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The Effect of Physical Activity on Blood Pressure In The Elderly With Hypertension

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A R T I C L E I N F O

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A B S T R A C T

Background: Hypertension is a condition where the systolic blood pressure is above 140 mmHg and the diastolic blood pressure is above 90 mmHg. Physical exercise can encourage the heart to work optimally by causing a decrease in heart rate and cardiac output resulting in a decrease in blood pressure. This study aims to analyze the effectiveness of physical exercise on blood pressure in the elderly.
Subject and Method: This was a systematic review and meta-analysis. The data was obtained through journal databases including Science Direct and Google Scholar by selecting articles published in 2012-2022. The keywords used were ("Physical activity" OR "Exercise" OR "Exercise Training") AND ("Older" OR "Elderly") AND "Blood Pressure" AND "Hypertension" AND "Randomized Controlled Trial". The inclusion criteria were full paper articles Randomized Controlled Trial (RCT) research method. The size relationship used's of Mean SD, the intervention given was Physical Activity; elderly research subjects were 60-75 years old and experienced hypertension. Search articles were done by using the PICO model. Population = Elderly with hypertension, Intervention = Physical Activity, Comparison = not given physical activity, and Outcome = decreased blood pressure. Articles were collected by using PRISMA flow diagrams and analyzed using the Revman 5.3 application.
Result: Meta-analysis of 3 articles showed that physical activity could reduce blood pressure by 0.96 times higher compared to other interventions or no intervention (SMD= -0.96; 95% CI= -1.79 to -0.14; p= 0.020) for systolic blood pressure and 0.20 times higher compared to other intervention or no intervention (SMD= -0.20; 95% CI= -0.59 to 0.20; p= 0.330) for diastolic blood pressure.
Conclusion: Physical activity can reduce blood pressure in the elderly with hypertension.

INTRODUCTION

The increase in the elderly population cannot be separated from the health problems that occur in the elderly, where decreased organ function triggers the occurrence of various degenerative diseases. Degenerative diseases that occur in the elderly if not handled properly will add to the burden and reduce the quality of life of the elderly. Some of the most common degenerative diseases in the elderly include joint disorders, cataracts, stroke, heart disease, diabetes mellitus, and hypertension (Anwari et al., 2018). The World Health Organization (WHO) states that around 1.13 billion people in the world suffer from hypertension. 1 in 3 people in the world is diagnosed

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with hypertension and only 36.8% of them are taking medication. Hypertension can cause the death of 8 million people each year, and 1.5 million of them come from Southeast Asian countries. The global prevalence of hypertension is 42%. Meanwhile, the prevalence of elderly hypertension in Indonesia shows results of 45.9% for those aged 55-64 years, 57.6% aged 65-74 years, and 63.8% for those aged over 75 years (Yulisa & M, 2018).

Hypertension is a condition in which a person experiences an increase in blood pressure above normal which results in increased morbidity and mortality. Hypertension in the elderly is defined as a systolic pressure above 160 mmHg and a diastolic pressure above 90 mmHg. Hypertension in the elderly is associated with an increased risk of congestive heart failure, ischemic heart disease, stroke, and death (Sumartini et al., 2019). Changes in blood pressure that occur in the elderly are due to structural and functional changes in the peripheral vascular system. Lack of exercise can cause cholesterol buildup, especially LDL in the artery walls. The entry of lipoproteins into the lining of the blood vessel walls can increase blood pressure and increase the permeability of the blood vessel walls (Yulisa & M, 2018).

Regular physical activity plays a role in achieving healthy aging and contributes significantly to a longer and healthier life. In addition, exercise and physical activity can prevent the adverse effects of aging, not only inhibiting oxidative stress and inflammation but also anti-oxidative and anti-inflammatory actions. Exercise affects the body's metabolism where the body's cells use oxygen efficiently for muscle metabolism so that the heart and hypertension also decrease (Ruangthai & Phoemsapthawee, 2019). Research conducted by Abdurakhman et al., (2022) showed that 31 respondents experienced stage 1 hypertension before doing exercise, exercising the majority of respondents experienced hypertension as many as 28 people with pre-test and post-test results obtained p values of 0.000 <0.05 so there is a significant effect between exercise on changes in blood pressure in the elderly.

