

Ergonomic Exercise Effects on Cholesterol in Elderly in LKS (Social Welfare Agency) Love House Jambon

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ABSTRACT

Elderly (elderly) is a part of the process of human development. As we get older, physiological functions decrease which causes various health problems. One of the health problems in old age is an increase in blood cholesterol levels. Total cholesterol in the blood increases with the aging process. One way to reduce cholesterol levels is to do ergonomic exercises to restore or correct the position and flexibility of the nervous system and blood flow. The purpose of this study was to analyze the effect of ergonomic exercises on cholesterol levels in the elderly at LKS Rumah Kasih Jambon. The research design is a quantitative quasy experiment with a one group pretest posttest design approach. The sample in this study were 15 respondents who were given routine ergonomics exercise 4 times a week for 2 weeks. Sampling in this study was carried out in a non-probability way using a purposive sampling technique. The results of the Paired Sample t-test statistic showed that there was an effect of ergonomic exercise on cholesterol levels in the elderly at the Jambon Love Care Center with p value = 0.000 (p < 0.05). The results showed that the average blood cholesterol levels before and after the ergonomic exercises were 240.73 mg/dl and 230.40 mg/dl. The difference in cholesterol levels before and after ergonomics exercise was 10.33 mg/dl.

I. Introduction

One part of the human development process is becoming old. A process that will be experienced and inevitable for every individual, where growth and development starts with babies, children and adults and then develops into old age as they age. (Azizah, 2011). High blood cholesterol is one of the problems experienced by older people. Total blood cholesterol levels increase as you age. (Mamitoho et al., 2016). Cholesterol will cause blood vessels to clog, or called atherosclerosis. (Sartika, 2012). Cholesterol levels can be lowered by doing ergonomic exercise. Ergonomic exercises can be done at least 2 to 3 times a week with a duration of ± 30 minutes (Sagiran, 2012).

According to the World Health Organization (WHO) 2015, the prevalence of older persons worldwide is projected to rise to 14.9% by 2025 and 16.4% by 2030. According to Health Ministry of Republic Indonesia, there are 23.66 million elderly people in Indonesia in 2017. This number is estimated to increase by 33.69 million people by 2025 and will rise further to 40.95 million by 2030. (Kemenkes RI, 2017). According to BPS East Java Province (2019), for senior presentation in East Java.

According to WHO MONICA I (Monitoring Trends and Determinants in Cardiovascular Disease) the incidence of hypercholesterolemia in women was 13.4% and in men 11.4%. According to RISKESDAS Indonesia data for 2018, abnormal cholesterol levels in the population age >15 years of 34.82%. The 2016 PPTM data showed a prevalence of high cholesterol of 52.3%. Based on the data, out of 34 eastern Java provinces it ranks 23rd in



Indonesia, with 2,967 people detected high cholesterol out of 8,225 people undergoing the examination. One way to deal with high cholesterol is through a healthy lifestyle. Exercise becomes one of the efforts in implementing a healthy lifestyle (Perdana, 2014). The exercise that can be done by an individual with high cholesterol is an ergonomic exercise that is done 2-3 times a week. (Handayani, 2020). High density lipoprotein (HDL) levels can be increased by exercise. The increase in HDL levels after exercise is caused by the burning of fat for energy, thus leading to a decline in VLDL and triglycerides, and ultimately leading to an increase of HDL (Pradana & Pramana 2018).

Ergonomic exercise also maximizes the oxygen supply to the brain. When the blood vessels are elastic, the brain does not lack oxygen and nutrient conditions occur because blood flows smoothly to the brain, so this condition minimizes vascular damage to the blood. Ergonomic exercises can optimize the burning system, including cholesterol burning. Burning cholesterol can affect HDL levels, which can subsequently minimize atherosclerosis that can inhibit blood flow. (Muharni & Christya Wardhani, 2020). Ergonomic exercise is a combination of breathing techniques and muscle movements. Consciously performed breathing techniques using the diaphragm allow the abdomen to be lifted slowly and the chest fully expanded. These breathing techniques can give a massage to the heart, which is beneficial by raising and lowering the diaphragm, opening the cloths, making the blood flow into the heart smooth and improving blood flow throughout the body. Increased blood flow leads to more nutrients and oxygen. (M.Wratsongko, 2015).

