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Effect of Interval Mode versus Continuous Mode of Aerobic Exercise on Cholesterol level Profile in Essential Hypertensive Patients

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Abstract

Background: It has been proposed that regular physical activity can alleviate hypertension and lead to improvements in lipid profiles.

Aim of the study: This study was conducted to assess the impact of interval versus continuous mode of moderate aerobic exercise on Cholesterol level in essential hypertensive patients.

Subjects and methods: A total of 60 males suffering from high blood pressure, their ages ranging between 55 to 65 years old, were randomly selected for this research from the internal medicine department at the third district medical center in Badr city. They were randomly assigned into two equal groups, and each group consisted of 30 patients. Group (A) consisted of 30 males, who exercised interval mode of moderate aerobic training two times/week for three months, each session lasting for 42 min, Group (B) consisted of 30 males, who exercised continuous mode of aerobic training two times/week for three months, each session lasted for 40 min. Total Cholesterol, body mass index (BMI), Borg rating of perceived exertion (BRPE), systole, and diastole blood pressure were assessed pre-and post-treatment for both groups.

Results: The results demonstrated a significant improvement in both groups. Therefore, it could be concluded that both the interval mode of moderate aerobic training and the continuous mode of moderate aerobic training were effective in improving Cholesterol, BMI, BRPE, systole, and diastole blood pressure levels in hypertensive patients. However, the decrease in total cholesterol (TC) was more in Group (A) than in Group (B).

Conclusion: It is possible to deduce that both interval and continuous modes of moderate aerobic exercise have an effect on cholesterol of essential hypertensive patients.

Keywords: Interval aerobic exercise; Continuous aerobic exercise; Cholesterol; Essential hypertension.

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Introduction

Cardiovascular disease (CVD) accounts for the greatest number of deaths globally. Hypertension is a major contributor to CVD; those with two types, primary (essential) and secondary hypertension, essential hypertension without apparent medical cause accounts for 90%–95% of cases. Hypertension is a significant risk factor for chronic kidney disease, stroke, myocardial infarction, heart disease, aortic aneurysm, and peripheral arterial disease **[1].**

Dyslipidemia, a lipoprotein profile that increases CVD risk, is characterized by borderline elevated total cholesterol; high triglyceride, low-density lipoprotein (LDL); and low

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high-density lipoprotein (HDL) levels **[2].** Dyslipidemia has been shown to cause 2.6 million deaths and 29.7 million disabled life years worldwide **[3].** Hypertension is linked to dyslipidemia and obesity; visceral adiposity is responsible for 65%–75% of essential hypertension risk. Each of these is a substantial contributor to coronary artery disease (CAD) risk **[4].**

Physical activity (PA) is any movement generated by skeletal muscle contraction that boosts caloric requirements over resting energy expenditure **[5].** Researchers have found a negative correlation between PA and CVD incidence **[6, 7]**. The beneficial cardiovascular effects of exercise may be implicated in the following mechanisms: improved endothelial function, decreased sympathetic neural activity, and decreased arterial stiffness **[8].**

Aerobic exercise may be conducted continuously or with rest intervals. Interval aerobic exercise involves rest intervals between the aerobic activity periods, while continuous aerobic exercise is done without pause until completion. Therefore, regular aerobic exercise continues to serve as a preventive and therapeutic measure against the occurrence of obesity and CVD **[9, 10].**

Therefore, our study aimed to study impact of interval versus continuous aerobic exercise on Cholesterol level among essential hypertensive patients.

Subjects and Methods

Sixty males suffering from high blood pressure, their ages ranging between 55 and 65 years, were randomly selected for this research from the internal medicine department of the third district medical center in Badr city.

Inclusion criteria

Men with age (55: 65) years, capable of performing therapeutic modality, have essential hypertension I (< 140–159 mmHg systolic blood pressure SBP) (90–99 mmHg diastolic blood pressure DBP), BMI ranged between 25 and 29.9 kg/m^2, and without medical drug control for hypertension and dyslipidemia.

Exclusion criteria

All patients with neurological problems, recent fractures in the lower extremities, kidney diseases, unstable cardiac conditions, diabetes mellitus (DM), brain tumors, recent facial, oral, or skull surgery or trauma within the skull, chest diseases, and secondary hypertension were excluded from the study.