Gymnastics is a sport that aims to increase blood flow and oxygen supply to the active muscles and skeleton, especially to the heart muscle. At the time of exercise oxygen in the cells will increase for the process of forming energy, increasing the heart rate which will result in increased cardiac output. Thus blood pressure will increase. After resting, the blood vessels will dilate and blood flow will decrease temporarily, then return to the blood pressure before exercise. If exercise is done regularly and continuously, the decrease in blood pressure will last a long time and the blood vessels will become elastic. The mechanism for reducing blood pressure after exercise is that exercise can relax the blood vessels. So that by dilating blood vessels blood pressure will decrease (Anwari et al., 2018).

Based on the background and some of the things above, it is known that providing physical activity is effective for reducing blood pressure in the elderly with hypertension, so researchers are interested in studying the effectiveness of physical activity in reducing blood pressure in the elderly. The data obtained will be analyzed using meta-analysis by synthesizing the results of studies conducted to reduce bias.

METHODS

1. Study Design

The study design used in this study was a systematic review and meta-analysis, using the PRISMA flow chart guidelines. Article searches were carried out using a database of journals which included: Science Direct and Google Scholar by selecting articles from 2012-2022. The keywords used are ("Physical activity" OR "Exercise" OR"Exercise Training") AND ("Older" OR "Elderly") AND "Blood Pressure" AND "Hypertension" AND "Randomized Controlled Trial".

2. Inclusion Criteria

In this study the inclusion criteria were full paper articles with the randomized controlled trial (RCT) research method, the relationship measure used was the Mean SD, the intervention was given Physical Activity, the elderly research subjects had an age range of 60-75 years, and had hypertension.

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3. Exclusion Criteria

Exclusion criteria in this study included published articles other than English and Indonesian, the elderly who had a medical history including cancer, impaired coordination, and balance disorders.

4. Variable Operational Definition

In formulating the research problem here using PICO. The population is elderly with hypertension, the intervention is physical activity, the comparison is not given physical activity and the outcome is a decrease in blood pressure.

5. Research Instruments

The quality of the research articles was assessed using the Critical Appraisal Skills Program (CASP).

6. Data Analysis

Data analysis in this study used the Review Manager (RevMan 5.3). Data were analyzed based on variations between studies by determining the use of random effect and fixed effect analysis models. This study uses I2 to quantify dispersion.

The results of the data analysis are in the form of effect size values for the heterogeneity of the study which will later be interpreted in the form of forest plots and funnel plots.

RESULT AND DISCUSSION

Result

Research from primary studies related to the effectiveness of physical exercise to reduce blood pressure in the elderly with hypertension, there are 3 articles. Articles were obtained from 3 countries, namely Indonesia, Thailand, and Brazil. Each study had a sample of fewer than 100 participants.

An article search was carried out using a database based on the PRISMA flow diagram as shown in Figure 1. Assessment of quality and quantity. Quality assessment in this study uses the critical appraisal skills program (CASP). After assessing the quality of the study, 3 articles included in the meta-analysis quantitative synthesis process were analyzed using RevMan 5.3.

