JUSINDO, Vol. 8 No. 2, February 2026
p-ISSN: 2303-288X, e-ISSN: 2541-7207

The Effect of Isometric Forearm Contraction Exercises Added to Elderly Gymnastics on Blood Glucose Levels and Blood Pressure Among Older Adults in Kebumen

Asifa Maura Salsabila*, Moh. Ali Imran, Tri Laksono
Universitas 'Aisyiyah Yogyakarta, Indonesia
Email: asifamaura2@gmail.com*, trilaksono@unisayogya.ac.id

Keywords: gymnastics for the elderly, isometric handgrip exercise, blood sugar levels, blood pressure

ABSTRACT

The global elderly population continues to rise, with Indonesia ranking fourth worldwide. The increasing number of older adults is accompanied by a rising prevalence of non-communicable diseases such as hypertension and diabetes mellitus. In the Mutiara Sari Kebumen Elderly Community (34 members), low physical activity levels have been observed, increasing vulnerability to these health problems. Therefore, appropriate interventions are needed to help reduce blood sugar levels and blood pressure through the activation of regular physical activity. This study aimed to determine the effects of elderly gymnastics with and without isometric handgrip exercises on blood sugar levels and blood pressure, as well as to compare the effectiveness of the two interventions among elderly members of the Mutiara Sari Kebumen community. This research employed a quasi-experimental pre-test and post-test control group design. The study subjects were 34 elderly individuals aged 60–74 years, selected using a total sampling technique. Participants followed an exercise program five times per week for four weeks. Instruments used included the Easy Touch GCU device and a sphygmomanometer. Data were analyzed using descriptive statistics, normality and homogeneity tests, and hypothesis testing. Paired Sample T-Test results showed significant effects in both groups ($p = 0.000$; $p < 0.05$). However, Independent Sample T-Test results indicated no significant difference between the two interventions in reducing blood sugar and blood pressure. Both elderly gymnastics alone and in combination with isometric handgrip exercises effectively reduced blood sugar levels and blood pressure, with no significant difference between the two interventions

INTRODUCTION

Health problems in many countries are becoming increasingly complex and are under public scrutiny, including in Indonesia (Elfaria & Retnani, 2025). Not only infectious diseases but also degenerative diseases are increasing. Changes in the lifestyle of modern society, such as lack of physical activity, stress, and consumption of foods high in fat and sugar, can trigger an increase in cases of systemic diseases, including those that appear in old age and are known as degenerative diseases (Fahdhienie et al., 2024). The elderly population is increasing in the process of demographic transition, in which the birth rate is lower than the death rate (BPS, 2023). Aging is a degenerative process that occurs in body tissues where the structure and function of the body change abnormally, gradually reducing adaptability to environmental changes and ultimately affecting the organism's ability to maintain survival (Elfaria & Retnani, 2025). Aging will affect health (Elfaria & Retnani, 2025).

According to the Regulation of the Minister of Health of the Republic of Indonesia Number 67 of 2015 concerning the Implementation of Elderly Health Services in Public Health

Centers, the elderly are individuals who have reached the age of 60 years and above (Ministry of Health of the Republic of Indonesia, 2020). Meanwhile, the Central Statistics Agency (BPS) stated the age classification as follows: 60–69 years is the young elderly, 70–79 years is the intermediate elderly, and 80 years and above is the elderly (BPS, 2023). The World Health Organization (WHO, 2024) has predicted that by 2030 one in six people in the world will be 60 years old or older. Currently, the proportion of the population aged 60 and over has increased from 1 billion in 2020 to 1.4 billion in 2024 (WHO, 2024). The elderly population worldwide is estimated to be more than 629 million people, and by 2025 it is projected to reach 1.2 billion (Ministry of Health of the Republic of Indonesia, 2020). Indonesia's elderly population is the fourth largest in the world after China with 1.35 billion, India with 1.234 billion, and the United States with 313 million; Indonesia ranks fourth with 242 million people (Jehaman et al., 2021).