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Ethical consideration

The whole procedure was explained to every patient. The patients gave their consent after being informed (Appendix I). The study had approval **No**: P.T.REC/012/003345 from Ethical Committee of the Cairo University Faculty of Physical Therapy.

Study design

Participants were randomized equally into two equal groups, each group consisting of 30 patients. Group (A) received a moderate-intensity interval aerobic training (MIIT) program, while Group (B) received a moderate-intensity continuous aerobic training (MICT) program.

Evaluation procedures

All patients were subjected to the sociodemographic collection, clinical, laboratory, and anthropometric characteristics determination.

To measure blood pressure (BP), the OMRON digital device (Vietnam) ® was used. Standard weight and height scale (UGM-200) health scale that is made in China to measure weight and height. Body mass index (BMI) was assessed by dividing body mass (Kg) by height squared (m^2).

Modified Borg rating scales for exercise intensity (0–10) quantitatively: The Borg Rating of Perceived Exertion (BRPE) is a method for quantifying PA intensity.

For Cholestrol analysis, blood was collected from the participants following 8 h of fasting. Total cholesterol was determined by enzymatic colorimetry.

Exercise training protocol (Therapeutic procedures)

All participants performed exercise training twice weekly for 12 weeks, with ≥ 48 h of rest interval across sessions. The procedure was conducted on a treadmill (Sprint 80/55); individualized intensity recommendations and grading were provided. The intensity was measured and regulated utilizing maximal heart rate (HRmax) through **Inbar et al. [11]** formula.

All participants would have 5-minute intervals for warming up and cooling down. Velocity has been rose by 0.1 to 0.5 km/h when HR dropped below minimum threshold at training end.

Group (A) (n=30) received MIIT program for 4-min sets intervals at 55%–75% HRmax followed by 4-min recovery periods at 45%–50% HRmax for overall 42 min of exercise per session (with warming-up and cooling-down) **[12].**

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Group (B) (n=30) received MICT for 40 min of jogging/walking on treadmill at 55%–75% HRmax, with warming-up and cooling-down **[13].**

Statistical analysis

The SPSS software, V.25, for Windows, was utilized in statistical analysis (SPSS, Inc., Chicago, IL). The subsequent statistical techniques were performed:

Means ± SD is utilized to represent descriptive analyses. Patients' demographic data factors were compared utilizing an independent t-test for groups A and B.

MANOVA is utilized to compare significant tested variables of interest. Bonferroni *post hoc* analysis was performed to evaluate differences among groups. $P<0.05$ was deemed statistically significant.

Results

Subject's characteristics

Sixty hypertensives were enrolled in our study. They were divided into two equal groups (30 patients/group). ***Group (A)*** Subjects have mean age, weight, height, and BMI values of 59.15 ±1.43 years, 87.46 ±4.17 kg, 176.17 ±3.98 cm, and 28.16 ±0.42 kg/m^2, respectively. ***Group (B)*** participants have mean age, weight, height, and BMI values of 59.79 ±2.08 years, 87.01 ±3.17 kg, 176.53 ±3.67 cm, and 27.92 ±0.76 Kg/m^2, respectively. The t-test did not show significant differences ($p>0.05$) in general characteristics data between the two groups (**Table 1**).

Table 1. General characteristics of participants between both groups.

Items	General characteristics (Mean ±SD)			
	Age (Year)	Weight (kg)	Height (cm)	BMI (kg/m2)
Group A (n=30)	59.15 ± 1.43	87.46 ± 4.17	176.17 ± 3.98	28.16 ± 0.42
Group B (n=30)	59.79 ± 2.08	87.01 ± 3.17	176.53 ± 3.67	27.92 ± 0.76
t-value	1.394	1.610	0.370	0.502
P-value	0.169	0.113	0.713	0.603

2 X 2 mixed design MANOVA

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Total cholesterol

Within groups

In Group A, mean total cholesterol values pre- and post-treatment were 249.66 ±18.18 and 213.64 ±17.03, respectively. Post hoc tests showed a significant decrease (P=0.0001; P<0.05) in total cholesterol at post-treatment than pretreatment, with an improvement percentage of 14.43%.

