OMNI NURSING JOURNAL

The Effect of Walking Exercise on Blood Pressure of Older Adults with Hypertension

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Article info:
Received: 2024-01-15
Revised: 2024-01-31
Accepted: 2024-02-27

Volume 1(1): 1-8, February 2024

Abstract

Background: Hypertension is one of the diseases that causes the most prominent death worldwide. Most hypertension attacks the elderly. One of the causes of hypertension is a lack of physical activity. Performing regular morning walking exercise may lower blood pressure of patients with hypertension.
Objective: This study aimed to evaluate blood pressure before and after performing walking exercise to reduce blood pressure in the elderly with hypertension**.**
Methods: This study used a pre-experimental design with a pretest-posttest design. The purposive sampling technique was utilized. The sample number was 18 respondents at Antang Health Center.
Results: The study showed that systolic blood pressure before walking exercise was 174 mmHg with a standard deviation of 8.762, and diastolic blood pressure after walking exercise was 75.56 mmHg with a standard deviation of 4.369. The Wilcoxon test showed a value of p= 0.000. This means that there is an effect of walking exercise on reducing systolic and diastolic blood pressure in the elderly.
Conclusion: Walking exercise has an effect on lowering blood pressure in the elderly with hypertension at Antang Health Center.

Keywords: elderly; hypertension; walking exercise

Introduction

Hypertension is a major problem in both developed and developing countries. Hypertension is a non-communicable disease and is the number one cause of death globally (Gulindari et al., 2022). Hypertension is a condition where blood vessels have high blood pressure, namely systolic blood pressure of 140 mmHg and diastolic blood pressure of 90 mmHg. Hypertension is also called a silent killer since it is asymptomatic (WHO, 2019). Hypertension also plays a role in the death of thousands of people due to complications of dangerous diseases, such as stroke, heart attack, and chronic kidney failure. Hypertension is caused by an increase in blood pressure beyond normal limits. There are two types of blood pressure, including systolic blood pressure and diastolic blood pressure. Systolic pressure occurs when heart muscle contractions, while diastolic pressure is the pressure in the arteries when the heart rests between beats (Candra, 2018).

The International Society of Hypertension (ISH) reported that there have been three million people with hypertension dying every year worldwide. World Health Organization notes that there are one billion people in the world suffering from hypertension. Two-thirds of whom were in developing countries with low income. The prevalence of hypertension might continue to increase sharply. It is predicted that in 2025, around 29% of adults worldwide suffer from hypertension. Hypertension has resulted in the death of about eight million people every year. About 1.5 million deaths occur in Southeast Asia, of which one-third suffer from hypertension (Ekarini et al., 2019).

According to Riskesdas (2018), the prevalence of hypertension in the 18-year-old age group was 34.1%, where the highest prevalence was found in South Kalimantan (44.1%), while the lowest was in Papua (22.2%). Hypertension occurred in the age group of 31-44 years (31.6%), age 45-54 years (45.3%), and 55-64 years (55.2%). From the prevalence of

hypertension of 34.1%, it is known that 8.8% of people diagnosed with hypertension did not take medication, and 32.3% did not routinely take medication (Indonesian Ministry of Health, 2018). An estimated 23% of women and 14% of men over 65 years of age suffer from hypertension. Hypertension attacks more in the age group of 55-64 years (Sartika et al., 2020). Hypertension is influenced by several risk factors, such as genetic factors, age, lifestyle, and lack of physical activity (Jehaman, 2020**).** Hypertension can be avoided and prevented by various means, including healthy lifestyle by doing regular physical activity. The need for adequate sleep, relaxation, reduced alcohol, smoking and stress, then apply a healthy diet by avoiding foods that contain high fat, high calories, cholesterol, and foods containing salt and regular physical activity (Noviati, 2021).

One of the first alternatives when diagnosed with hypertension is that 75% of patients use pharmacological therapies such as captopril, amlodipine, diltiazem, and metoprolol, although this first option emphasizes lowering blood pressure, but prolonged use can have a negative impact on other organs, such as kidney and liver function disorders (Adrian, 2019). There are nonpharmacological alternatives in people with hypertension by changing lifestyles such as doing exercise, not smoking, reducing salt intake, losing weight, drinking less coffee, reducing alcohol, regulating diet, and reducing stress (Nuriyati, 2020). Strategies to treat people with hypertension are focused on factors that can still be controlled su,ch as changing the negative lifestyle of the patient (Hamria et al., 2020).