According to data released by the Central Statistics Agency in 2024, three provinces in Indonesia have entered the elderly population structure phase, namely D.I. Yogyakarta in first place with an elderly percentage of 16.28%, followed by East Java (16.02%) and Central Java (15.46%) (BPS, 2024). Meanwhile, at the Kebumen Regency level, data from BPS in 2021 recorded 188,043 elderly people (Hidayat, 2025). This figure increased by 5.08% in 2022, reaching 197,591 people, and continued to rise in 2023 with a growth rate of 1.32%, reaching 200,206 people (Hidayat, 2025). The projection for 2025 shows a further increase, with the number of elderly reaching 215,650 people, and is expected to continue in 2026, when the number of elderly is estimated to reach 223,360 people, an increase of 3.58% from 2025 (Hidayat, 2025).

The increasing elderly population every year has led to a rise in various diseases. Among the elderly, the prevalence of non-communicable diseases such as diabetes, hypertension, and heart disease continues to increase, in line with lifestyle and dietary changes (Fahdhienie et al., 2024). Hypertension and diabetes mellitus (DM) are the most common chronic diseases and have become global health problems, including in Indonesia, as both conditions cause serious complications such as heart disease, kidney failure, stroke, and even death if not treated optimally (Sukmara & An-Ti, 2025). According to WHO data, the number of people with hypertension is estimated to reach 1.56 billion globally by 2025 (WHO, 2024).

According to the International Diabetes Federation (IDF, 2021), approximately 537 million adults aged 20 to 79 years are living with diabetes worldwide, and this number is expected to increase to 643 million by 2030. In Indonesia, there were around 10.7 million diabetes cases in 2021, making Indonesia one of the countries with the highest number of people with diabetes in the world (Fahdhienie et al., 2022). According to data from the 2023 Central Java Provincial Health Profile, there were around 6,987,551 non-communicable disease (NCD) cases, with hypertension being the most frequently reported disease (72.0%), followed by diabetes mellitus (DM) at 9.59% (Central Java Health Office, 2024). Kebumen Regency ranks ninth highest in hypertension cases, with the prevalence reaching 84% (BPS Central Java, 2021).

High blood pressure, often referred to as hypertension, is a medical condition in which an individual has a blood pressure of ≥ 140/90 mmHg. This disease is chronic and cannot be completely cured, although it can be controlled through appropriate interventions (Urrico, 2018). It is often known as a silent killer because it usually does not show obvious signs or symptoms and can affect both men and women (Wikandari et al., 2025). Diabetes mellitus (DM)

is a metabolic disorder caused by impaired insulin production and function, resulting in daily fluctuations in blood glucose levels, where blood sugar levels usually rise after meals and return to normal in about 2 hours (Rahma et al., 2025). This disease is classified as hereditary (Rahma et al., 2025).

In the context of public health, unhealthy eating habits such as excessive salt consumption, coupled with a lack of physical activity, are major factors that trigger hypertension and diabetes mellitus in the elderly (Urrico, 2018). This is supported by previous research showing that risk factors such as smoking and obesity also play a significant role in increasing the incidence of hypertension (Febriza et al., 2025). In addition, low education levels in the community are closely related to a lack of awareness about the risk factors and symptoms of hypertension and diabetes mellitus, which can ultimately increase their prevalence (Central Java Health Office, 2024).

In this context, according to the Regulation of the Minister of Health of the Republic of Indonesia Number 65 of 2015 concerning Physiotherapy Standards Article 1 paragraph 2, physiotherapy is a form of health service provided to individuals or groups to develop, maintain, and restore body movement and function throughout the life cycle by using manual handling, movement improvement, equipment (physical, electrotherapeutic, and mechanical), functional and communication training (Permenkes, 2015). One of the government programs for empowering the elderly is through the Posyandu Lansia (Elderly Posyandu). The Posyandu Lansia aims to improve the health and welfare of the elderly and expand their access to health services so that they can receive appropriate care according to their needs (Patandean et al., 2025).

The use of a nonpharmacological approach is an alternative that involves regulating diet, increasing physical activity such as walking, running, and cycling, and regular health monitoring (Putri et al., 2024). Lifestyle changes can be part of nonpharmacological therapy, including interventions such as isometric handgrip exercise and elderly gymnastics (Azmilia et al., 2024). Isometric exercises are muscle contractions performed without lifting heavy weights or with minimal resistance, so the length of the muscles involved remains the same (Urrico, 2018). Besides increasing muscle mass and strength, this type of exercise also affects hemodynamics by reducing systolic and diastolic blood pressure, heart rate, and total peripheral resistance through decreased cardiovascular reactivity to psychophysiological stress in individuals with hypertension (Azmilia et al., 2024). The isometric exercise uses a grip device (Nopriani, 2025).

