oxygen at a rate that can keep up with the energy needs of muscle activity.[2] Cardiovascular endurance refers to the amount of strain your heart can withstand when exercising. In other words, a person with increased cardiovascular endurance can endure longer and more intense training sessions than someone who has not yet reached that level of cardiovascular endurance because their body becomes more efficient at pumping blood while performing that particular activity. A key determinant of physical health is cardiovascular endurance, which is the ability of the heart and lungs to provide working muscles with oxygen during extended physical activity.[3]

Ageing includes gaining weight, losing physical strength, and experiencing joint pain. Getting through this stage is like getting through an emotional to mental transition.[4] Between the ages of 35 and 55 years, adults experience a sequence of physiological, mental, and emotional changes that lead to hair loss, greying of the hair, and suppleness loss in the skin.[5] You have to work to enhance your capacity to perform a specific activity for extended periods of time through endurance training.

Assessing overall endurance gives a basic notion of an elderly person's capacity to produce enough force for actions that require continuous effort, including long-distance walking. Primarily aerobic exercise activities seem to be the most effective for achieving good metabolic and cardiovascular endurance among the various exercise training methods.[6] According to physiology, the goal of endurance exercise is to gradually transition the anaerobic metabolism and lactate production towards high-intensity interval training by performing the activity at a sub-maximal level. This happens as a result of intricate changes in muscle metabolism, including an increase in Oxidative enzymes and density of mitochondria, changes in the type of muscle fibres, and an increase in capillarization.

In patients with cardiovascular illness, The fundamental component of exercise-based rehabilitation programs is endurance training, which improves cardiovascular and autonomic balance results. Programmes for interval training adjust the length of the rest periods, how long and how hard the work periods are, and both to produce the intended training effects originally known as fartlek (Swedish word), which means "speed play", interval training mixes gentler, slower movements with quick, intense bursts of exercise.[7] A complete interval training programme typically consists of multiple brief, alternating sessions of harder and lighter workouts. Interval training has long been utilized as the cornerstone of physical fitness training since it increases speed, strength, and endurance while also promoting calorie burning and enhancing the general level of athletic ability.

HIIT, sometimes referred to as interval training or sprint interval training, is performing a predetermined number of exercises at a high intensity, immediately followed by recovery intervals. The duration of the intense activity can be minutes.[8] "HIIT" is a technique in which the participant increases their workout intensity for a brief amount of time. If running is your preferred form of exercise, you can choose to run at a faster pace for the first 20 seconds of each interval and then gradually slow down for the next minute. This not only improves your insulin sensitivity over time but also increases your endurance over the long term. The length of the intervals of recovery can also vary. Exercises with short bursts of high energy include squatting, planking, jumping jacks, stepping, and running. This study's objective was to determine if 20 minutes of walking exercise, both with and without HIIT, is useful among healthy persons.

Subjects and Methods

This experimental study was conducted from January 2023 to June 2023 at Aarupadai Veedu Medical College & Hospital, Puducherry. The ethical clearance committee of Aarupadai Veedu Medical College gave approval for the study and consent was obtained from all participants before starting the study. To increase cardiovascular endurance, a sample of 80 healthy individuals was split up into two groups according to the inclusion and exclusion criteria. Men in good health between the ages of 35 and 55 years were chosen; those with a history of alcohol use, tobacco use, cardio-respiratory diseases, recent fractures, and other anomalies, and females were discarded. The goal of the study was presented to the subjects prior to data collection. An extensive orientation of the therapy and test processes has been provided by the investigations. Following a thorough explanation of the condition and a demonstration of the study's methods, each participant's full cooperation and concern were requested. A randomised controlled trial was the method used in the investigation. For this investigation, simple random sampling (slot method) was chosen as the sampling technique. Group A (Intervention) received high-intensity interval training and 20 minutes of walking practice. The "6-minute walk test" was used as the

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outcome measure; 20 minutes of walk training alone was given to Group B (Control). The time between the outcome examination measures was four weeks.

