Regular Gymnastics for Three Weeks Lowers Blood Pressure and Cholesterol Levels in Older Women

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ABSTRACT
Background: The goal of this study is to see how elderly gymnastics affect blood pressure, plasma glucose levels, and total cholesterol levels in women over the age of 65. Objective: The purpose of this study is to look into the effects of gymnastics on changes in blood pressure, blood sugar levels, and total cholesterol levels in the elderly. Methods: Thirty-four female elderly women were divided into two groups: those who received gymnastics and those who did not. For three weeks, regular gymnastics exercises were performed on a weekly basis. Blood pressure, plasma glucose levels, and total cholesterol levels were measured using standard techniques and methods. Results: When compared to controls, regular gymnastics exercise can significantly lower blood pressure (p < 0.05). This decrease is also observed in total cholesterol levels (p < 0.05). Conclusions: Elderly gymnastics was found to lower blood pressure and total cholesterol levels in the elderly. As a result, elderly gymnastics could be a viable option for preventing cardiovascular disease and metabolic syndrome. Keywords: regular exercise, metabolism, blood pressure, aging, elderly women, gymnastics.

1. BACKGROUND
Aging is a global phenomenon that affects people all over the world. In the United Kingdom, the elderly constitute approximately 8% of the population. Japan has the highest proportion of the elderly population in Asia. The elderly are expected to account for one-third of the population in Hong Kong, Taiwan, Singapore, and South Korea by 2060. Indonesia's developments will undoubtedly be closely followed. Chronic diseases, polypharmacy, abnormal drug reactions, and health care utilization are among the issues confronting the elderly population (1-7). Hypertension is a risk factor for chronic diseases that disproportionately affect the elderly. High blood pressure is a risk factor for disease worldwide, causing 10.4 million deaths. This factor is detrimental to cardiovascular health. Every ten mm Hg rise in blood pressure reduces cognitive function and interferes with daily activities (8-13). Thus, the extent of the effects of hypertension will necessitate ongoing efforts to control blood pressure. Aside from hypertension, hyperglycemia and hypercholesterolemia are two metabolic conditions associated with an increased risk of chronic disease in the elderly (14). It also emphasizes the importance of making efforts to control these three “H” factors. Several studies have been conducted to investigate the effects of physical activity on system changes in the body. Physical activity can lower blood pressure by modulating inflammation (6), lowering the risk of cardiovascular disease (10). Acute exercise can cause changes in aortic compliance, plasma volume expansion, and blood viscosity reduction (15, 16). Physical activity causes endothelial modulation in vasodilation and decreased arterial distensibility in endothelial cells (17, 18). Physical exercise will improve hyperglycemia and insulin sensitivity (19-21). Exercise can lower triglyceride levels but not cholesterol levels in people with metabolic syndrome. Exercise has been shown in other studies to influence cholesterol metabolism (22-24).

The Republic of Indonesia's government runs an elderly gymnastics program to prepare the country for an increase in the elderly population. There are no data on the health benefits of elderly gymnastics in the Indonesian population that we are aware of.
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2. OBJECTIVE
The purpose of this study is to look into the effects of gymnastics on changes in blood pressure, blood sugar levels, and total cholesterol levels in the elderly.

3. METHODS
Subjects
The subjects of this study are females aged 65 to 70 who are willing to complete the elderly gymnastics exercises. They’ve never seen elderly gymnastics before. Thirty-four elderly females were divided into two groups: the control group (who did not receive elderly gymnastics) and the group who did receive elderly gymnastics (Gym).

Elderly gymnastics
For three weeks, elderly gymnastics was performed once a week. All details in the video show that elderly gymnastics were performed under the supervision of an instructor. Every Sunday, gymnastics was performed in a health service center. A warm-up, core gymnastics, transition movements, and cooling movements are included in the sequence of elderly gymnastic procedures (25).