Based on the exposure above, ergonomic gymnastics can be the solution. In decreasing cholesterol levels in old age, through this movement, ergonomic exercises whose movements are in accordance with the principles of body creation inspired by prayer movements can be a parameter in the control of cholesterol in older age. For that, the researchers wanted to study “the impact of ergonomic exercise on cholesterol levels in older age at the LKS of the Dear Home Jambon”.

II. Methods

The research design was quantitative quasy experiment with a one group pretest posttest design approach. The sample in this study were 15 respondents who were given routine ergonomics exercise 4 times a week for 2 weeks. Sampling in this study was carried out in a non-probability way using a purposive sampling technique.

The data was analyzed with bivariate analysis to determine the difference in blood cholesterol levels before and after ergonomic exercise using Paired Sample t-test.

III. Results and Discussion

Results

a. Characteristics of Respondents by Age

Table 1. Frequency Distribution of Respondents by Age in the LKS Gymnastics Group at Rumah Kasih Sayang on May 21, 2023-June 4, 2023

<i>z</i>	Frequency	Percentage (%)
60 – 65	6	40,0
66 – 71	9	60,0
	15	100,0

Based on table 5.1, it can be seen that most of the respondents who experienced high cholesterol were aged 66-71 years as many as 9 respondents (60.0%).

b. Characteristics of Respondents by Gender

Table 2. Distribution of Respondents Based on Gender at LKS Rumah Kasih Sayang Jambon.

Gender	Frequency	Percentage (%)
Male	4	26,7
Female	11	73,3
Total	15	100,0

Based on table 5.2, it can be interpreted that almost half of the 4 respondents (26.7%) are male and most of the 11 respondents (73.3%) are female.

c. Characteristics of Respondents based on Respondents' Occupations.

Table 3. Frequency Distribution of Respondents based on Occupation at LKS Rumah Kasih Sayang Jambon.

Occupation	Frequency	Percentage (%)
Housewife	7	46,7
Self Employe	2	13,3
Farmer/laborer	6	40,0
Total	15	100,0

Based on the data in table 5.3 above, there is an opinion on the percentage of respondents based on employment. That almost half (46.7%) or 7 respondents work as housewives and a small proportion (13.3%) or 2 respondents work as entrepreneurs.

d. Frequency of Cholesterol Levels Before Intervention

Table 4. Frequency Distribution of Respondents Based on Cholesterol Levels Before Being Given Ergonomic Gymnastics at LKS Rumah Kasih Sayang Jambon on May 21, 2023 - June 4, 2023.

Limit	Frequency	Percentage (%)
High	11	73,3
Higher Limit	4	26,7
Total	15	100,0

Based on table 5.4, it can be seen that of the 15 respondents before being given ergonomic exercises, most respondents (73.3%) had cholesterol levels before being given ergonomic exercise interventions in the high category with a prevalence of 11 elderly people. While almost half of the respondents (26.7%) had cholesterol levels at high limits with a prevalence of 4 elderly people.

e. Frequency of Cholesterol Levels After Intervention

Table 5. Frequency Distribution Based on Cholesterol After Being Given Ergonomic Gymnastics at LKS Rumah Kasih Sayang Jambon on May 21, 2023 - June 4, 2023.

Limit	Frequency	Percentage (%)
High	15	100,0
Higher Limit	0	0
Total	15	100,0

Based on Table 5.5, it can be seen that all respondents (100%) have cholesterol levels in the high limit category after the ergonomic exercise intervention.

f. The Effect of Ergonomic Gymnastics on Cholesterol Levels in the Elderly
Table 6. Distribution of the Effect of Ergonomic Gymnastics on Cholesterol Levels in the Elderly at LKS Rumah Kasih Sayang.