Negative lifestyles can be influenced by lack of exercise where exercise is one of the nonpharmacological therapies, especially people with hypertension. Physical exercise recommended for people with hypertension is walking exercise in a group (Mustofa, 2022). Regular exercise in addition to reducing stress, can also lose weight, burn more fat in the blood, and strengthen the heart muscle. To be able to do light exercise, we do not need to come to a special training place, because the best program is a preferred exercise and can be done regularly, as it has been carried out as a daily activity, for example, doing more activities such as walking casually in the morning (Zannah et al., 2021). The recommended exercise is walking compared to other sports such as tennis, cycling, or running. This is because walking exercise does not require equipment except comfortable shoes for walking. Walking exercise can be done by everyone, both young and old. Walking is the most enjoyable exercise that can be done as a brisk walk or a leisurely walk repeatedly (Munawarah, 2017).

Lack of exercise in people with hypertension can adversely impact health. It may cause stiffness in blood vessels so that they cannot have the strength to drain blood from the heart or throughout the body, calories or fat contained in the body are still well metabolized into energy so that it can inhibit blood flowing through blood vessels (arthrosclerosis). If hypertension is not treated properly, it can develop into chronic heart failure, stroke, bicardial infarction, and renal failure. The impact of hypertension in the long term can also result in sudden death (Aji et al., 2015; Indrawati, 2018).

According to the phenomenon above, there are still many people with hypertension who do not know exercise as a technique that can lower blood pressure. They are likely prioritizing healthy diet and consuming pharmacological medicine. Therefore, the authors were interested in examining the effect of walking exercise on reducing systolic blood pressure of the elderly with hypertension which conducted at Antang Health Center Work Area.

Methods

Study Design

The research method used was the quantitative method. This research design utilized pre-experimental design with one group pre-test / post-test.

Samples/Participants

The population in this study was all elderly with hypertension at Antang Public Health Center and the sample was 18 people. The sampling technique employed purposive sampling. The inclusion criteria included: 1) Elderly suffering from hypertension at Antang Health Center; 2) Respondents aged ≥60 years; 3) Rarely exercise; and 4) Not taking antihypertensive drugs.

Meanwhile, the exclusion criteria included: 1) elderly consuming alcohol; 2) Smoking; 3) Having Comorbidities (diabetes mellitus, stroke, kidney failure); and 4) Severe hypertension: systole ≥ 180 and diastole ≥110.

Instruments

The observation sheet was used to document the measurement of walking exercise, including respondent codes and the result of pretest and posttest blood pressure measurements. A digital sphygmomanometer was used to measure blood pressure response. The sphygmomanometer used in this study was an adult-sized digital sphygmomanometer. The sphygmomanometer used was automatic pressure monitor Omron type brand HEM 7130. Pedometer was a tool used for walking exercise because it could record the amount of physical movement done in a day. A pedometer measured the amount of physical movement with a very high degree of accuracy. A stopwatch was a device used to measure the length of time it took to perform an activity. The stopwatch was activated when starting the measurement and stopped after the measurement.

Interventions

The intervention used in this study was walking exercise. After screening the respondents for the inclusion criteria, an initial blood pressure measurement (pre) was taken before the walking exercise. Walking exercise was carried out three times per person for 15 minutes. Respondents who did not have time to follow walking exercises in groups then did walking exercises in their free time. Researchers took the final blood pressure measurement (post) after finishing the walking exercise.

Data Collection

This study was conducted in 2022 at Antang public health center Makassar. Patients with hypertension were screened for eligibility by researchers. They were given informed consent. If they were interested in participating in the study, the researchers then collected the data of all participants.

Data Analysis

All data were analyzed using the SPSS statistical program. Descriptive statistics were used to analyze the participants' characteristics. Bivariate analysis was conducted to determine the relationship between two variables, namely the independent variable of walking exercise and the dependent variable of blood pressure in patients with hypertension. Bivariate analysis was used to see the distribution of respondents before and after the experiment using comparative statistical test data analysis techniques. The dependent t-test was used to test the mean difference of the research variables before and after intervention. Before conducting data analysis, a data normality test was carried out utilizing Shapiro Wilk test because sample was <50. The normality test showed a p-value < 0.05, so the Wilcoxon test was employed in data analysis.