Blood pressure measurement
A digital manometer (OMRON, HEM-7113, Brazil) was used to measure systolic and diastolic blood pressure on the upper arm. Measurements are taken in a well-lit room with a comfortable temperature. Subjects sat in a relaxed state with their eyes open, looking at the wall, and not speaking before being measured. This relaxation should take place at least five minutes before the measurement (26). This measurement was taken twice, once before and once after the study.

Analysis of blood glucose levels
Plasma glucose levels are measured in venous blood. Experienced nurses draw venous blood. After centrifuging the blood at 3000 RPM, it is dialed and stored at 80°C. Glucose oxidase was used to determine plasma glucose levels. This measurement was taken twice, once before and once after the study.

Analysis of total cholesterol plasma
A Hitachi Model 747 Automatic Analyzer was used to measure total cholesterol plasma levels (Bellport, NY, USA). This measurement was taken twice, once before and once after the study.

Ethics
The Health Research Ethical Committee of Universitas North Sumatera, Medan, Indonesia, has given ethical approval for this study (Number: 1932/XI/SP/2019). Before the investigation, all subjects read and signed the informed consent form.
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4. RESULTS

Figure 1 depicts baseline systolic blood pressure and changes due to exercise. Under baseline conditions, the two groups’ systolic blood pressures are comparable. Exercise resulted in a significant decrease in blood pressure in the treatment group compared to controls (p < 0.05).

Figure 2 depicts baseline and post-gymnastics diastolic blood pressure from both groups. At baseline, there was no significant difference in diastolic blood pressure. We discovered a significant decrease after exercise (p < 0.05).

Figure 3 depicts the heart rates of the two study groups. Before and after treatment, there were no differences in the heart rates of the two study groups.

Figure 4 depicts blood sugar levels before and after treatment. Blood sugar levels did not differ significantly between the two study groups (p > 0.05).

Figure 5 depicts total cholesterol levels in both groups at baseline and after gymnastics. Total cholesterol levels in the gymnastics group were significantly higher than in the control group (p < 0.05). This increase can be reduced when compared to the baseline by providing training (p < 0.05).

5. DISCUSSION

This is the first study to evaluate the benefits of elderly gymnastics on the population of older females in Indonesia. The main findings of this study are that gymnastics can significantly lower blood pressure and total cholesterol in a female elder compared to controls.

This finding suggests that elderly exercise, as a form of acute exercise, can lower blood pressure. Blood pressure reduction caused by aerobic exercise is caused by changes in arterial compliance. Furthermore, changes in vasodilation vas avarum in the aorta are influenced by nitric oxide and temperature (27). Endothelial cells that are intact and functional can release vasodilator compounds and vasoconstrictors to control blood flow and vascular tone during rest and exercise (28). Exercise can reduce endothelin-1, which causes an increase in NO (29-33). Exercise for four weeks has been shown in previous studies to lower blood pressure (34).

Total cholesterol levels before exercise were higher in the treatment group than in the control group (p < 0.05). This increase can be reduced when compared to the baseline by providing training (p < 0.05).

There are several limitations to this study. First, the number of samples used is small and limited to a single region. This may limit generalizations, but it does raise the possibility that elderly gymnastics may provide cardiovascular protection. Second, no molecular biomarker analysis was carried out.

6. CONCLUSION

We conclude that short-term regular exercise can affect the physiology and lipid metabolism of older women, resulting in lower blood pressure and total cholesterol levels. As a result, this exercise could be used to maintain cardiovascular health and metabolism in the elderly Indonesian population.

What is already known on this topic:

The elderly population is a group that is vulnerable to cardiovascular problems and metabolic syndrome.

The Indonesian government sets elderly exercise as a form of exercise, there will still be no evidence of clinical benefit.

What this study adds:

The present study demonstrated that elderly gymnastics can improve blood pressure and total cholesterol levels in the elderly.

Thus, elderly gymnastics can be an alternative for protection against cardiovascular disease and metabolic syndrome.

• Competing interest statement: All authors declare that there is no conflict of interest in the research or publication of this article.