Outcome Procedure

Before the test, there was no "warm-up" period. The 6MWT was carried out indoors on a long, level, straight hallway with a comfortable firm surface. The walking route was 30 metres long. A marking of 30 metres was made and two cones were placed at each location. One indicated the beginning, and the other indicated the end. Every three metres, the corridor's length was indicated. There was a chair close to the beginning position where the patient could sit and rest. The patient had to circle the two cones on foot for six minutes. There was a coloured tape marking the floor at every 60 metres. Within six minutes, the patient's walking distance was measured. The patient was asked to stand and use the BORG to score their general fatigue and dyspnoea. Subjects were inquired how they felt between trials, whether they required rest or they were still able to take part. The participants could withdraw at any time from the study if they felt unwell.

Treatment Procedure

Group A: High-Intensity Interval Training Along with 20 Minutes of Walk Training[9]

- Each HIIT exercise was iterated 15–20 times. Every week, exercises were advanced by including 5–10 additional repetitions.

Half Squat

- Place your feet firmly together.
- Extend your fingers and bend your elbow, wrist, and shoulder 45 degrees.
- Slightly bending the hip and knee.

Stepping

- To achieve the desired training effect, upright stepping incorporates the sequence of one foot up, two feet up, one foot down, and two feet down.

Jumping Jacks

- Place your arms by your side and stand with your feet together.
- Jump, spread your feet, and extend your arms above your hands.
- Leap back to your starting posture and carry on with this motion.

Butt Kickers

- Face forward while standing with your feet shoulder-width apart.
- Begin kicking your feet until the heels hit your glutes, and then simultaneously pump the opposing arm.

Chair Dips

- Lean back on the chair while standing.
- Extending the wrist, elbow, and shoulder.
- Hand placed over the edges of the chair.
- Your knees should be slightly bent, and your buttocks should be above the floor.
- A few inches in front of your knees, your heel should make contact with the floor.
- Inhale as you progressively lower your body and rotate your elbows until they are 90 degrees apart.

Group B: 20 Minutes Walk Training

Start out gentle brisk walking - moderate intensity, move steadily, swing your arms at will on the plain surface and stand as straight as you can. From heel to toe, your feet should move in a rolling motion for 20 minutes.

Data Analysis

For categorical variables, the frequency or percentage was utilised as a summary. The summary measure for continuous variables was the mean standard deviation. The "paired t test" was used to compare the average scores between the prior to and following the intervention periods. The average results of the two groups were compared using the "independent t test". The threshold for statistical significance was set at $p < 0.05$. SPSS version 28 will be used for the data analysis.

Results

Following the selection of 80 samples based on the inclusion and exclusion criteria, they were divided into two groups at random:

Group A: 20 minutes of Walk training and HIIT

Group B: 20 minutes walk training

Both experimental groups received therapy for 4 days per week for 4 weeks. For the cardiovascular endurance (CVE) evaluation, healthy participants underwent the 6 MWT test.

The paired 't' value for 6 MWT was 25.3866 in Group A (Table 1). The outcomes of the pre- and post-tests for the healthy individual's HIIT and 20 minutes of walk training are significantly different, as indicated by the aforementioned "p" value.

The paired 't' value for 6 MWT was 20.3581 in Group B (Table 2). The pre- and post-test results of the healthy individual's 20 minutes of walk training are significantly different, as indicated by the aforementioned "p" value.

Given that the preceding 'p' value suggests a noticeable distinction between 20 minutes of walk training combined with HIIT and 20 minutes of walk training in healthy individuals, the calculated unpaired 't' value for 6 WMT in Groups A and B was 2.2380 (Table 3).

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Table 1.Comparison of Pre-Test and Post-Test Values of Group A for 6 Minute Walk Test

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' Value	p Value
Pre-test	503.38	31.70	84.82	25.3866	< 0.0001
Post-test	535.08		86.85		

Table 2.Comparison of Pre-Test and Post-Test Values of Group B for 6 Minute Walk Test

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' Value	p Value
Pre-test	486.50	9.93	66.16	20.3581	< 0.0001
Post-test	496.43		66.23		

Table 3.Mean Values for Groups A and B for 6 Minute Walk Test

Groups	Mean	Mean Difference	Standard Deviation	Unpaired 't' Test	p Value
A	535.08	38.65	86.85	2.2380	< 0.028
B	496.43		66.23		

The CVE was considerably improved by 20 minutes of walking exercise with and without HIIT, according to the results. Moreover, the 20-minute walk training with HIIT group showed larger gains than the 20-minute walk training group in CVE (p = 0.028).