Ethical Considerations

Ethical number 07012009-II/BKBP/VIII/2022 was received from the National and Political Unity Agency of South Sulawesi Province. Researchers also received a research permit from Antang Public Health Center.

Results

Characteristics of respondents

This study showed that the majority of respondents were females, accounting for 14 (77.8%) respondents, while males were merely 4 (22.2%) respondents. According to age, level of education, and occupation, the respondents were dominated by those aged ≤ 62 years, junior high school, and housewife, which accounted for 11 respondents (61,1%), 7 (38,8%), and 14 (77.8%), respectively.

Respondents who had a salt diet were as many as 17 people (94.4%) and respondents who did not have a salt diet were 1 person (5.6%). Also, respondents having congenital

diseases was 1 person (5.6%), and those who did not have congenital diseases accounted for 17 people (94.4%). Respondents who had suffered from hypertension for less than 12 months were 6 people (33.3%) while those who had suffered from hypertension for ≥ 12 months were 12 (66.7%) respondents. Respondents with activity duration ≤ 2 times were 14 people (77.8%), while respondents with activity length >2 times were 4 people (22.2%).

Blood pressure before and after performing walking exercise

Table 1 exhibited that the systolic blood pressure of respondents before performing walking exercise was in a maximum value of 185 mmHg and minimum value of 160 mmHg. Meanwhile, respondents' diastolic blood pressure before walking exercise had a maximum value of 105 mmHg and a minimum value of 90 mmHg. The standard deviation for systolic blood pressure before walking exercise was 8.762 and diastolic pressure was 5.028. This means that the smaller the standard deviation indicates that these average values can be used to represent the blood pressure of 18 elderly people. In addition, systolic blood pressure after walking exercise with a maximum value of 140 mmHg and a minimum value of 120 mmHg, and diastolic blood pressure after a leisurely walking technique with a maximum value of 80 mmHg, a minimum value of 70 mmHg with a sample of 18 elderly people. The standard deviation for systolic blood pressure after a leisurely walk of 4.857 and the diastolic pressure of 4.369 is getting smaller, indicating that these average values can be used to represent the blood pressure of 18 elderly people.

Table 1. Blood pressure before and after performing walking exercise

	n	Minimum	Maximum	Mean	Std. Deviation
Systolic blood press Pre-Test	18	160	185	174.78	8.762
Diastolic BP Pre-Test	18	90	105	97.11	5.028
Systolic BP Post-Test	18	120	140	133.78	4.857
Diastolic BP Post-Test	18	70	80	75.56	4.369

Source: Primary Data 2022; Note: BP= Blood Pressure

The effect of walking exercise on blood pressure in the elderly with hypertension

The data normality test showed a value of p = 0.010 for systolic blood pressure before the walking exercise, a value of p = 0.189 for diastolic blood pressure before the walking exercise, a value of p = 0.016 for systolic blood pressure after the exercise, a value of *p* = 0.001 for diastolic blood pressure after the walking exercise. This value was smaller than the p-value 0.05, so the Wilcoxon Signed Ranks Test was used because the data was not normally distributed. The Wilcoxon test showed a value of p= 0.000 was smaller than the value of 0.05, this means that there was an effect of walking exercise on reducing systolic blood pressure in the elderly.

Discussion

The study showed that respondents were dominated by females. Data reported men are more likely to experience hypertension than women at the age of less than 55 years. While at the age of more than 55 years, women are more likely to experience hypertension. One of the reasons women are more likely to suffer from hypertension because women have estrogen and progesterone hormones, where those hormones can protect blood vessels from oxidative reactions due to pollution (Sepriani, 2020). Previous study showed that women had more hypertension than men. Therefore, authors assume that the older a person is, especially in women, the hormones estrogen and progesterone also decrease. This may cause women to

tend to suffer from hypertension due to increased blood pressure as the result of decreased estrogen and progesterone hormones.