• Author’s contributions: NV, TIF, EAS, LL conceived and designed the experiments; TIF, NK, MM, CM performed the experiments; HH, YS analyzed and interpreted the data; NV, EAS contributed reagents, materials, analysis tools or data; NV, YS, CM, NK wrote the paper.

• Conflict of interest: None declared.

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REFERENCES

1. Barnett K, Marcer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study Lancet. 2012; 380(9836): 37-43.

2. Manski RJ, Moeller JF, Chen H, Schimmel J, St Clair PA, Pepper JV. Patterns of older American’s health care utilization over time. Am J Public Health. 2013; 103(7): 1314-1324.

3. Page AT, Potter K, Clifford R, Etherton-Beer C. Deprescribing in older people. Maturitas. 2016; 91: 115-134.

4. Brahma DK, Wahlang IB, Marak MD, Ch. Sangma M. Adverse drug reactions in the elderly. J Pharmacol Pharmacother. 2013; 4(2): 91–94.

5. Olsen MH, Angell SY, Asma S, Boutouyrie P, Burger D, Chirinos JA, et al. A call to action and a lifestyle strategy to address the global burden of raised blood pressure on current and future generations: the Lancet Commission on hypertension. Lancet. 2016; 388(10060):2665-2712.

6. Huang LH. Well-being and volunteering: Evidence from aging societies in Asia. Social Science and Medicine. 2019; 229: 172-180.
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7. Chomik R, McDonald P, Piggot J. Population ageing in Asia and the Pacific: Dependency metrics for policy. The J Economics Aging. 2016; 8: 5-18.

8. Whelton PK, He J, Appel LJ, Cutler JA, Havas S, Kotchen TA, et al. Primary prevention of hypertension: clinical and public health advisory from the national high blood pressure education program. J Am Med Assoc J Am Med Assoc 2002; 288(15): 1882–1888.

9. GBD 2016 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017; 390: 1345-1422.

10. Lawes CMM, Vander Hoorn S, Rodgers A. International Society of Hypertension. Global burden of blood-pressure-related disease, 2001. Lancet. 2008; 371(9623):1513-1518.

11. Williams KN, Kemper S. Interventions to reduce cognitive decline in aging. J Psychosoc Nurs Ment Health Serv. 2010; 48(5): 42–51.

12. Tsivgoulis G, Alexandrov AV, Wadley VG, Unverzaqt VW, Go RC, Moy CS, Kissela B, Howard G. Association of higher diastolic blood pressure levels with cognitive impairment. Neurology. 2009; 73(8): 589–595.

13. Zhang Z, Hoek G, Chang LY, Chan TC, Guo C, Chuang YC, et al. Particulate matter air pollution, physical activity and systemic inflammation in Taiwanese adults. Int J Hyg Environ Health. 2018; 221(1): 41-47.

14. Samos LF, Roos BA. Diabetes mellitus in older persons. Med Clin N Am. 1998; 82: 791–803.

15. Kubesch N, De Nazelle A, Guerra S, Westerdahl D, Martinez D, Bouso L, et al. Arterial blood pressure responses to short-term exposure to low and high traffic-related air pollution with and without moderate physical activity. Eur J Prev Cardiol. 2015; 22(5): 548-557.

16. Kingwell BA. Large artery stiffness: implications for exercise capacity and cardiovascular risk. Clin Exp Pharmacol Physiol. 2002; 29: 214–217.

17. Kingwell BA, Berry KL, Cameron JD, Jennings GL, Dart AM. Arterial compliance increases after moderate-intensity cycling. Am J Physiol 1997; 273: H2186–91.

18. Naka KK, Tweddell AC, Parthimos D, Henderson A, Goodfellow J, Fenenneaux MP. Arterial distensibility: acute changes following dynamic exercise in normal subjects. Am J Physiol Heart Circ Physiol. 2003; 284: H970–79.

19. Jorge ML, de Oliveira VN, Resende NM, et al. The effects of aerobic, resistance, and combined exercise on metabolic control, inflammatory markers, adipokines, and muscle insulin signaling in patients with type 2 diabetes mellitus. Metabolism. 2011; 60(9): 1244-1252.