Average Cholesterol Levels	Means	Difference	P-value
Before	240,73	10,33	0,00
After	230,40		

Based on table 5.6 shows that the results of statistical tests using Paired Sample T-test, obtained a significant value of p value of 0.00. Because the p-value <0.05, it is concluded that H1 is accepted, which means that there is an effect of ergonomic gymnastics on cholesterol levels in the elderly at LKS Rumah Kasih Sayang Jambon.

Discussion

1. Cholesterol levels before the Ergonomic Gymnastics Intervention at LKS Rumah Kasih Sayang

Based on table 5.4, it can be seen that of the 15 respondents with cholesterol at LKS Rumah Kasih Sayang, 11 respondents (73.3%) before being given ergonomic exercises had high cholesterol levels and as many as 4 respondents (26.7%) had cholesterol levels in the high limit category. The average cholesterol level of the elderly before being given ergonomic exercise is 240.73 mg/dl. Total cholesterol levels increase gradually with age. Increased levels of LDL cholesterol and low levels of HDL cholesterol in both men and women over the age of 65 years cause an increase in cholesterol levels (Pontoh, 2013). The aging process is defined by a progressive decrease in active body tissue and a decrease in basal metabolism by 2% per year, along with changes in all body systems, in accordance with (Adam, 2014), which states that age is associated with changes in lipoprotein metabolism.

Cholesterol in men increases during puberty until the age of 50 years and continues until the age of 70 years, then serum cholesterol concentrations decrease slightly (Pontoh, 2013). Cholesterol is a fatty substance that is processed in the liver. cholesterol is atherogenic, or easily attached which then forms plaque on the walls of blood vessels (Mamitoho et al., 2016). Vascular obstruction or atherosclerosis can occur due to the accumulation of fatty deposits on the walls of blood vessels (Taqwin, 2014). Although the body naturally produces cholesterol, when blood cholesterol levels are too high, blood vessels become blocked. Blood flow is obstructed by this disease, which in turn reduces the blood supply to the heart. Chest pain is an indication of inadequate blood supply. Many people are unaware of most of the disorders that cause an increase in total cholesterol because they do not initially show any symptoms (Sari & Ainnur, 2022). Based on these facts and theories, the researcher believes that with increasing age the risk of developing hypercholesterolemia becomes higher.

Many researchers say that as we age, the capacity of low-density lipoprotein receptors decreases, causing blood LDL levels to rise, which contributes to coronary artery blockage. Cholesterol also increases with age (Kurniadi, 2012). Cholesterol levels in the elderly increase with age, organ function deteriorates so that it can no longer function optimally, causing metabolic disorders in the body and decreased activity that affects the body's metabolism, such as cholesterol metabolism. In addition, frequent consumption of fatty foods in the elderly can increase cholesterol (Widiyono 2021). Based on these facts and theories, the researcher believes that hypercholesterolemia can occur due to the weakening of the working mechanism of body parts in an elderly person.

Women have a higher risk of developing high cholesterol. Before menopause, women tend to have lower cholesterol levels than men. Menopause in women is often associated with increased cholesterol levels (Sri, 2015). Increased hypercholesterolemia occurs due to

decreased estrogen levels after menopause (Hutami, 2019). This is related to the lack of estrogen hormone activity in older women (Hamna Vony Lasanuddin et al., 2022). Estrogen is a hormone that plays an important role in preventing oxidation of bad cholesterol (LDL).

This hormone also balances the levels of bad cholesterol (LDL) and good cholesterol (HDL) in the body. Therefore, when a woman approaches menopause, she loses this "balancing" function, making it difficult to control cholesterol in her body (vito, 2018). Based on these facts and theories, researchers argue that women will be more at risk of having high cholesterol levels, due to the lack of estrerogen hormone activity in elderly women so it is very important for women to always check cholesterol levels when entering menopause to reduce the risk of developing hypercholesteromia.