In Group B, the mean total cholesterol values pre- and post-treatment were 249.08 ±17.76 and 227.95 ±19.41, respectively. Post-hoc tests revealed a significant (P=0.0001; P<0.05) decrease in total cholesterol post-treatment than pretreatment, with an improvement percentage of 8.48% **(Table 2).**

Between groups:

Regarding total cholesterol mean values in examined groups, showed no statistical difference (P=0.902; P>0.05) at pretreatment between group A and group B (249.66 ±18.18 and 249.08 ±17.76, respectively). However, there was a statistical difference (P=0.003; P<0.05) in mean total cholesterol values after treatment between the two groups (213.64 ±17.03 and 227.95 ±19.41, respectively). So, this significant decrease in total cholesterol after treatment is more favorable for patients (Group A) patients than those in group B who received MICT for 40 min of jogging or walking **(Table 2)**.

Table 2. Comparison between pre- and post-treatment total cholesterol within and between each group.

Items	Total cholesterol (Mean ± SD)	
	Group A (n=30)	Group B (n=30)
Pretreatment	249.66 ±18.18	249.08 ±17.76
Post-treatment	213.64 ±17.03	227.95 ±19.41
Mean difference (change)	36.02	21.13
Improvement %	14.43%	8.48%
P-value	0.0001*	0.0001*
Items	Total cholesterol (Mean ± SD)	
	Pretreatment	Post-treatment
Group A (n=30)	249.66 ±18.18	213.64 ±17.03
Group B (n=30)	249.08 ±17.76	227.95 ±19.41
Mean difference (change)	0.58	14.31
P-*value*	0.902	0.003*

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Weight

Within the group

In Group A, Pre- and post-treatment mean weights were 87.46 ±4.27 and 82.95 ±3.98, respectively. Post hoc tests indicated a statistical (P=0.0001; P<0.05) decrease in weight after treatment than before treatment with a 5.16% improvement of 5.16%.

In Group B, mean weight values at pre- and post-treatment were 87.01 ±3.17 and 83.29 ±2.52, respectively. Post hoc tests indicated a statistical significance (P=0.002; P<0.05) decrease in weight after treatment compared to pretreatment with a 4.28% improvement of 4.28%.

Group A showed an improved weight decrease difference (5.16%) than Group B (4.28%).

Between groups

No significant differences (P=0.625; P>0.05) in mean weight values were reported before treatment between two groups (87.46 ±4.27 and 87.01 ±3.17, respectively). However, there was no statistical difference (P=0.708; P>0.05) in the mean VAS values after treatment between the two groups A and B (82.95 ±3.98 and 83.29 ±2.52, respectively).

BMI

Within group

In Group A, before- and after-treatment BMIs were 28.16 ±0.43 and 26.71 ±0.45, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) decrease in BMI after treatment than before treatment with a 5.15% improvement of 5.15%.

In Group B, mean values of BMI at before and after-treatment were 27.92 ±0.76 and 26.73 ±0.67, respectively. Post hoc tests showed a significant (P=0.0001; P<0.05) decrease in BMI after treatment than before treatment with a 4.46% improvement of 4.46%.

In terms of BMI, Group A showed a higher improvement (5.15%) than Group B (4.46%).

Between groups

No significant differences (P=0.120; P>0.05) in mean BMI values were reported before treatment between the two groups (28.16 ±0.43 and 27.92 ±0.76, respectively). Furthermore, there was no statistical difference (P=0.893; P>0.05) in mean BMI values after treatment between the two groups (26.71 ±0.45 and 26.73 ±0.67, respectively).

There is no significant decrease in BMI after treatment (Group A) compared to (Group B) **(Table 3).**

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Table 3. Comparison between pre- and post-treatment BMI within and between each group.

Items	BMI (Mean ± SD)	
	Pretreatment	Post-treatment
Group A (n=30)	28.16 ±0.43	26.71 ±0.45
Group B (n=30)	27.92 ±0.76	26.73 ±0.67
Mean difference (change)	0.24	0.21
P-value	0.120	0.893
Items	BMI (Mean ± SD)	
	Pretreatment	Post-treatment
Group A (n=30)	28.16 ±0.43	26.71 ±0.45
Group B (n=30)	27.92 ±0.76	26.73 ±0.67
Mean difference (change)	0.24	0.21
P-value	0.120	0.893

Systolic blood pressure

Within the group

In Group A, SBP mean values before- and after-treatment were 145.82 ±1.73 and 133.83 ±1.57, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) decrease in SBP after treatment than before treatment with an 8.22% improvement percentage of 8.22%.