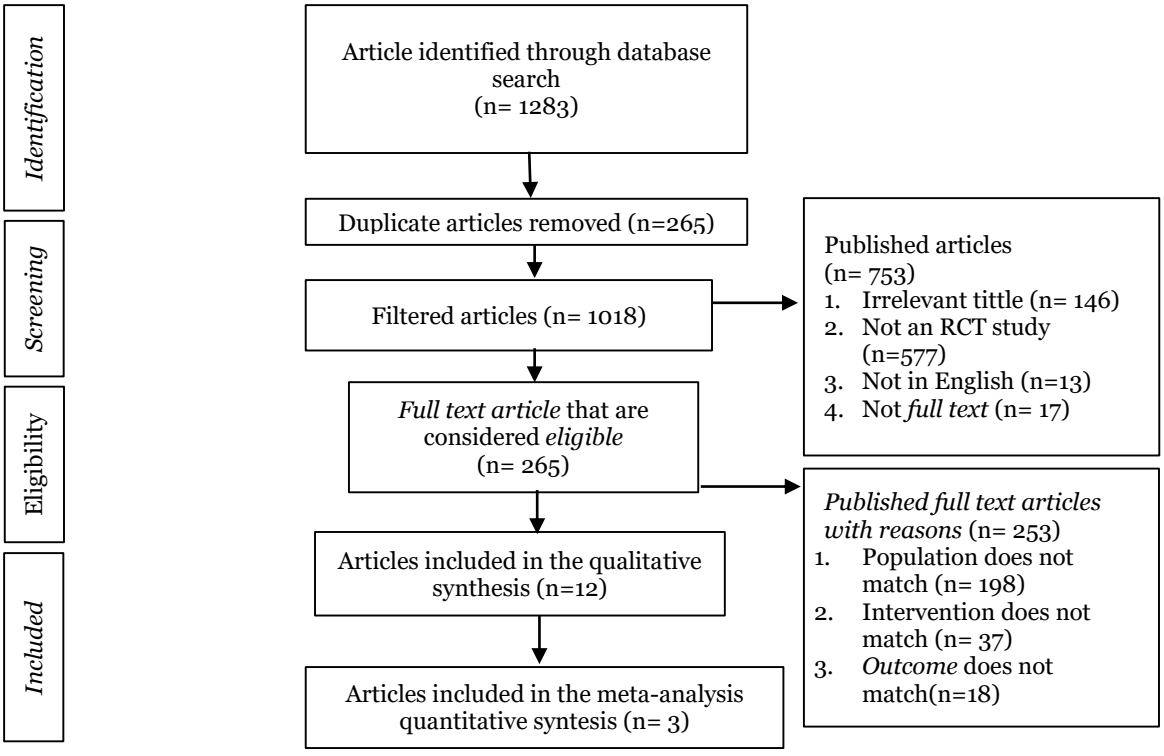

Figure 1. Prisma Flow Diagram

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There are 3 articles from the results of the review that qualify as sources for a meta-analysis of the effect of physical activity on reducing blood pressure, originating from 3 countries, namely Indonesia, Thailand, and Brazil.

a. Forest Plot

Interpretation of the meta-analysis process can be seen through the forest plot. Figure 2 shows as many as 3 articles reporting that physical activity can reduce systolic blood pressure in elderly hypertension compared to other interventions or no intervention. Meanwhile, there was quite high heterogeneity (I2=59%;p<0.09). Thus the Random Effect Model is used in data analysis in forest plots. Physical activity was able to reduce systolic blood pressure by 0.96 times compared to other interventions or no intervention and was statistically significant (SMD= -0.96; 95% CI= -1.79 to -0.14; p= 0.020).

Interpretation of the meta-analysis process can be seen through the forest plot. Figure 3 shows as many as 3 articles reporting that physical activity can reduce diastolic blood pressure in elderly hypertension compared to other interventions or no intervention. Meanwhile, there was no heterogeneity (I2=0%;p<0.53). Thus the Fixed Effect Model is used in data analysis in forest plots. Physical activity was able to reduce diastolic blood pressure by 0.20 times compared to other interventions or no intervention, however, it was not statistically significant (SMD= -0.20; 95% CI= -0.59 to 0.20; p= 0.330).