According to the age, the majority of respondents were aged ≤ 60 years. Generally, a person is categorized as elderly if the age is 65 years and over. The elderly is not a disease but is an advanced stage of a life process characterized by a decrease in the body's ability to adapt to the environment (Khotimah, 2018). A study by Delvi et al. (2022) confirmed that the older the age, the more at risk someone has hypertension. Their study revealed that those aged 60-64 years had an increased risk of hypertension by 2.18%, those aged 65-69 years by 2.45%, and those aged >70 years by 2.97% times. The authors assume that the blood pressure of the elderly may increase due to ageing. Large arteries lose their flexibility and become stiff so that it can cause an increase in blood pressure in the elderly.

Respondents who had an education level of junior high school, were housewives, and did not consume excessive salt were dominant in suffering from hypertension. Excessive salt consumption will increase the amount of sodium in the cells and disrupt fluid balance. The entry of fluid into the cells will shrink the diameter of the arteries so that the heart must pump blood more strongly, which results in increased blood pressure. Increased blood pressure affects the improvement of heart work, which in turn will increase the risk of having a heart attack (Apriani, 2021). Salt or sodium is a mineral the body needs, but excessive salt consumption should also be limited if someone has certain health conditions. The authors assume that one of the benefits of a low-salt diet is to help lower blood pressure, especially for people with hypertension.

The majority of respondents had experienced hypertension for a long time. Chronic hypertension that occurs for a very long time will make smooth muscle cells of blood vessels proliferate. This proliferation causes the lumen to get narrower and the walls of blood vessels thicker so that the nutrients carried by blood to the brain are also disrupted. Neuron cells in the brain will experience ischemic if not immediately treated (Nurimah, 2018).

This study found that the majority of respondents rarely did exercise. This was confirmed because most respondents were busy with family management and preferred to do activities or take advantage of time to work at home compared to exercise. According to Ruseski (2014), doing exercise or regular physical activity can reduce the risk of chronic diseases. One of which can reduce high blood pressure (hypertension), and reduce stress depression, and increase emotional well-being, energy levels, confidence and power with social activities. A study by Manembu et al. (2015) suggested that there was a decrease in blood pressure after exercise. Their study showed a significant decrease in systolic blood pressure by 7 mmHg and diastolic blood pressure by 5.2 mmHg after performing regular exercise. The authors assume that performing physical activities is beneficial to improving and maintaining health. This can be done by exercising regularly for a duration of 15 minutes to reduce high blood pressure. This study found that there was a decrease in the systolic and diastolic blood pressure of respondents after performing walking exercise, which were 3.2 mmHg for systolic blood pressure and 5.7 mmHg for diastolic blood pressure. A study by Larasiska and HN (2017) revealed that there was a relationship between regular exercise and hypertension, whereas regular exercise reduced systolic blood pressure by 6±12 mmHg and diastolic pressure by 3±7 mmHg.

Successful aging depends on how the elderly feel satisfied with doing activities. Maintaining those activities is more important than the quantity of activities performed. However, this is often not realized by some elderly and they only spend time sitting back and lying down, whereas lack of movement or rarely exercise can increase the risk of various health problems, including hypertension (Adrian, 2020).

Meeting the needs of physical activity is essential to support good growth and development. Physical activity is the movement of limbs that can cause energy expenditure for maintaining physical and mental health, as well as maintaining the quality of life to stay healthy. Physical activity is pivotal, especially for people with the. The elderly can perform leisure walking exercise to reduce risk factors for degenerative diseases such as hypertension, stroke, and diabetes mellitus (Hasibuan, 2010). The authors assume that the elderly have to do light activities such as walking exercise in the morning to maintain fitness and health, which later may increase the expectancy.

Conclusion

This study found that there is a decrease in both systolic and diastolic blood pressure after the elderly perform walking exercise. This means that there is an effect of walking exercise on lowering blood pressure in the elderly with hypertension.

Acknowledgment

The authors expressed their gratitude to Antang Public Health Center, respondents, and all parties involved in this study.

References

Adrian, S. J. (2019). Hipertensi esensial: diagnosis dan tatalaksana terbaru pada dewasa. *Cermin Dunia Kedokteran*, *46*(3), 172–178.

Aji, W. P. B., & Isnaeni, Y. (2015). *Pengaruh Senam Lansia terhadap Tekanan Darah pada Lansia Penderita Hipertensi di Posyandu Lansia Dusun Banaran 8 Playen Gunung Kidul*. Stikes'Aisyiyah Yogyakarta.