Research conducted by Azmilia et al. (2024) in RT 07 RW 06, Sawangan Depok, with a total of 18 subjects aged 46–65 years, showed that performing isometric handgrip exercise for 5 consecutive days for approximately 3 minutes resulted in a decrease in mean systolic blood pressure from 152.72 mmHg before the intervention to 140.50 mmHg after the intervention. Meanwhile, the mean diastolic blood pressure before isometric handgrip exercise was 72 mmHg, and after the intervention it increased to 80.33 mmHg (Azmilia et al., 2024).

Elderly gymnastics is a type of light physical exercise that involves regular movements and can be easily performed by older adults. In addition to maintaining muscle and joint flexibility, this form of exercise also helps balance blood pressure and increase insulin response, thereby supporting the regulation of blood sugar levels (Maldini & Surabaya, 2024). Elderly gymnastics can be used as an exercise option to improve the health and fitness of older adults.

Its regular implementation has a positive impact on improving elderly health (Laughter et al., 2024).

Research conducted by Sriwahyuni and Astuti (2023) at the Batumalonro Health Center, Gowa Regency, with 23 subjects aged 45–>90 years, showed that after 4 weeks of elderly gymnastics, the average blood pressure decreased from 151.09/80.00 mmHg before the intervention to 148.87/79.83 mmHg after the intervention. Research by Saeroji et al. (2022) at the Karang Mulya Health Center, Pangkalan Banteng District, West Kotawaringin Regency, with 100 subjects aged 49–55 years, showed that after 4 weeks of gymnastics, the average blood sugar level decreased from 286.52 mg/dL before the intervention to 262.56 mg/dL after the intervention.

A preliminary study was conducted on 3 November 2025 in Kebumen Regency, specifically in the Mutiara Sari Kebumen Elderly Community, Central Java. The observations showed that this community is newly established, with members aged 43–74 years. The total number of community members reached 100 people, and interviews with 60 attending members found that 22 had a history of hypertension and 18 had a history of diabetes mellitus. In addition, interviews and observations indicated that the elderly in the Mutiara Sari Kebumen Elderly Community are not homebound seniors who merely enjoy old age without activities; instead, they carry out activities every Tuesday, indicating that the community is active and organized.

Based on the above background and several sources on elderly gymnastics and isometric handgrip exercise, the researchers are interested in adding an isometric handgrip exercise intervention to elderly gymnastics to examine the effects of each intervention. Isometric handgrip exercise is added to determine whether it can be combined with elderly gymnastics as one of the methods to lower blood sugar levels and blood pressure. Therefore, the researchers chose the study title: “The Effect of Isometric Contraction Exercises of the Forearm in Elderly Gymnastics on Blood Sugar Levels and Blood Pressure in the Elderly.” Based on the background described above, the research problems can be formulated as follows: first, is there an effect of elderly gymnastics on blood sugar levels and blood pressure in the elderly? Second, is there an effect of adding isometric handgrip exercise to elderly gymnastics on blood sugar levels and blood pressure in the elderly? Third, is there a difference in effect between adding isometric handgrip exercise to elderly gymnastics and elderly gymnastics alone on blood sugar levels and blood pressure in the elderly?

The general objective of this study was to determine the effect of elderly gymnastics and the addition of isometric handgrip exercise on blood sugar levels and blood pressure in the elderly. The specific objectives were: to determine the effect of elderly gymnastics on blood sugar levels and blood pressure in the elderly; to determine the effect of adding isometric handgrip exercise to elderly gymnastics on blood sugar levels and blood pressure in the elderly; and to determine the difference in effect between adding isometric handgrip exercise to elderly gymnastics and elderly gymnastics alone on blood sugar levels and blood pressure in the elderly. This research is expected to provide both theoretical and practical benefits. Theoretically, this study contributes to the development of knowledge in the field of physiotherapy and geriatric health, particularly regarding non-pharmacological interventions for controlling blood sugar levels and blood pressure in the elderly. Practically, the results of this study can be used as a reference for healthcare professionals, especially physiotherapists, in designing effective exercise programs for the elderly. For the Mutiara Sari Kebumen Elderly