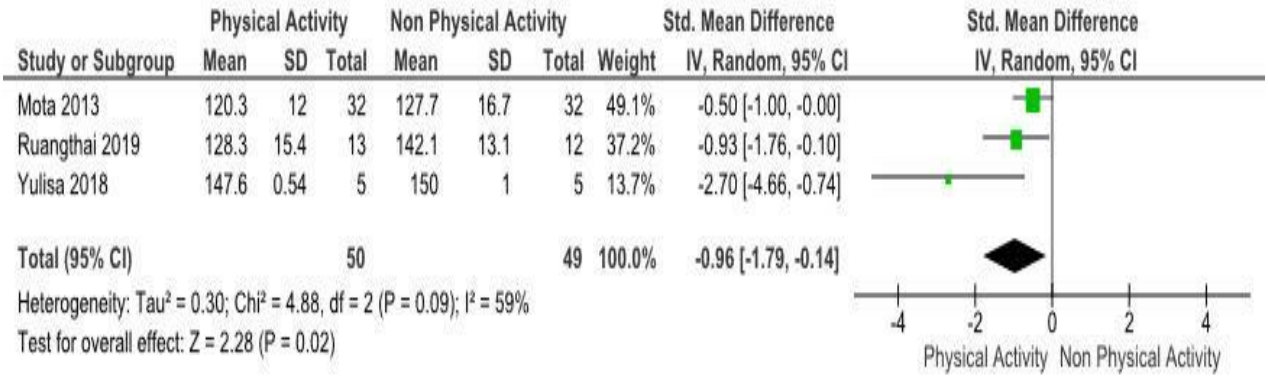

Figure 2. Forest Plot Physical Activity Can Reduce Systolic Blood Pressure In Elderly Hypertension

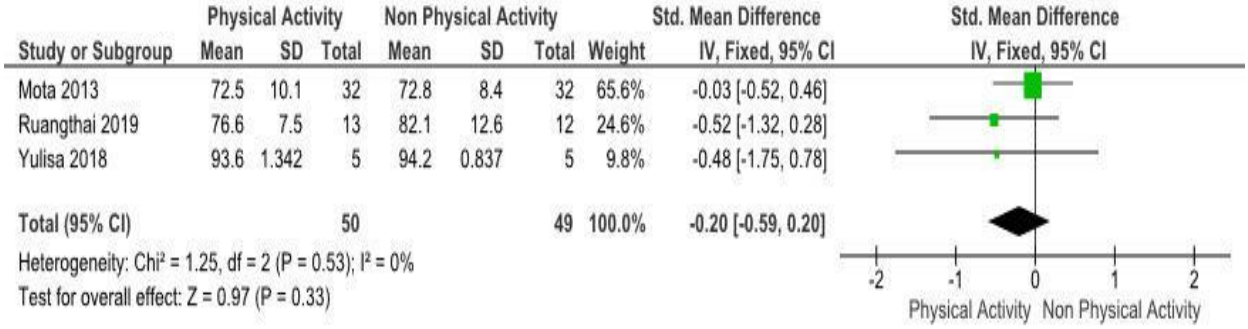

Figure 2. Forest Plot Physical Activity Can Reduce Dyastolic Blood Pressure In Elderly Hypertension

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b. Funnel Plot

Figure 4: Funnel plot of physical activity on decreasing systolic blood pressure in the elderly, showing the results that there is a publication bias which is characterized by an asymmetry of the right and left plots where there is 1 plot on the left, 1 plot on the right and 1 plot in the middle of the line. The left plot of the graph has a standard error of 1 and the right 0.25.

Figure 5 funnel plot of physical activity on decreasing diastolic blood pressure in the elderly, showing the results that there is a publication bias which is characterized by an asymmetry of the right and left plots where there are 2 plots on the left and 1 plot on the right. The left plot of the graph has a standard error of 0.4 and the right 0.2.

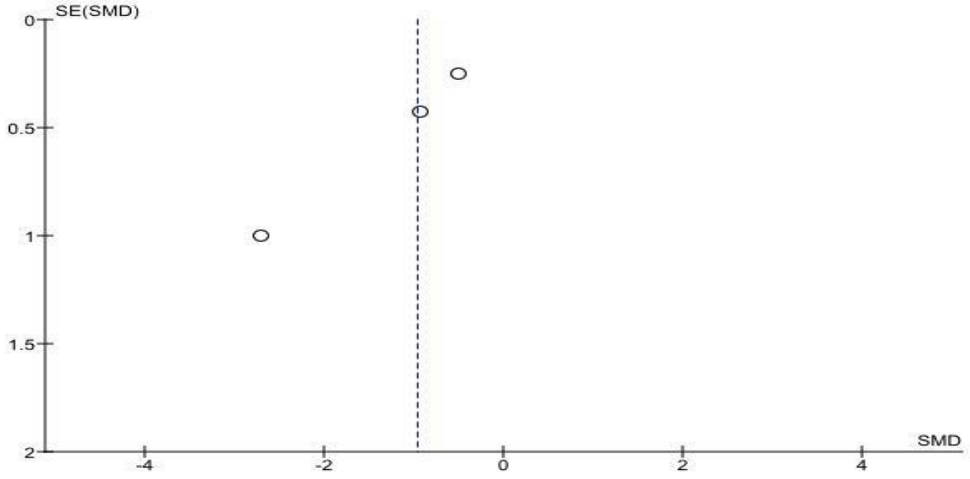

Figure 4. Funnel Plot Physical Activity Can Reduce Systolic Blood Pressure In Elderly Hypertension