In addition, another factor that can cause hypercholesterolemia is the consumption of fatty foods, such as fried foods. Most Indonesians consume fried foods that contain saturated fat. Saturated fat risks blocking blood flow to the heart, and saturated fat can also increase total cholesterol and LDL (Hanum, 2016). The national proportion of the population that consumes fatty, high-cholesterol, and fried foods more than once a day is 40.7% (MOH RI, 2013). Repeated use of oil in the frying process can also affect a person's cholesterol levels. If the oil is used repeatedly, the saturated fatty acids contained in it will be lost and only saturated fat remains, this condition can cause cholesterol formation (Nadirawati, 2010). This is supported by the results of observations made by researchers where most respondents as housewives said that they often consume oily or fried foods. Based on these facts and theories, researchers argue that housewives who consume fatty foods and use excess oil have the potential to have high cholesterol levels.

2. Cholesterol levels after being given Ergonomic Gymnastics at LKS Kasih Sayang

Based on table 5.5, it can be seen that after being given the ergonomic exercise intervention, all respondents have cholesterol levels in the high limit category. The average elderly cholesterol level after being given ergonomic exercise is 230.40 mg/dl. Regular gymnastics is a form of physical exercise that can help prevent an increase in cholesterol levels. Exercise or ergonomic gymnastics is a gymnastic technique that helps burn cholesterol.

Ergonomic gymnastics exercises are very effective, efficient and logical movements. This activity can help increase good cholesterol (HDL) and lower bad cholesterol (LDL) (Desi et al. 2020). This decrease in total cholesterol levels occurs because ergonomic exercises for people with high cholesterol levels are carried out 2-3 times a week (Handayani, 2020). Ergonomic gymnastics is a gymnastic technique to restore or correct the position and flexibility of the nervous system and blood flow, maximize oxygen supply to the brain, burning uric acid, cholesterol, blood sugar, lactic acid and oxalate crystals (Niode, 2018).

Similarly, the results of the study showed that there was a decrease in the average total cholesterol, triglyceride levels, and LDL levels, as well as an increase in HDL after ergonomic exercise (Wahyuningsih, 2015). After doing ergonomic exercises, the respondent's body responds by sweating profusely and quickly. In gymnastics, a number of circulatory and respiratory systems must work together to supply active tissues with the oxygen they need. Gymnastic movements have the ability to increase blood oxygen concentration and improve blood circulation, which has the effect of lowering cholesterol levels from the high category to the borderline high category. This means that with consistent exercise and sufficient frequency, the body's cholesterol can change (Muqqorobin, 2017). Physical exercises such as ergonomic exercises can increase the activity of lechitin cholesterol acyltransferase (LCAT) which will convert HDL3 cholesterol into HDL2 cholesterol and activate the reverse cholesterol transport pathway. Another benefit of exercise is that it can reduce the activity of

cholesteryl ester transfer protein (CETP), which slows the transfer of cholesterol from HDL to LDL or VLDL, thereby increasing HDL yield (Erwinanto, 2013).

Based on the facts and theories described above, the researchers argue that ergonomic exercises can reduce cholesterol levels in the elderly.

3. The Effect of Ergonomic Gymnastics on Elderly Cholesterol Levels at LKS Rumah Kasih Sayang Jambon.

Based on research that has been conducted by researchers, it shows that the cholesterol levels of the elderly at LKS Rumah Kasih Sayang Jambon between before and after being given ergonomic exercise interventions have changed. The average cholesterol level of the elderly before being given ergonomic exercises is 240.73 and after being given ergonomic exercises the average elderly cholesterol level has decreased to 230.40. This means that elderly cholesterol levels have decreased after being given an ergonomic exercise intervention with a difference of 10.33.