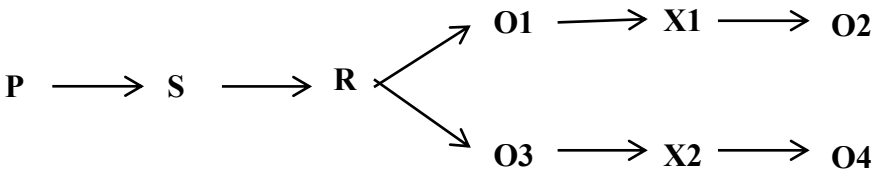
Community, this research provides evidence-based recommendations for physical activity programs that can help maintain the health of its members. For future researchers, this study can serve as a foundation for further investigations on the combination of different exercise modalities in managing degenerative diseases in the aging population. Additionally, this research promotes the importance of regular physical activity as a preventive and therapeutic approach for non-communicable diseases among the elderly.

RESEARCH METHODS

Research Design

The type of research used is *quasi-experimental* with *pre-test and post-test research design methods with control group design*. The design involved two treatment groups with two bound variables measured, namely blood sugar levels and blood pressure, both before and after the intervention. The design of this study was used to determine the effect of *isometric handgrip exercise* in elderly gymnastics on blood sugar levels and blood pressure in the elderly. The experimental group in this study was given an intervention only in elderly gymnastics. Meanwhile, the control group was given elderly gymnastics with an additional *isometric handgrip exercise*. The control group was used as a comparison to see the effects of the intervention more objectively. Before being given treatment, measurements were taken using *Easy Touch GCU* for blood sugar levels during and *Sphygmomanometer* for blood pressure. The intervention was given 5 times a week for 4 weeks. After the entire series of interventions were completed, blood sugar and blood pressure levels were measured again, just like the measurement procedure before treatment.

Scheme 3. 1 Research Design



Description:
P : Population
S : Sample
R : *Random* Sample
O1: *Pretest* in the experimental group
X1 : Intervention in the experimental group
O2 : *Posttest* after intervention in the experimental group
O3 : *Pretest* on the control group
X2 : Intervention in the control group
O4 : *Posttest* after intervention in the control group

Research Variables

Variable

Independent *Variable*

The free variables in this study were *isometric handgrip exercise* and elderly gymnastics.

Dependent *Variable*

The bound variables in this study were blood sugar levels and blood pressure.

Population and Sample

Population

The population in this study is elderly in Kebumen Regency. The affordable population of all elderly members in the Mutiara Sari Elderly Community, Kebumen, Central Java is 34 people.

Sample

Number of Samples

Sample Size

The sample size in this study was determined using *a total sampling* of 34 people, which means that all samples in the population were used as respondents.

Sampling Technique

The sampling technique used in this study is *the total sampling technique.* Samples from the population must meet the following inclusion and exclusion criteria:

a) Inclusion Criteria:

(1) Member of the Mutiara Sari Kebumen Elderly Community.

(2) Aged between 60-74 years.

(3) Blood sugar values when they are more than 100 mg/dL and blood pressure is more than 130/89 mmHg

(4) Willing to participate in the research and sign *informed consent*.

b) Exclusion Criteria

(1) Respondents who use assistive devices.

(2) Respondents had heart disease.

c) Drop Out Criteria

(1) Respondents who were not present during the blood sugar and blood pressure checks after treatment.

(2) Respondents who were not willing to participate in the research program until the end.

(3) The respondent resigned in the middle of the study.

After the determination of the sample based on inclusion and exclusion criteria, the next is the division of the group into treatment groups and control groups. The division of this group was drawn randomly.

Data Processing and Analysis

Data Processing

At the data processing stage, there are 4 stages that must be done, namely: editing, coding, data entry, and tabulation.

Data Editing

The results of interviews or questionnaires obtained through questionnaires and blood sugar measurements with *Easy Touch GCU* and blood pressure were edited first using *Excel*. It is then put into the observation data table.

Coding

Data coding is a method to convert data from sentences or letters to numerical or numerical data that has been collected during research. This coding is done after the questionnaire has been edited.

Entry Data (*Editing*)

A process to enter data into *a Software Computer program.* The program used in this study is the SPSS program.

Tabulasi

Creating data tables according to the research objectives or desired by the researcher. This tabulation aims to simplify the hypothesis testing process.

Ethical Clearance

Obtain approval or written information provided by the research ethics commission for research involving living beings.

Data Analysis

The data analysis techniques used in this study are descriptive and analytical.