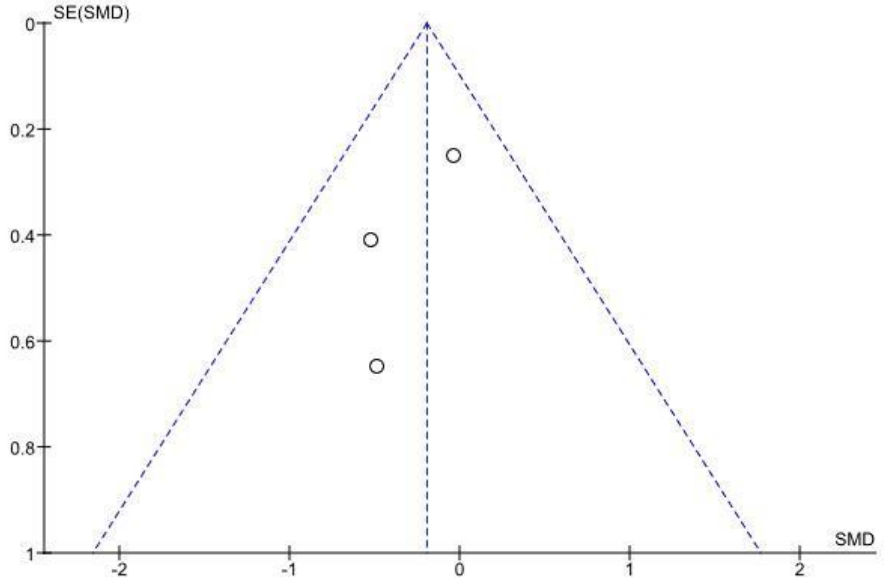

Figure 5. Funnel Plot Physical Activity Can Reduce Dyastolic Blood Pressure In Elderly Hypertension

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Discussion

Hypertension is commonly experienced by the elderly due to age, having a history of hypertension, heredity, gender, and cultural factors. This is due to the older a person's age, the regulation of calcium metabolism is disrupted, so that a lot of calcium circulates in the bloodstream and as a result, the blood becomes denser and blood pressure increases. In addition, as we get older, there is a physiological decline in the elderly which causes the large arteries to lose flexibility and become stiff, not expanding when the heart pumps blood through the arteries. Therefore, blood in each heartbeat is forced through vessels that are narrower than usual and causes blood pressure to rise (Sartika et al., 2020).

In this systematic review, there are 3 intervention study articles identified around the world from 2012 to 2022. This study analyzes the articles using the Mean SD. The results of the systematic review and meta-analysis are presented in the form of forest plots and funnel plots. 3 research articles with a study design of randomized controlled trials as a source of meta-analysis of the effectiveness of physical exercise on reducing blood pressure in elderly hypertension.

The results of the forest plot show that physical exercise can reduce systolic blood pressure by 0.96 times compared to other interventions or no intervention, and is statistically significant (SMD= -0.96; 95% CI= -1.79 to -0.14; p= 0.020). Meanwhile, the results of the forest plot physical exercise were able to reduce diastolic blood pressure by 0.20 times compared to other interventions or no intervention, but statistically not significant (SMD= -0.20; 95% CI= -0.59 to 0.20; p= 0.330).

The results of this study are in line with the research of Sumartini et al., (2019) which resulted in that there was a significant effect between exercise on reducing blood pressure in the elderly with the results of the study showing the average systolic blood pressure before elderly hypertension exercise was 151.80 mmHg, diastolic 94, 73 mmHg and the average systolic blood pressure after elderly exercise was 137.13 mmHg and 90.27 mmHg diastolic and the results of the paired sample t-test obtained p = 0.000. In the elderly, the pumping force of the heart is reduced. Important blood vessels in the heart and brain experience stiffness, physical exercise can help the heart's pumping power increase because the heart muscle in people who exercise regularly is so strong that the heart muscle in these individuals contracts less than the heart muscle in individuals who rarely exercise. Exercise can cause a decrease in heart rate and decrease cardiac output, which in turn can reduce blood pressure and blood flow to return to normal.