In Group B, mean SBP values before- and after-treatment were 144.97 ±1.60 and 133.97 ±2.05, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) decrease in SBP after treatment than before treatment with an improvement percentage of 7.59%.

Group A (8.22%) showed a higher improved SBP than Group B (7.59%).

Between groups

No significant differences (P=0.063; P>0.05) in mean SBP values were reported before treatment among the two groups (145.82 ±1.73 and 144.97 ±1.60, respectively). Furthermore, there was no statistical difference (P=0.758; P>0.05) in mean SBP values after treatment among the two groups (133.83 ±1.57 and 133.97 ±2.05, respectively).

Diastolic blood pressure

In Group A, mean DBP values of pre- and post-treatment were 95.84 ±1.13 and 88.23 ±2.04, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) decrease in DBP after treatment than before treatment with an improvement percentage of 7.94%.

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In Group B, mean DBP values pre- and post-treatment were 95.07 ±1.19 and 88.18 ±1.85, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) decrease in DBP after treatment than before treatment with an improvement percentage of 7.25%.

Group A (7.94%) showed a higher improved DBP than Group B (7.25%).

Between groups

No significant differences (P=0.066; P>0.05) in mean DBP values were reported before treatment between the two groups (95.84 ±1.13 and 95.07 ±1.19, respectively). Furthermore, there were no statistical difference (P=0.908; P>0.05) in mean DBP values after treatment between the two groups (88.23 ±2.04 and 88.18 ±1.85, respectively).

This non-significant decrease was shown more in DBP at post-treatment in (Group B) than in (Group A).

Borg rating of perceived exertion scale

Within the group

In Group A, the mean values of BRPE scale before and after-treatment were 10.18 ±0.89 and 15.72 ±1.12, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) increase (P = 0.0001; P <0.05) on the BRPE scale after treatment than before treatment, with an improvement percentage of 54.42%.

In Group B, mean BRPE scale values at pre- and post-treatment were 10.37 ±1.11 and 15.36 ±1.32, respectively. Post hoc tests indicated a significant (P=0.0001; P<0.05) increase (P = 0.0001; P <0.05) in the BRPE scale after treatment compared to before treatment, with an improvement percentage of 48.12%.

(Group A) showed an improved higher BRPE scale (54.42%) than Group B (48.12%).

Between groups

No significant differences (P=0.524; P>0.05) in mean BRPE scale values were reported before treatment between group A and group B (10.18 ±0.89 and 10.37 ±1.11, respectively). Furthermore, there was no statistical difference (P=0.218; P>0.05) in the mean values of the BRPE scale after treatment among group A and group B (15.72 ±1.12 and 15.36 ±1.32, respectively) **(Table 4)**.

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Table 4. Comparison between pre-and post-treatment Borg within and between each group.

Items	Borg rating of perceived exertion scale (Mean ± SD)	
	Group A (n=30)	Group B (n=30)
Pretreatment	10.18 ±0.89	10.37 ±1.11
Post-treatment	15.72 ±1.12	15.36 ±1.32
Mean difference (change)	5.54	4.99
Improvement %	54.42%	48.12%
P-value	0.0001*	0.0001*
Items	Borg rating of perceived exertion scale (Mean ± SD)	
	Pretreatment	Post-treatment
Group A (n=30)	10.18 ±0.89	15.72 ±1.12
Group B (n=30)	10.37 ±1.11	15.36 ±1.32
Mean difference (change)	0.19	0.36
P-value	0.524	0.218

Discussion

The results revealed that in Group A, total cholesterol after treatment after treatment was significantly decreased compared to before treatment, with an improvement percentage of 14.43%. Group B exposed that there was a significantly reduced in total cholesterol at post-treatment in comparison to pretreatment, with an improvement percentage of 8.48%. In Group A, weight was reduced significantly after treatment compared to before treatment (improvement percentage = 5.16%). Group B demonstrated a considerable reduction in weight after treatment compared to pretreatment, with an improvement percentage of 4.28%. Group A indicated a significant reduction in BMI after treatment than pretreatment (improvement percentage = 5.15%). The results showed that in Group B, the post-treatment BMI was lower than before treatment, with an improvement percentage of 4.46%. Group A demonstrated a significant decrease in SBP at post-treatment than pretreatment, with an improvement percentage of 8.22%. Group B indicated a significant decrease in SBP at post-treatment compared to pretreatment, with an improvement percentage of 7.59%. There was an improvement of 7.94% in DBP from pretreatment to post-treatment in Group A. The DBP of Group B patients improved by 7.25 percent after treatment compared to pretreatment levels. In Group A, the post-treatment BRPE scale was significantly larger than the pretreatment, with an improvement percentage of 54.42%. In Group B, post-treatment BRPE scales were significantly higher than pretreatment, with an improvement percentage of 48.12%.