20. Froisic C, Richter EA. Improved insulin sensitivity after exercise: focus on insulin signaling. Obesity (Silver Spring) 2009; 17(Suppl 3): S15-20.

21. Lund S, Holman GD, Schmitz O, Pedersen O. Contraction stimulates translocation of glucose transporter GLUT4 in skeletal muscle through a mechanism distinct from that of insulin. Proc Natl Acad Sci U S A. 1995; 92(13): 5817-5821.

22. Antonio Casella-Filho A, Chagas ACP, Maranhão RC, Trombeta IC, Cesena FHY, Silva VM, Tanus-Santos JE, Negrão CE, da Luz PL. Effect of exercise training on plasma levels and functional properties of high-density lipoprotein cholesterol in the metabolic syndrome. Am J Cardiol. 2011; 107: 1168-1172.

23. Cho AR, Moon JY, Kim S, An KY, Oh M, Jeon JY, Jung DH, Choi MH, Lee JW. Effects of alternate day fasting and exercise on cholesterol metabolism in overweight or obese adults: A pilot randomized controlled trial. Metab Clin Exp. 2019; 93:52-60.

24. Rahmati-Ahmadabad S, Broom DR, Ghanbari-Niaaki A, Shirvany H. Effects of exercise on reverse cholesterol transport: A systemized narrative review of animal studies. Life Sci. 2019; 224: 139-148.

25. Azmi R. Pengaruh senam bugar lansia Indonesia terhadap penurunan kadar kolesterol pada wanita lansia. Available at: https://lib.unnes.ac.id/23329/1/6301411078.pdf. Accessed March 23, 2020.

26. Pickering TG, Hall JE, Appel LJ, Farkker NE, Graves J, Hill MN, et al. Recommendations for blood pressure measurement in humans and experimental animals: part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council. Circulation. 2005; 111: 697-716.

27. Thompson PD, Crouse SF, Goodpaster B, Kelley D, Moyna N, Pescatello L. The acute versus the chronic response to exercise. Med Sci Sports Exerc. 2001; 33: S438-45.

28. Mairora A, O’Driscoll G, Taylor R, et al. Exercise and the nitric oxide vasodilator system. Sports Med. 2003; 33(14): 1013-1035.

29. Maeda S, Tanabe T, Miyauchi T, Otsuki T, Sugawara J, Iemitsu M, et al. Aerobic exercise training reduces plasma endothelin-1 concentration in older women. J Appl Physiol. 2003; 95: 336-341.

30. Nishida K, Harrison DG, Navas JP, Fisher AA, Dockery SP, Uematsu M, et al. Molecular cloning and characterization of the constitutive bovine aortic endothelial cell nitric oxide synthase. J Clin Invest. 1992; 90: 2092-2096.

31. Maeda S, Tanabe T, Otsuki T, Sugawara J, Iemitsu M, Miyauuchi T, et al. Moderate regular exercise increases basal production of nitric oxide in elderly women. Hypertension Research. 2004; 27: 947-953.

32. Maeda S, Miyauchi T, Kakiyama T, Sugawara J, Iemitsu M, Irukayama-Tomobe Y, et al. Effects of exercise training of 8 weeks and detraining on plasma levels of endothelium-derived factors, endothelin-1 and nitric oxide, in healthy young humans. Life Sci. 2001; 69: 1005-1016.

33. Taddei S, Galetta F, Virdis A, Ghiadoni L, Salvetti G, Franchi F, et al. Physical activity prevents age-related impairment in nitric oxide availability in elderly athletes. Circulation. 2000; 101: 2896-2901.

34. Hetts SV, Wisco TR, Chavis LN, Derella CC, McLaughlin KC, Perez AN, et al. Effects of circuit exercise training on vascular health and blood pressure. Prev Med Reports. 2018; 10: 106-112.

35. Ploug T, Stallknecht BM, Pedersen O, et al. Effect of endurance training on glucose transport capacity and glucose transporter expression in rat skeletal muscle. Am J Physiol. 1990; 259: E778-786.