This is also evidenced by the results of the Paired sample T-test test obtained $p\text{-value} = 0.000$, which means $p\text{-value} < 0.05$ so that H_1 is accepted, and it can be concluded that there is an effect of ergonomic gymnastics on cholesterol levels in the elderly at LKS Rumah Kasih Sayang. this is very beneficial for these elderly people because ergonomic gymnastics has proven to be beneficial for the elderly in addition to lowering cholesterol levels but also in applying it is very easy and does not require much energy.

This is in accordance with the opinion of Wratsongko, 2015 that ergonomic gymnastics or core exercise is a gymnastic technique to restore or correct the position and flexibility of the nervous system and blood flow which is beneficial to maximize oxygen supply to the brain, open the intelligence system, sweat system, body heating system, cholesterol burning system, uric acid, blood sugar, lactic acid, cristal ozalate, and carbohydrate conversion system.

Based on previous research conducted by Pontoh (2013), the effect of elderly gymnastics on elderly cholesterol levels BPLU Senja CeraH Manado, the results showed that routine elderly gymnastics can reduce blood cholesterol in the elderly. The research target was 30 elderly people in care. Elderly gymnastics exercises are done regularly 3 times a week for 3 weeks. In statistical analysis, paired sample t test was used to determine the effect of gymnastics on elderly cholesterol levels before and after the intervention with $\alpha = 0.05$. The results showed that the average cholesterol level before exercise in the elderly was 236.23 mg/dl, while in the elderly after three weeks of exercise it dropped to 195.63 mg/dl.

Another study was also conducted by Handayani (2020) with the research title The Effect of Ergonomic Gymnastics on Blood Cholesterol Levels in the Elderly at the Teratai Tresna Werdha Social Home Palembang. This study aims to determine changes in blood cholesterol levels after ergonomic exercise in the elderly. The results of the study using the pair-sample t-test statistical test showed that ergonomic exercises had an effect on blood cholesterol levels at the Teratai Tresna Werdha Social Home Palembang, with a $p\text{-value} = 0.000$ ($p < 0.05$). The average blood cholesterol levels before and after ergonomic exercises are 205.80 mg/dl and 200.40 mg/dl. With the frequency of gymnastics performed in 2-3 times a week. Ergonomic gymnastics is structured by prioritizing heart function, large muscle movements and joint flexibility. As well as efforts to get as much oxygen as possible. In addition to improving well-being and managing stress, exercise increases HDLC levels and lowers LDL cholesterol.

Regular exercise can stimulate the entire body system to keep the body healthy (Fakhrudin, 2013). Good exercise is exercise that is done regularly by paying attention to physical abilities and in accordance with the dose of exercise. The movements included in ergonomic gymnastics are very effective, efficient and logical movements, because the series

of movements are movements made by humans from ancient times to the present. There is no movement as perfect as the ergonomic gymnastics movements, because the movements are adapted to the principles of body building and inspired by prayer movements. This means that it can directly open, clean, and activate all body systems, such as the cardiovascular, bladder, and reproductive systems (Wratsongko, 2015). So ergonomic gymnastics is one of the effective exercises to reduce cholesterol levels for people with hypercholesterolemia.

Based on the facts and theories above, researchers argue that ergonomic exercises have an effect on cholesterol levels in the elderly. The changes that occurred from before being given the intervention to being given the intervention 4 times a week for 2 weeks were influenced by the desire of the elderly to carry out the ergonomic exercise intervention according to the SOP that had been taught by the researcher.

IV. Conclusion

In this study, it was concluded that the results of the Paired Sample t-test statistical test showed that there was an effect of ergonomic exercises on cholesterol levels in the elderly at LKS Rumah Kasih Sayang Jambon with p value = 0.000 ($p < 0.05$). The results showed that the average blood cholesterol levels before and after ergonomic exercises were 240.73 mg/dl and 230.40 mg/dl. The difference in cholesterol levels before and after ergonomic exercises amounted to 10.33 mg/dl. Conclusion: Ergonomic gymnastics performed 4 times a week for 2 weeks can reduce cholesterol levels in the elderly.