Alpin, H. (2016). Hubungan Fungsi Gerak Sendi Dengan Tingkat Kemandirian Lansia Di Panti Sosial Tresna Werdha Gau Mabaji Kabupaten Gowa. *Jurnal Ilmiah Kesehatan Sandi Husada*, *4*(1), 43–49. https://doi.org/10.35816/jiskh.v4i1.84

Andriyani, J. (2019). Strategi coping stres dalam mengatasi problema psikologis. *At-Taujih: Bimbingan Dan Konseling Islam*, *2*(2), 37–55.

Arovah, N. I. (2015). Prinsip pemrograman latihan fisik pada penyakit kronis. *Pendidikan Kesehatan Rekresi FIK UNIY,(1)*, 1–14.

Astrawan, I. P., Adiputra, N., & Jawi, I. M. (2016). Pelatihan Footwork Bulutangkis 10 Repetisi 2 Set Lebih Baik Dibandingkan 5 Repetisi 4 Set Untuk Meningkatkan Kekuatan Otot Tungkai Dan Kelincahan. *Sport and Fitness Journal*, *4*(2), 18–29.

Astuti, A., & Maulani, M. (2018). Faktor Resiko Infark Miokard di Kota Jambi. *Jurnal Endurance: Kajian Ilmiah Problema Kesehatan*, *3*(1), 82–87.

Atussaadah, L. (2018). *Gambaran Kadar Hemoglobin Pada Perokok Elektrik (Vapor) Komunitas Vaporaizer Kota Semarang*. Unimus.

Azizah, A. N., & Rahayu, S. A. (2016). Hubungan Self-Esteemdengan Tingkat Kecenderungan Kesepian Pada Lansia. *Hubungan Self-Esteemdengan Tingkat Kecenderungan Kesepian Pada Lansia*, *07*(02), 40–58.

Candra, W. N. (2018). *Hubungan Antara Kualitas Tidur Dengan Tekanan Darah Pada Siswa Kelas X-XI DI SMA N 1 Kwadungan Kabupaten Ngawi*. Stikes Bhakti Husada Mulia.

Dafriani, P., & Prima, B. (2019). *Pendekatan Herbal Dalam Mengatasi Hipertensi*.

Delvi Yuliana, Rifka Huwae, and Putu Ni Putu Ariani. 2022. "Penerapan Relaksasi Otot Progresif Dalam Menurunkan Tingkat Stres Dan Tekanan Darah Pada Lansia Di RW 11 Kelurahan Pasir jaya."

Desy Melina Saadi, P., Misbah, S. R., & Atoy, L. (2018). *Asuhan Keperawatan Keluarga Dengan Hipetensi Dalam Penerapan Terapi Diet Dash Di Desa Mekar Wilayah Kerja Puskesmas Soropia Kabupaten Konawe*. Poltekkes Kemenkes Kendari.

Fitriana, L. N., Lestari, D. R., & Rahmayanti, D. (2021). Hubungan Antara Aktivitas Fisik Dengan Tingkat Kesepian pada Lanjut Usia di Karang Lansia Bahagia Banjarmasin. *Dunia Keperawatan: Jurnal Keperawatan Dan Kesehatan*, *9*(2), 169–179.

Furqani, N., Rahmawati, C., & Melianti, M. (2020). Hubungan Gaya Hidup Dengan Kejadian Hipertensi Pada Pasien Rawat Jalan di Puskesmas Pagesangan Periode Juli 2019. *Lumbung Farmasi: Jurnal Ilmu Kefarmasian*, *1*(1), 34–40.

Gulindari, N. G., Nurmainah, N., & Susanti, R. (2022). Gambaran Penggunaan Kontrasepsi Hormonal Yang Berisiko Penyakit Hipertensi Berdasarkan Klasifikasi World Health Organization. *Jurnal Farmasi Galenika*, *9*(1), 1–11.

Gunawan, E. (2019). *Fisiologi Olahraga latihan indoor dan Outdoor*. Myria Publisher.

Hamria, H., Mien, M., & Saranani, M. (2020). Hubungan Pola Hidup Penderita Hipertensi

Dengan Kejadian Hipertensi Di Wilayah Kerja Puskesmas Batalaiworu Kabupaten Muna. *Jurnal Keperawatan*, *4*(01), 17–21.