Descriptive Statistics

The description of the data in the characteristics of the respondents taken in the study presented in the frequency table consisted of data on age, sex, BMI, physical activity, smoking, and diet.

Statistical Analysis

Normality Test

Normality test to determine the appropriate statistical test that needs to be known whether the data is normally distributed using a parametric test with a $p>0.05$ value. Meanwhile, abnormally distributed data was used a non-parametric test with a value of $p<0.05$. The normality test of the research data used the *Saphiro Wilk Test*.

Homogeneity Test

The data homogeneity test uses *Lavene's test* which aims to determine data variation or data stability because the data must be stable and not change systematically. If the value of $p>0.05$ means that the data is homogeneous, while if the value of $p<0.05$ indicates that the data is not homogeneous.

Hypothesis Test

Hypotheses I & II

Hypothesis tests I & II in this study used a *paired sample t-test* hypothesis test if the data were normally distributed, if the data were not normally distributed using *the Wilcoxon hypothesis test*. If $p<0.05$, then Ha is accepted and Ho is rejected.

Hypothesis III

Hypothesis test III to determine the difference in the effect of adding *isometric handgrip exercise* in elderly gymnastics to elderly gymnastics on blood sugar levels and blood pressure in the elderly. This study is for hypothesis III data that are normally distributed using the *Independent Sample T-Test* hypothesis test, while the data that are abnormally distributed use *the Mann Whitney U-Test.* This test aims to determine the significance of the difference in values from the two sample groups. If $p<0.05$, Ha is accepted, and Ho is rejected.

RESULTS AND DISCUSSION

Blood Sugar Levels Before and After Exercise for the Elderly

It showed that the average value of blood sugar levels in the elderly exercise group before treatment was 198.82 mg/dl and the standard deviation value was 19.475 with a maximum value of 243 mg/dl and a minimum value of 167 mg/dl. Meanwhile, the average blood sugar level value in the elderly gymnastics group after treatment was 188.47 mg/dl and

the standard deviation value was 19.375 with a maximum value of 230 mg/dl and a minimum value of 151 mg/dl.

Blood Sugar Level Values Before and After *Isometric Handgrip Exercise* and Elderly Exercise

It showed that the average value of blood sugar levels in the *isometric handgrip exercise* and elderly gymnastics group before treatment was 205.06 mg/dl and the standard deviation value was 36.639 with a maximum value of 303 mg/dl and a minimum value of 157 mg/dl. Meanwhile, the average blood sugar level value in *the isometric handgrip exercise* and elderly gymnastics group after treatment was 189.82 mg/dl and the standard deviation value was 36.880 with a maximum value of 289 mg/dl and a minimum value of 140 mg/dl.

Blood Pressure Values Before and After Elderly Exercise

It showed that the average blood pressure value in the elderly gymnastics group before treatment was 155.47/96.65 mmHg and the standard deviation value was 14.036 for systolic and 5.326 for diastolic with a maximum value of 189/106 mmHg and a minimum value of 137/87 mmHg. Meanwhile, the average blood pressure value in the elderly gymnastics group after treatment was 144.29/91.76 mmHg and the standard deviation value was 13.195 for systolic and 3.930 for diastolic with a maximum value of 171/99 mmHg and a minimum value of 128/85 mmHg.

Blood Pressure Values Before and After *Isometric Handgrip Exercise* and Elderly Gymnastics

The average blood pressure value in the *isometric hangdrip exercise* and elderly gymnastics group before treatment was 145.18/96.29 mmHg and the standard deviation value was 17.454 for systolic and 7.840 for diastolic with a maximum value of 201/107 mmHg and a minimum value of 131/80 mmHg. Meanwhile, the average blood pressure value in *the isometric hangdrip exercise* and elderly gymnastics group after treatment was 146.59/89.06 mmHg and the standard deviation value was 13.421 for systolic and 6.005 for diastolic with a maximum value of 183/98 mmHg and a minimum value of 130/80 mmHg.

Statistical Analysis Test Results

Normality Test

The normality test is used *as a normality* test because this test is more accurate for small samples or the number of samples is less than 50 people. The results of *the sapphire wilk test* can be seen in the following table:

Normality of Blood Sugar Level Measurement Data for Treatment Groups and Control Groups

The result of the normality test with *the shapiro wilk test* in group I before being given treatment was 0.888 and after being given treatment was 0.957, this shows that the data is distributed normally because p>0.05. Meanwhile, in group II before being given treatment it was 0.148 and after being given treatment it was 0.127, this shows that the data is distributed normally because p>0.05.