Discussion

Exercise has long been recognised as a powerful cardio-productive method for treating structural and functional heart problems. In order to increase cardiovascular endurance in healthy individuals, this study compared the outcomes of two intervention programmes (20 minutes of walk training with and without HIIT).

The study's key findings are that 20 minutes of walk training along with HIIT considerably enhances CVE compared to 20 minutes of walk training alone. Both HIIT and non-HIIT with 20-minute walk training increase CVE and enhance physical, mental, and emotional health.

Among the numerous exercise training techniques, mostly aerobic exercise activities appear to be the most successful for building strong metabolic and cardiovascular endurance. By engaging in the activity at a sub-maximal level, endurance exercise is intended to progressively move the anaerobic metabolism and lactate production towards high-intensity interval training. Complex modifications to muscle metabolism, such as an increase in mitochondrial density and oxidative enzymes, modifications to the type of muscle fibres, and an increase in capillarization, cause this to occur.

The respiratory and cardiovascular systems must function perfectly in tandem during aerobic exercise to supply the muscles with the energy they require to turn into mechanical effort. The circulatory system's enhanced arterial blood supply and continual removal of metabolic wastes (such as CO2 or lactate) so muscle training requires an increase in cardiac output. The heart's ability to pump more blood to satisfy demand is aided by sympathetic activation, which causes the left ventricle to enlarge and contract during exercise.

Similar changes occur at the microvascular level in the right ventricle; elevated nitric oxide production is associated with improved endothelium, lower arterial stiffness, and dependent vasodilatation.

Cardiovascular disease patients benefit greatly from endurance training, which is a vital component of exercise-based rehabilitation programmes. It also improves autonomic balance and cardiovascular outcomes.

The mechanism underlying HIIT's superiority has not been fully explained. There are numerous plausible mechanisms, too.

The following intracellular signalling process explains the initial cause of the increase in aerobic capacity brought about by HIIT.

AMP-activated protein kinase (AMPK) activity in muscle cells is increased by HIIT, which also increases the activity of PGC-1α, a coactivator that activates the receptor γ in peroxisome proliferators. MRNA and protein → rise in the mitochondrial oxygenation enzyme's mRNA and protein expression → enhancement of physical fitness (aerobic capacity).

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Secondly, it is conceivable that greater cellular and molecular reactions brought on by the elevated shear stress encountered during HIIT training sessions could lead to partial recovery from endothelial dysfunction.

The results of a study by Martin-Smith et al. showed that HIIT is an effective method to improve cardiorespiratory fitness (CRF), which correlates with the results of the current study.[10] Another study by Delfan et al. also corroborates the results of the present study.[11]

Ramos et al. conducted a study according to a systematic review and meta-analysis and showed that HIIT is superior to moderate-intensity continuous training for enhancing brachial artery vascular function.[12]

Similarly, Weston et al. conducted a systematic review and meta-analysis of HIIT in patients with lifestyle-induced cardiometabolic disease and concluded that HIIT significantly increases CRF.[13]

Limitations

- Females were not included, and those in the late adult period were excluded.
- Only cardiovascular endurance results were taken into consideration.

Suggestions

- Both genders must be included in future research.
- It is advised that late adulthood can also be included in future investigations.
- It is anticipated that HIIT will be used in more medical situations in the near future, and its feasibility and safety will need to be further assessed.

Conclusion

This study discovered that both interventions (20-minute walk training and high-intensity interval training) improved cardiovascular endurance. It was also seen that 20-minute walk training combined with high-intensity interval training produces a discernible difference.

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Conflict of Interest: None

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