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The effects of high-intensity interval training HIIT versus MIIT on lipid profile in overweight women were studied in Racil et al. **[14]** study. The subjects were divided into two training groups: HIIT group 110%–100% VO2peak intensity and MIIT group 70%–80% VO2 peak intensity. Following 12 training weeks, both groups demonstrated improvements in LDL and HDL values. Only the HIIT group had substantial reductions in triglyceride and cholesterol levels.

Our study findings are reinforced by Dimeo et al. **[15];** Shaphe et al. [16]; Gunjal et al. **[17];** Ammar et al. **[18];** Hong et al. **[19],** and Liang et al. **[20]** who found a significant reduction in SBP and DBP following MIIT achieved 3 to 5 times weekly for 30 to 60 min per session on a treadmill. Age, food, stress, excessive alcohol intake, inactivity, sleep apnea, and obesity can all affect blood pressure.

In addition, aerobic exercise is known to cause significant reductions in blood pressure among essential hypertension patients and through reducing arterial stiffness **[21].** Between 5 to 15 mmHg, exercise-induced blood pressure rate drop varies greatly among studies **[15, 19].** It is also acknowledged that aerobic exercise at light, moderate, and strong intensities efficiently controls blood pressure. Nevertheless, moderate-intensity aerobic activity was more efficient in blood pressure management than either high-intensity or light-intensity aerobic activity **[22, 23].** Additionally, research indicates that 30 min of vigorous exercise more than three times weekly can aid in the treatment of systemic hypertension **[24]**.

One of the processes responsible for the decrease in SBP during exercise is a rise in functional sympatholysis. Vascular endothelial-derived substances, including nitric oxide (NO), inhibit sympathetic vasoconstriction in contracting muscles during activity. Nevertheless, vascular endothelial function diminishes with age, resulting in diminished functional sympatholysis in sedentary older persons **[20].**

The results shown by Bashiri **[25]** demonstrated that regular exercise, such as running on a treadmill, reduces blood pressure by lowering systemic vascular resistance and autonomic nervous system activity. The kidneys, which are the most important organ in maintaining healthy blood pressure over time, will also feel the effects of a reduction in sympathetic nervous system activity. Blood pressure is controlled by the renin-angiotensin system, which acts directly on smooth muscles of arteriolar blood vessels, causing vasoconstriction, and indirectly by improving water consumption with water and sodium retention in distal renal tubules, leading to a general increase in blood volume**.**

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Perdomo et al. **[26]** indicate that after 30 min of moderate-intensity aerobic activity on treadmill, both SBP and DBP decreased. This suggests that a 10-min sporadic exercise is not as efficient as a 30-min continuous exercise in enhancing cardiorespiratory fitness. A total of 10 min activity could not be enough to counterbalance Vasoconstriction resulting from sympathetic stimulation because of the difference in the timing of exercise onset and shear stress-induced NO shorter duration of release.

In contrast, only the DBP dropped in Ramos et al. **[27]** study. Researchers found that DBP was lowered in the elderly with overweight/obese hypertension following 12 weeks of MICT without changes in body composition or biochemical markers. Increased salt retention, sympathetic heart activity, and the renin-angiotensin-aldosterone system are all related to elevated blood pressure in obese individuals. Exercise alone can restrict improvement, but when combined with nutritional management, it can cause significant biochemical and body composition improvements **[28].**

Aerobic activity is shown to lower both systolic and DBP, as evidenced by the findings of studies such as those conducted by Navan et al. **[29],** Baghaiee et al. **[30],** and Honda et al. **[31].** Untrained individuals exhibit poorer physiological responses, including fat oxidation and energy expenditure, than trained persons. Many variables contribute to its development, but most significant are decreased endothelium and renin-angiotensin function and sympathetic nervous system hyperactivity. Aerobic exercise decreases blood pressure by decreasing sympathetic force and increasing parasympathetic force, therefore decreasing catecholamines generation **[29].**