V. References

- Adam, J. 2014. Dislipidemia. In Setiadi dkk (ed). Buku Ajar Penyakit Dalam Jilid II Edisi VI. Jakarta: Fakultas Kedokteran Universitas Indonesia.
- Adhiyani, C., Analis Kesehatan Nasional Surakarta, A., & Yos Sudarso, J. (2013). Hubungan Usia dan Konsumsi Makanan Berlemak dengan Kolesterol Total Pada Lanjut usia Kelurahan Serengan Surakarta The Relationship of Age and Consumption of Fatty Food with Cholesterol for Elderly People in Serengan Sub- District Surakarta. *Journal of Pharmacy*, 2(1), 1.
- Anwar. (2004). Dislipidemia sebagai Faktor Risiko Penyakit Jantung Koroner [Sumatera Utara: Fakultas Kedokteran USU]. <http://www.library.usu.ac.id/download%0Aad/fk/gizi-bahri3.pdf>.
- Arikunto, S. (2006). Metode Penelitian Kualitatif. Jakarta: Bumi Aksara.
- Arikunto, S. (2010). Prosedur Penelitian Suatu Pendekatan Praktik. Jakarta: Rineka Cipta.
- Arikunto, S. (2013). Prosedur Penelitian: Suatu Pendekatan Praktik. Jakarta: Rineka Cipta.
- Ari Wulandari. (2011). Cara jitu mengatasi kolesterol / Yekti Mumpuni, Ari Wulandari. Yogyakarta: Penerbit ANDI, 2011.
- Azizah. (2011). Keperawatan Lanjut Usia. Yogyakarta: Graha Ilmu.
- Badan Pusat Statistik Provinsi Jawa Timur. (2019). Profil Penduduk Lanjut Usia Provinsi Jawa Timur 2019. 35520.2009. <https://jatim.bps.go.id/publication/2020/12/07/e5c79d0bc3b0e62a8313f9c6/profil-penduduk-lanjut-usia-provinsi-jawa-timur-2019.html>.
- Cortes, V. A., Busso, D., Maiz, A., Arteaga, A., Nervi, F., & Rigotti, A. (2014). Physiological and pathological implications of cholesterol. *Frontiers in Bioscience - Landmark*, 19(3), 416–428. <https://doi.org/10.2741/4216>.
- Durstine, J. L. (2012). Program Olahraga: Kolesterol Tinggi. Yogyakarta: Citra Aji Parama.
- Erwinanto. Pedomannya Tatalaksana Dislipidemia. Jakarta: centra Communications, 2013
- Friska, B., Usraleli, U., Idayanti, I., Magdalena, M., & Sakhnan, R. (2020). The Relationship Of Family Support With The Quality Of Elderly Living In Sidomulyo Health Center