Normality of Blood Pressure Measurement Data for Treatment Groups and Control Groups

The results of the normality test with Shapiro wilk test in group I before treatment were 0.149 for systolic and 0.674 for diastolic, while after treatment was 0.064 for systolic and 0.912 for diastolic, this indicates that the data is normally distributed because p>0.05. Meanwhile, in group II before treatment, it was 0.088 for systolic and 0.284 for diastolic, while after treatment was 0.089 for systolic and 0.304 for diastolic, this shows that the data is normally distributed because p>0.05.

Homogeneity Test

The homogeneity test in this study uses *the Levene's Test*. The homogeneity test aims to find out whether the population of data obtained from the same variant is or not.

Homogeneity of Sugar Content Measurement Data

The results of the homogeneity test with *the lavene's Test*, where the *results of the lavene's test* before being given treatment were 0.064, this shows that the data is homogeneous because the p>0.05 value. Meanwhile, after being given the treatment was 0.069, this shows that the data is homogeneous because the p>0.05 value.

Homogeneity of Blood Pressure Data

The results of the homogeneity test with *the lavene's test*, where the *results of the lavene's test* before being given treatment were 0.508 for systolic and 0.53 for diastolic, this shows that the data is homogeneous because of the p>0.05 value. Meanwhile, after being given treatment, it was 0.975 for systolic and 0.54 for diastolic, this shows that the data is homogeneous because the p>0.05 value is used.

Hypothesis Test

The results of hypothesis test III with *independent sample t-test*, where the results of *the independent sample t-test* were p = 0.894 for the result of blood sugar levels, this shows that p > 0.05 so that the Ha data was rejected and Ho was accepted. Therefore, it was concluded that there was no difference between elderly gymnastics and the addition of *isometric handgrip exercises* in elderly gymnastics to reduce blood sugar levels and blood pressure in the elderly in the Mutiara Sari Kebumen Elderly Community or the treatment given to groups I and II did not have a significant difference in the reduction of blood sugar levels and blood pressure in the elderly. Meanwhile, for blood pressure results, the results of *the independent sample t-test* were p = 0.619 for systolic and p = 0.130 for diastolic, this shows that p > 0.05, so that the Ha data was rejected and Ho was accepted. So it was conveyed that there was no difference between elderly gymnastics and the addition of *isometric handgrip exercises* in elderly gymnastics to reduce blood pressure and blood pressure in the elderly in the Mutiara Sari Kebumen Elderly Community.

The Effect of Elderly Exercise on Blood Sugar Levels and Blood Pressure in the Elderly

The Effect of Elderly Exercise on Blood Sugar Levels

The results of the processing of blood sugar level values before and after treatment in the hypothesis test I of the elderly gymnastics group using *paired sample t-test* obtained a value of p=0.000, this shows that p<0.05 so that the Ha data is accepted and Ho is rejected. The data from the measurement of blood sugar levels with *Easy Touch GCU* before treatment obtained a blood sugar level value with a *mean* of 198.82 mg/dl and after treatment a blood sugar level value with a *mean* of 188.47 mg/dl. So it can be concluded that there is an influence of elderly gymnastics on reducing blood sugar levels in the elderly in the Mutiara Sari Kebumen Elderly Community.

Gymnastics for the elderly has an effect on the decline of the cardiovascular system and facilitates the burning of glucose and fat stored in the body, which is then converted into energy. In the implementation of elderly gymnastics in group I, movements involve all joints, including the hands, hips, and legs, thereby improving body fitness and overall physical activity. This contributes to improved blood circulation and oxygen, which supports the function of insulin in transferring glucose into cells to be converted into energy. In addition, elderly gymnastics promotes calorie burning and increased energy expenditure, which plays a role in weight management. Optimal weight also promotes blood glucose level control.