Hapipah, H. (2021). Edukasi Tentang Hipertensi Pada Lansia Di Masa Pandemi Covid-19 Di Desa Ubung Lombok Tengah. *Abdimas Madani*, *3*(1), 1–6.

Hashemi, R., Rahimlou, M., Baghdadian, S., & Manafi, M. (2019). Investigating the effect of DASH diet on blood pressure of patients with type 2 diabetes and prehypertension: Randomized clinical trial. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *13*(1), 1–4.

Indrawati, L. (2018). Pengaruh Senam Aerobik Terhadap Penurunan Tekanan Darah Pada Penderita Hipertensi. *Citra Delima: Jurnal Ilmiah Stikes Citra Delima Bangka Belitung*, *2*(1), 31–38.

Jehaman, T. (2020). Faktor-Faktor yang Berhubungan dengan Kejadian Hipertensi di UPT Puskesmas Sabbang Tahun 2020. *Jurnal Kesehatan Luwu Raya*, *7*(1), 28–36.

Kadir, A. (2018). Hubungan patofisiologi hipertensi dan hipertensi renal. *Jurnal Ilmiah Kedokteran Wijaya Kusuma*, *5*(1), 15–25.

Lusiana, E. D., & Mahmudi, M. (2020). *Teori dan Praktik Analisis Data Univariat dengan PAST*. Universitas Brawijaya Press.

Mamondol, M. R. (2021). Proses Dan Paradigma Penelitian. *Metode Penelitian Pendekatan Kuantitatif*, 19.

Mardikaningsih, R. (2017). Variabel Kepemimpinan dan Lingkungan Kerja serta Pengaruhnya terhadap Kinerja Karyawan. *Management & Accounting Research Journal*, *1*(1).

Marhaendra, Y. A., Basyar, E., & Adrianto, A. A. (2016). *Pengaruh letak tensimeter terhadap hasil pengukuran tekanan darah*. Diponegoro University.

Mufarrikoh, Z. (2019). *Statistika pendidikan (Konsep sampling dan uji hipotesis)*. Jakad Media Publishing.

Munawarah, S. (2017). *Pengaruh Jalan Santai terhadap tekanan darah pada penderita hipertensi warga RW 005 pisangan barat Ciputat*. UIN Syarif Hidayatullah Jakarta: Fakultas Kedokteran dan Ilmu Kesehatan, 2017.

Mustofa, E. (2022). Pengaruh Aktifitas Fisik terhadap Tekanan Darah pada Prajurit Penderita Hipertensi. *Jurnal Keperawatan*, *14*(S1), 239–246.

Nadeak, B. (2016). Hipertensi sekunder akibat perubahan histologi ginjal. *Sari Pediatri*, *13*(5), 311–315.

Noviati, E. (2021). Pengaruh Senam Terhadap Penurunan Tekanan Darah Pada Lansia Yang Mengalami Hipertensi Di Dusun Cintasari Kecamatan Parigi Kabupaten Pangandaran. *Jurnal Kesehatan: Jurnal Ilmu-Ilmu Keperawatan, Kebidanan, Farmasi Dan Analis Kesehatan, Sekolah Tinggi Kesehatan Muhammadiyah Ciamis*, *8*(2), 14–25.

Nuriyati, A. P. (2020). *Literature Review: Pengaruh Senam Anti Stroke Dan Aromaterapi Lavender Terhadap Tingkat Stress Penderita Hipertensi*.

Pearce, E. C. (2016). *Anatomi dan fisiologi untuk paramedis*. PT Gramedia Pustaka Utama.

Pramestiyani, M., Oktavia, S., Sulung, N., Wahyuni, T. P., Safitri, W., Lestari, N. C., & Iriani, F. A. (2022). *Anatomi Fisiologi*. Global Eksekutif Teknologi.

Pribadi, A. (2015). Pelatihan Aerobik untuk kebugaran paru jantung bagi lansia. *Jorpres (Jurnal Olahraga Prestasi)*, *11*(2).

Putra, D. S. (2016). *Klasifikasi Sinyal EMG Pada Otot Tungkai Selama Berjalan Menggunakan Learning Vector Quantization-Classification Of EMG In Lower Limb Muscle During Walking Using Learning Vector Quantization*. Institut Teknologi Sepuluh Nopember.

Ramadhan, A. (2016). kategori-umur-menurut-depkes-ri-2009. *Diambil Pada*, *5*.