- Work Area In Pekanbaru Road. *Jurnal Proteksi Kesehatan*, 9(1), 1–8.
<https://doi.org/https://doi.org/10.36929/jpk.v9i1.194>.
- Garnadi. (2012). *Hidup Nyaman Dengan Hiperkolesterol*. AgroMedia Pustaka.
- Hamna Vonny Lasanuddin, Rosmin Ilham, & Rianti P. Umani. (2022). Hubungan Pola Makan Dengan Peningkatan Kadar Kolesterol Lanjut usia Di Desa Tenggara Kecamatan Tilango. *Jurnal Ilmu Kedokteran Dan Kesehatan Indonesia*, 2(1), 22–34.
<https://doi.org/10.55606/jikki.v2i1.566>
- Handayani, E. D., Herliawati, & Rizona, F. (2020). Pengaruh Senam Ergonomis Terhadap Kadar Kolesterol Darah Pada Lanjut Usia di Panti Sosial Tresna Werdha Teratai Palembang. *Keperawatan*, 2, 8–13.
- Hanum Y. (2016). Dampak Bahaya Makanan Gorengan bagi Jantung. *J Kel Sehat Sejah.*, 14(28), 103–114. <https://doi.org/10.24114/jkss.v14i28.4700>
- Hermawati, N. Ayu Gustia, Y. D. (2018). Pengaruh Aktivitas Olah Raga Terhadap Kadar Kolesterol Total Di Poli Klinik Jantung. *Jurnal Kesehatan Saintika Meditory Jurnal Kesehatan Saintika Meditory*, 2(August), 79–88.
<http://jurnal.syedzasaintika.ac.id/index.php/meditory/article/view/244>.
- Hutami, A. T., Ratnawati, & Wahyuningsih, H. (2019). Hubungan Antara Indeks Massa Tubuh dengan Kadar Kolesterol (Studi Observasional Analitik Pada Mahasiswa Fakultas Kedokteran Universitas Islam Sultan Agung Angkatan 2015). *Prosiding Konferensi Ilmiah Mahasiswa Unissula (KIMU)* 2, 12.
- Juli Andry. (2019). Mukjizat Gerakan Shalat & Rahasia 13 Unsur Manusia. Jakarta. *Journal of Telenursing (JOTING)*, 1(2), 304–313.
- Kemenkes RI. (2013). *Riset Kesehatan Dasar*. In Balitbang Kemenkes RI.
- Kementerian Kesehatan RI. (2016). Peraturan Menteri Kesehatan Nomor 25 tahun 2016 tentang Rencana Aksi Nasional Kesehatan Lanjut Usia Tahun 2016-2019. Undang-undang Nomor 13 Tahun 1998 tentang Kesejahteraan Lanjut usia. Kementrian Kesehatan RI.
- Kementerian Kesehatan RI. (2016). *Keperawatan Gerontik*. Jakarta.
- Kementerian Kesehatan RI. (2016). PROFIL Penyakit Tidak Menular Tahun 2016.
<https://p2ptm.kemkes.go.id/dokumen-ptm/profil-penyakit-tidak-menular-tahun-2016>.
- Kementerian Kesehatan RI. (2017). *Analisis Lanjut usia di Indonesia*.
- Kemenkes RI. (2018). *RISKESDAS 2018.pdf*. In *Riset Kesehatan Dasar*.
- Kementerian Kesehatan RI. (2022). *kolestrol*. RSUP dr.Soeradji Tirtonegoro Klaten.
https://yankes.kemkes.go.id/view_artikel/1743/kolesterol.
- Kementerian Kesehatan RI. (2022). *Bahaya Kolesterol Tinggi yang Perlu Diketahui*.
<https://www.alodokter.com/bahaya-kolesterol-tinggi-tidak-boleh-diremehkan>.
- Kholifah, S. N. (2016). *Keperawatan Gerontik*. In *In Modul bahan Ajar Cetak Keperawatan* (8th ed.). Pusdik SDM Kesehatan.
- Kurniadi. (2012). *Stop Penyakit Jantung Koroner*. Yogyakarta: Familia.
- Kurniawan, A., & Kusumayanti, E. (2020). Pengaruh Senam Lanjut usia Terhadap Penurunan Skala Insomnia Pada Lanjut usia Di Desa Batu Belah Wilayah Kerja Puskesmas Kampar. *Jurnal Ners*
- Lestari, A., Handini, M. C., & Sinaga, T. R. (2018). Faktor Risiko Kejadian Dislipidemia Pada Lanjut usia. *Jurnal Riset Hesti Medan*, 3(2), 16–26.
- Mahardika, Agung Bakti. (2017). Perbedaan Kepatuhan Mengikuti PROLANIS Dengan Kadar Kolestrol Pada Penderita Hipertensi Di Puskesmas Banjardawa Kabupaten Pemalang. Universitas Muhammadiyah Semarang. Skripsi.