Aerobic activity has the same mechanism of action as beta-blockers for lowering blood pressure by inhibiting sympathetic nerve activity and decreasing HR**[15].** During the activity, vascular smooth muscle (myogenic tone) and muscular afferent fibers induce hypertension. Decreased sympathetic activity resets baroreflex to a lower level after activity is stopped **[20].** Aerobic exercise restores vascular elasticity and peripheral resistance that have diminished. Therefore, the flexibility of blood vessel alteration during aerobic exercise exacerbates vascular pressure increase and blood vessel dilation caused by increase in blood flow across aerobic activity **[32].**

Aerobic exercise depends on the work interval's duration, intensity, and frequency, as well as recovery phase length, as per ACSM (American College of Sports Medicine) guidelines. Moderate-intensity PA should last 30 min five days weekly, and 20 min of strenuous exercise three days weekly is recommended **[28].**

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In contrast, Pagonas et al. **[33]** revealed that aerobic activity had no effect on blood pressure variability. Aerobic exercise effectively reduces blood pressure but does not reduce blood pressure variability. Maruf et al. **[34],** Belozo et al. **[24],** and Barros et al. **[32]** found that systolic and DBP did not change following moderate-intensity aerobic activity. The blood pressure of individuals who exercised alone did not differ significantly from those who exercised in conjunction with antihypertensive medicines. The use of antihypertensive medications that expedite blood pressure reduction is associated with substantial reductions in blood pressure within shorter time periods.

Previous research has demonstrated impact of regular activity on metabolic adaptations and an improved lipid profile **[35].** However, there is no consensus regarding optimum training intensity for enhancing lipid profile. It should be mentioned that training intensity and duration are significant factors. Okura et al. **[36]** evaluated walking effects (a low-intensity exercise) and aerobic activities (70%–85% maximum oxygen uptake) on improving lipid profile and concluded that training intensity was the main factor.

Contrarily, Whyte et al. **[37]** investigated the two-week impact of sprint interval training (SIT) on cholesterol level and health-linked parameters in obese and inactive individual. They noted that although SIT enhanced various variables related to cholesterol, these improvements were not statistically significant. They underlined the need for a substantial training duration to induce lipid profile alterations.

Conclusion

This study suggests that both interval and continuous modes of moderate aerobic exercise have an effect on the lipid profile particularly total Cholesterol among essential hypertensive patients. However, MIIT was more effective in all measured variables than MICT; consequently, the severity of lipid profile in essential hypertensive patients was reduced significantly.

Conflict of Interest: no conflicts of interest.

Consent for publication: All authors consented to manuscript publication.

Data Availability: The corresponding author can provide current study data upon reasonable request.