Sartika, A., Betrianita, B., Andri, J., Padila, P., & Nugrah, A. V. (2020). Senam Lansia Menurunkan Tekanan Darah pada Lansia. *Journal of Telenursing (JOTING)*, *2*(1), 11–20.

Seta, B. (2021). *Aplikasi Terapi Jalan Santai 30 Menit Pada Ny. S Dengan Diabetes Mellitus Tipe 2*. Karya Ilmiah, Universitas Muhammadiyah Magelang.

Sugiyono. (2019). *Metode Penelitiian Kuantitatif Kualitatif dan R&D* (Sutopo (ed.); 1st ed.). Alfabeta Bandung.

Suprayitno, E., & Huzaimah, N. (2020). Pendampingan lansia dalam pencegahan komplikasi hipertensi. *SELAPARANG Jurnal Pengabdian Masyarakat Berkemajuan*, *4*(1), 518–521.

Telaumbanua, A. C., & Rahayu, Y. (2021). Penyuluhan Dan Edukasi Tentang Penyakit Hipertensi. *Jurnal Abdimas Saintika*, *3*(1), 119.

Widia, C., Kurniasih, E., & Alifiar, I. (2021). Literature Review Pengaturan Tekanan Darah Dengan Low Impact Exercise Pada Penderita Hipertensi Di Masa Pandemi Covid-19. *Jurnal Keperawatan Muhammadiyah*, *6*(4).

Widiyawati, W., & SARI, D. J. E. K. A. (2020). *Keperawatan gerontik*. Literasi Nusantara.

Wulandari, R., & Puspita, S. (2019). Hubungan Pengetahuan, Dukungan Keluarga, dan Peran petugas Kesehatan dengan Kepatuhan Penderita Hipertensi Dalam menjalani Pengobatan. *Jurnal'Aisyiyah Medika*, *4*(3).

Yulanda, G., & Lisiswanti, R. (2017). Penatalaksanaan Hipertensi Primer. *Jurnal Majority*, *6*(1), 28–33.

Zannah, M., Karo-karo, T. M., Yolanda, I., Ginting, R., & Sitepu, A. L. (2021). Pengaruh Latihan Fisik Terstruktur Terhadap Penurunan Kadar Kolestrol Pada Pasien Hipertensi Di RS Grandmed Lubuk Pakam. *Jurnal Pengmas Kestra (JPK)*, *1*(1), 19–25.

Hanisaningrum, Hidayah. 2020. "Pengaruh Senam Aerobik low Impact Terhadap Perubahan Tekanan Darah Pada Lansia Penderita Hipertensi Di Posyandu Lansia Jati Asih Kecamatan Geger Kabupaten Madiun."

Hasibuan, Rosmaini. 2010. "Terapi Sederhana Menekan Gejala Penyakit Degeneratif." *Jurnal ilmu keolahragaan* 8(02): 78–93.

Khotimah, Khusnul. 2018. "Fungsi Kognitif Lansia Demensia." *Journal of Holistic and Traditional Medicine* 3(01): 225–31.

Larasiska, Anggi, and Wiwin Priyantari HN. 2017. "Menurunkan Tekanan Darah Dengan Cara Mudah Pada Lansia." *IJNP (Indonesian Journal of Nursing Practices)* 1(2): 55–63.

Manembu, Mercy, Jimmy Rumampuk, and Vennetia R Danes. 2015. "Pengaruh Posisi Duduk Dan Berdiri Terhadap Tekanan Darah Sistolik Dan Diastolik Pada Pegawai Negeri Sipilkabupaten Minahasa Utara." *eBiomedik* 3(3).

Nurimah, Puput. 2018. "Hubungan Lama Menderita Hipertensi Dengan Kejadian Demensia Pada Lansia (Di Dusun Pajaran, Desa Peterongan, Kabupaten Jombang)."

Apriani, O A. 2021. "Pengaruh Senam Lansia Terhadap Tekanan Darah Pada Lansia Penderita Hipertensi Di Puskesmas Bandar Jaya Kabupaten Lahat Tahun 2021."

Sepriani, Rika. 2020. "Analisis Psikologis Mahasiswa Baru Jurusan Pendidikan Olahraga Saat Pembelajaran Daring Di Masa Pandemi Covid-19." *Jurnal JPDO* 3(10): 9–16.