Hypertension gymnastics is a sport that is structured by prioritizing the ability of the heart, large muscle movements, and joint flexibility as well as using as much oxygen as possible. In addition to increasing feelings of well-being and the ability to cope with stress, other benefits include lowering blood pressure, reduced obesity, reduced frequency of resting, and decreased insulin resistance. These results are in line with research conducted by Merianti & Wijaya, (2015) explaining that physical exercise/gymnastics for the elderly can be carried out for four weeks in the elderly with mild to moderate hypertension, once a week with a duration of 30 minutes. Where 15 respondents experienced a decrease in the average systolic and diastolic blood pressure from a systolic pressure of 145.33 mmHg to 137.33 mmHg and a diastolic pressure of 88.00 mmHg to 82.00 mmHg.

In addition, physical activity can increase the level of endorphins four to five times in the blood. This hormone can function as a natural sedative produced by

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the brain which creates a feeling of comfort and increases the levels of endorphins in the body to reduce high blood pressure. So, the more you do physical activity, the higher the levels of b-endorphins. When someone does physical activity, endorphins will come out and be captured by receptors in the hypothalamus and limbic system which function to regulate emotions. Increased b-endorphins are closely related to reduced pain, increased memory, improved appetite, sexual ability, blood pressure, and respiration (Sartika et al., 2020).

CONCLUSION

Physical activity can reduce blood pressure in the elderly with hypertension.

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REFERENCES

Abdurakhman, R. N., Abas Hidayat, D. T., & Department, A. R. (2022). Effect Of Hypertension Exercise On Blood Pressure In The Elderly. World Journal Of Advanced Research And Reviews, 13(3), 491–495. https://doi.org/https://doi.org/10.30574/wjarr.2022.13.3.0269

Anwari, M., Vidyawati, R., Salamah, R., Refani, M., Winingsih, N., Yoga, D., Inna, R., & Susanto, T. (2018). Pengaruh Senam Anti Hipertensi Lansia Terhadap Penurunan Tekanan Darah Lansia Di Desa Kemuningsari Lor Kecamatan Panti Kabupaten Jember. The Indonesian Journal Of Health Science, September, 160. https://doi.org/10.32528/ijhs.v0i0.1541

Merianti, L., & Wijaya, K. (2015). Pelaksanaan Senam Jantung Sehat Untuk Menurunkan Tekanan Darah Pada Pasien Hipertensi Di Panti Sosial Tresna Wherda Kasih. Jurnal Ilmu Kesehatan 'Afiyah, 2(1), 11–16. http://ejournal.stikesyarsi.ac.id/index.php/jav1n1/article/view/37

Ruangthai, R., & Phoemsapthawee, J. (2019). Combined Exercise Training Improves Blood Pressure And Antioxidant Capacity In Elderly Individuals With Hypertension. Journal Of Exercise Science And Fitness, 17(2), 67–76. https://doi.org/10.1016/j.jesf.2019.03.001

Sartika, A., Betrianita, Andri, J., Padila, & Nugrah, A. V. (2020). SENAM LANSIA MENURUNKAN TEKANAN DARAH PADA LANSIA. Contemporary Esthetic Dentistry, 2(1), 11–20. https://doi.org/10.1016/c2009-0-39360-5

Sumartini, N. P., Zulkifli, Z., & Adhitya, M. A. P. (2019). Pengaruh Senam Hipertensi Lansia Terhadap Tekanan Darah Lansia Dengan Hipertensi Di Wilayah Kerja Puskesmas Cakranegara Kelurahan Turida Tahun 2019. Jurnal Keperawatan Terpadu (Integrated Nursing Journal), 1(2), 47. https://doi.org/10.32807/jkt.v1i2.37

Yulisa, D. K., & M, S. B. (2018). The Effect Of Walking Exercise On Blood Pressure In The Elderly With Hypertension In Mulyoharjo Community Health Center Pemalang. Public Health Perspective Journal, 3(3), 176–184.

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