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References

1. SHEREEN H. EL-SAYED, P.D., AZZA A. ABD EL-HADY, Ph.D. and M.S. LAMIA M. FAHMY, WAEL ABO SHOKKA, M.D., Interval Aerobic Exercise versus Cupping Therapy on Essential Hypertension in Women The Medical Journal of Cairo University, 2018. 86(June): p. 1939-1946.
2. Di Giorgi, N., E. Michelucci, J.M. Smit, A.J. Scholte, M. El Mahdiui, J. Knuuti, et al., A specific plasma lipid signature associated with high triglycerides and low HDL cholesterol identifies residual CAD risk in patients with chronic coronary syndrome. Atherosclerosis, 2021. 339: p. 1-11.
3. Atilano, A.A., E.J.B. Llanes, D.I.D. Ona, and G.E. Brizuela, Management of Dyslipidemia and Hypertension–Journey Mapping in the Philippines. Acta Medica, 2022. 53(4): p. 307-316.
4. Tucker, W.J., I. Fegers-Wustrow, M. Halle, M.J. Haykowsky, E.H. Chung, and J.C. Kovacic, Exercise for primary and secondary prevention of cardiovascular disease: JACC focus seminar 1/4. JACC, 2022. 80(11): p. 1091-1106.
5. Almnifi, A.H.L., A.G. Elsayed, and L.M. Elgendy, Ketogenic diet and physical activity for prevention of hypertension. MISJ, 2023. 1(01): p. 1-6.
6. Tanaka, H., F.A. Dinenno, K.D. Monahan, C.M. Clevenger, C.A. DeSouza, and D.R. Seals, Aging, habitual exercise, and dynamic arterial compliance. Circulation, 2000. 102(11): p. 1270-1275.
7. Kakiyama, T., J. Sugawara, H. Murakami, S. Maeda, S. Kuno, and M. Matsuda, Effects of short-term endurance training on aortic distensibility in young males. Medicine science in sports exercise, 2005. 37(2): p. 267-271.
8. Maharaj, A., S.M. Fischer, K.N. Dillon, Y. Kang, M.A. Martinez, and A. Figueroa, Effects of L-Citrulline Supplementation on Endothelial Function and Blood Pressure in Hypertensive Postmenopausal Women. Nutrients, 2022. 14(20): p. 4396.
9. Raygan, F., M. Sayyah, S. Qamsari, H. Nikoueinejad, and M. Sehat, Effects of submaximal aerobic exercise on regulatory T cell markers of male patients suffering from ischemic heart disease. Iranian Journal of Allergy Asthma Immunology, 2017. 16(1): p. 14-20.
10. Man, A.W.C., H. Li, and N. Xia, Impact of Lifestyles (Diet and Exercise) on Vascular Health: Oxidative Stress and Endothelial Function. Oxid Med Cell Longev, 2020. 2020: p. 1496462.
11. Inbar, O., A. Oren, M. Scheinowitz, A. Rotstein, R. Dlin, and R. Casaburi, Normal cardiopulmonary responses during incremental exercise in 20- to 70-yr-old men. Med Sci Sports Exerc, 1994. 26(5): p. 538-46.
12. Coswig, V.S., M. Barbalho, R. Raiol, F.B. Del Vecchio, R. Ramirez-Campillo, and P. Gentil, Effects of high vs moderate-intensity intermittent training on functionality, resting heart rate and blood pressure of elderly women. Journal of translational medicine, 2020. 18: p. 1-11.
13. Armstrong, A., K. Jungbluth Rodriguez, A. Sabag, Y. Mavros, H.M. Parker, S.E. Keating, et al., Effect of aerobic exercise on waist circumference in adults with overweight or obesity: A systematic review and meta-analysis. Obesity Reviews, 2022. 23(8): p. e13446.
14. Racil, G., O. Ben Ounis, O. Hammouda, A. Kallel, H. Zouhal, K. Chamari, et al., Effects of high vs. moderate exercise intensity during interval training on lipids and adiponectin levels in obese young females. Eur J Appl Physiol, 2013. 113(10): p. 2531-40.

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Print ISSN 2636-3224
Online ISSN 2636-3232