- Mamitoho, R. F., Sapulete, I. M., & Pangemanan, D. H. C. (2016). Pengaruh senam lanjut usia terhadap kadar kolesterol total pada lanjut usia di BPLU Senja Cerah Manado. *Jurnal E-Biomedik*, 4(1). <https://doi.org/10.35790/ebm.4.1.2016.10845>
- Manungkalit, M. (2019). Kolesterol Pada Lanjut usia. 5(2), 52–57.
- Muharni, S., & Christya Wardhani, U. (2020). Penurunan Tekanan Darah pada Lanjut usia Hipertensi dengan Senam Ergonomik. *Jurnal Endurance*, 5(1), 71. <https://doi.org/10.22216/jen.v5i1.4550>
- Musdalifa, N. R., S. Wicaksono, & Tien. (2017). Hubungan Indeks Massa Tubuh dengan Kadar Kolesterol Total pada Staf dan Guru SMA Negeri 1 Kendari. *E-Journal UHO*, 4(2), 361–367. <http://ojs.uho.ac.id/index.php/medula/article/view/2813>. Diakses pada tanggal 14 April 2021.
- Muqorrob, A. (2017). Efektifitas Senam Tai Chi Terhadap Penurunan Kadar Kolesterol Total Pada Lanjut usia. Skripsi. Stis Insan Cendekia Medika Jombang.
- Nadirawati & Muthmainnah, N. N. (2010). Pengetahuan ibu rumah tangga tentang kolesterol dan penggunaan minyak jelantah. *Jurnal Keperawatan Soedirman*, 5(2), 58–65.
- Nelson, R. H. (2013). Hyperlipidemia as a Risk Factor for Cardiovascular Disease. *Primary Care - Clinics in Office Practice*, 40(1), 195–211. <https://doi.org/10.1016/j.pop.2012.11.003>
- Niode, U.L. (2018). Pengaruh Senam Ergonomis terhadap Kadar Asam Urat pada Lanjut usia di Panti Sosial Tresna Werdha Kota Gorontalo. Skripsi Jurusan Keperawatan, Universitas Negeri Gorontalo
- Notoatmojo. (2012). Metode Penelitian Kesehatan. Jakarta: Rineka Cipta.
- Nursalam. (2008). Konsep dan Penerapan Metodologi Penelitian Ilmu Keperawatan. Jakarta: Salemba Medika.
- Nursalam dan Parini, Siti. (2010). Pendekatan Praktis Metodologi Riset Keperawatan. Jakarta: CV. Sagung Seto
- Nursalam. (2016). Metodologi Penelitian Ilmu Keperawatan : Pendekatan Praktis Edisi 4 (4th ed.). Jakarta : Salemba Medika.
- Padila. (2013). Buku ajar keperawatan gerontik. Nuha Medika. http://ucs.sulselib.net/index.php?p=show_detail&id=54771.
- Perdana, R. M. (2014). Efektivitas Senam Ergonomik dengan Senam Aerobic Low Impact Terhadap Level Tekanan Darah Pada Lanjut usia Hipertensi. In Universitas Muhammadiyah Surakarta.
- Pontoh, L. P., Pangemanan, D. H. C., & Wungouw, H. I. S. (2013). Pengaruh Senam Bugar Lanjut Usia Terhadap Kadar Kolesterol. *Jurnal Biomedik (Jbm)*, 5(1). <https://doi.org/10.35790/jbm.5.1.2013.2627>
- Pradana, V. O., & Pramana, R. (2018). Efek Kerja Senam Jantung Sehat terhadap Kadar Kolesterol Total Klub Jantung Sehat Mitra Pegangsaan. *Jurnal Terapan Ilmu Keolahragaan*, 3(1), 12. <https://doi.org/10.17509/jtikor.v3i1.10395>
- Sagiran. (2012). Mukjizat Gerakan Sholat, edisi 1., Qultum Medika, Jakarta.
- Sartika, RAD. (2012). Pengaruh Suhu dan Lama Proses Menggoreng (Deep Frying) Terhadap Pembentukan Asam Lemak Trans. *Jurnal Kesmas Nasional*, Vol.13, No.1, Hal.26.