15. Dimeo, F., N. Pagonas, F. Seibert, R. Arndt, W. Zidek, and T.H. Westhoff, Aerobic exercise reduces blood pressure in resistant hypertension. Hypertension, 2012. 60(3): p. 653-8.
16. Shaphe, A., I. Ahmad, and F.Z. Kashoo, Effect of Aerobic Exercises on Blood Pressure in Mild and Moderate Hypertensive Middle-aged and Older Patients. Majmaah Journal of Health Sciences, 2020. 1(1): p. 46-46.
17. Gunjal, S.B., N. Shinde, A. Kazi, and S.M. Khatri, Effect of Aerobic Interval Training on Blood Pressure and Myocardial function in Hypertensive Patients. Int J Pharm Sci Invent, 2013. 2(6): p. 27-31.
18. Ammar, T., Effects of aerobic exercise on blood pressure and lipids in overweight hypertensive postmenopausal women. J Exerc Rehabil, 2015. 11(3): p. 145-50.
19. Hong S, Lee Dong Geon, and L.G. Chang, Effect of aerobic exercise on blood pressure and arterial compliance in patients with essential hypertension. . Journal of Exerc Physiol, 2018. 21(5).
20. Liang, J., X. Zhang, W. Xia, X. Tong, Y. Qiu, Y. Qiu, et al., Promotion of Aerobic Exercise Induced Angiogenesis Is Associated With Decline in Blood Pressure in Hypertension: Result of EXCAVATION-CHN1. Hypertension, 2021. 77(4): p. 1141-1153.
21. Swati S, Sonia, and S. K, Effects of Aerobic Versus Resistance Training on Blood Pressure in Hypertensive Patients. J Anesth Crit Care, 2015. 3(3).
22. Abdullah, M.R., V. Eswaramoorthi, R.M. Musa, A.B.H.M. Maliki, N.A. Kosni, and M. Haque, The effectiveness of aerobic exercises at difference intensities of managing blood pressure in essential hypertensive information technology officers. Journal of Young Pharmacists, 2016. 8(4): p. 483.
23. Masroor, S., P. Bhati, S. Verma, M. Khan, and M.E. Hussain, Heart rate variability following combined aerobic and resistance training in sedentary hypertensive women: a randomised control trial. Indian heart journal, 2018. 70: p. S28-S35.
24. Belozo, F.L., C.K. Katashima, A.V. Cordeiro, L. Lenhare, J.F. Alves, and V.R.R. Silva, Effects of ninety minutes per week of continuous aerobic exercise on blood pressure in hypertensive obese humans. Journal of exercise rehabilitation, 2018. 14(1): p. 126.
25. Bashiri, J., The effect of regular aerobic exercise and garlic supplementation on lipid profile and blood pressure in inactive subjects. Zahedan Journal of Research in Medical Sciences, 2015. 17(4).
26. Perdomo, S.J., J.R. Balzer, J.M. Jakicic, C.E. Kline, and B.B. Gibbs, Acute effects of aerobic exercise duration on blood pressure, pulse wave velocity and cerebral blood flow velocity in middle-aged adults. Sport Sciences for Health, 2019. 15: p. 647-658.
27. Ramos, R.M., H.J. Coelho-Júnior, R.C.R.d. Prado, R.S. da Silva, R.Y. Asano, J. Prestes, et al., Moderate Aerobic Training Decreases Blood Pressure but No Other Cardiovascular Risk Factors in Hypertensive Overweight/Obese Elderly Patients. 2018. 4: p. 2333721418808645.
28. Huldani, H., A. Asnawati, S.A. Sabila, N.N.A. Salsabilla, M.H. Ridhoni, and H.N. Maulidya, The effect of moderate intensity aerobic exercise on blood pressure in hypertension patients. Revista Latinoamericana de Hipertension, 2022. 17(1): p. 25-31.
29. Navan, L.G., The effect of aerobic exercises on cardiovascular risk taking factors in hypertension men. IJHSS, 2013. 3(15): p. 306-10.
30. Baghaiee, B., P. Karimi, K. Ebrahimi, M.H.S. Zali, A.M.D. Moghaddam, and M. Sadaghian, Effects of a 12-week aerobic exercise on markers of hypertension in men. Journal of cardiovascular thoracic research, 2018. 10(3): p. 162.

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31. Honda, H., M. Igaki, M. Komatsu, and S.-i. Tanaka, Effect of moderate-intensity seated exercise on the management of metabolic outcomes in hypertensive individuals with or without exercise habits. Journal of Exercise Science Fitness, 2021. 19(1): p. 51-56.
32. Barros, J.P., T. de Paula, M.F.F. Mediano, M.V.d.S. Rangel, W. Monteiro, F.A.d. Cunha, et al., The Effects of Acute Aerobic Exercise on Blood Pressure, Arterial Function, and Heart Rate Variability in Men Living With HIV. Frontiers in physiology, 2021. 12: p. 685306.
33. Pagonas, N., F. Dimeo, F. Bauer, F. Seibert, F. Kiziler, W. Zidek, et al., The impact of aerobic exercise on blood pressure variability. Journal of human hypertension, 2014. 28(6): p. 367-371.
34. Maruf, F., A. Akinpelu, and B. Salako, Effects of aerobic exercise and drug therapy on blood pressure and antihypertensive drugs: a randomized controlled trial. African Health Sciences, 2013. 13(1): p. 1-9.
35. Paoli, A., Q.F. Pacelli, T. Moro, G. Marcolin, M. Neri, G. Battaglia, et al., Effects of high-intensity circuit training, low-intensity circuit training and endurance training on blood pressure and lipoproteins in middle-aged overweight men. Lipids in health disease, 2013. 12(1): p. 1-8.
36. Okura, T., Y. Nakata, and K. Tanaka, Effects of exercise intensity on physical fitness and risk factors for coronary heart disease. Obesity research, 2003. 11(9): p. 1131-1139.
37. Whyte, L.J., J.M. Gill, and A.J. Cathcart, Effect of 2 weeks of sprint interval training on health-related outcomes in sedentary overweight/obese men. Metabolism, 2010. 59(10): p. 1421-1428.

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