This is supported by research conducted by *Daud et al.,* (2022) Elderly gymnastics which is carried out regularly twice a week shows a change in blood glucose levels in the elderly. The results showed that the average blood glucose level before the elderly was 137.76 mg/dL with a median of 112 mg/dL, while after the exercise the elderly decreased to 134.33 mg/dL with a median of 104 mg/dL. The decrease in blood glucose levels occurs because during the implementation of gymnastics, the body performs physical activities that involve muscle contractions, so that blood glucose is used as the main source of energy. This physical activity increases the use of glucose by body cells during the movement process, which ultimately makes blood glucose levels after gymnastics for the elderly lower when compared to levels before gymnastics. This shows that elderly gymnastics that are routinely performed twice a week have an effect on reducing blood glucose levels while in the elderly.

In addition, according to research conducted by Amir *et al.,* (2021) that elderly gymnastics which is carried out twice per week for four weeks with a duration of 15-20 minutes is able to reduce blood glucose levels, with an average value *Pre-intervention* 171 mg/dL becomes 147 mg/dL. Physiologically, the activity of gymnastics for the elderly involves muscle and joint movements which have an impact on increasing calorie burning in the body, thereby increasing the number and mechanism of action of cellular insulin receptors. When the number and mechanism of action of insulin receptors increases, the absorption of glucose into the cells increases, which ultimately lowers the level of glucose in the blood. Furthermore, elderly gymnastics also regulates the control of blood glucose levels through the pathway *psychoneuroendocrinology.* This occurs when gymnastics is able to create a feeling of happiness and while causing a sense of comfort and pleasure in the respondents, which contributes to a decrease in blood glucose levels in patients with diabetes mellitus through inhibition of the secretion of hormones such as epinerfin, cortisol, glucagon, corticosteroids, thyroid hormones, and adrenocorticotropic hormone (ACTH).

The Effect of Elderly Gymnastics on Blood Pressure

The results of the processing of blood pressure values before and after treatment in the hypothesis test I of the elderly gymnastics group using *a paired sample t-test* obtained a value of p=0.000, this shows that p<0.05 so that the Ha data is accepted and Ho is rejected. The data from blood pressure measurement with *a Sphygmomanometer* before treatment obtained a blood pressure value with a *mean* of 155.47/96.65 mmHg and after treatment a blood pressure value with a *mean* of 144.29/91.76 mmHg. So it can be concluded that there is an influence of elderly gymnastics on reducing blood pressure in the elderly in the Mutiara Sari Kebumen Elderly Community.

Elderly exercise has an effect on lowering blood pressure. Lack of physical activity, such as gymnastics, can also result in hypertension due to a decrease in *cardiac output* (cardiac

output) so that pumping to the heart becomes less. In addition, lack of physical activity can also cause stiffness in blood vessels, inhibit blood flow, and trigger hypertension.

Physiologically, a number of elderly gymnastics movements involve the lower limbs (*hamstrings, quadriceps, gastrocnemius, soleus, Achilles tendon,* and *calcaneus*), ankles, upper arms (*deltoid, biceps, triceps*), and abdominals. This activity increases muscle contraction as an effector in maintaining body balance. The physiological response to physical activity includes an increase in cardiac output, which is accompanied by a more optimal distribution of oxygen to the tissues of the body that need it, while in less active areas vasocontrextricity occurs, such as in the *digestive tract*. The increase in heart output directly affects blood pressure.

According to Fitrina *et al.,* (2025) The implementation of elderly gymnastics is effective in lowering blood pressure in the elderly with hypertension. The average blood pressure before the intervention was recorded at 160.76 mmHg for systolic and 97.62 mmHg for diastolic, which then decreased to 146.52 mmHg and 88.62 mmHg after elderly exercise. This decrease suggests that physical exercise for the elderly, as a form of light activity, can improve the elasticity of blood vessels and improve the function of the cardiovascular system, thus making a significant contribution to blood pressure management in the elderly population with hypertension.

Then supported by research by Rahmiati & Zurijah, (2020) that regular physical exercise such as gymnastics for the elderly can restore the heart valves that were previously experienced *Multiple Sclerosis* and the thickening will return to normal. This prevents the occurrence of myocardial contractions, facilitates the contraction of the heart muscle, and stabilizes the contents of the heart and volume without any increase. As a result, blood pressure does not increase or may even decrease.

The Effect of *Adding Isometric Handgrip Exercise* in Elderly Gymnastics on Blood Sugar Levels and Blood Pressure in the Elderly

The Effect of *Adding Isometric Handgrip Exercise* in Elderly Exercise on Blood Sugar Levels

The results of the processing of blood sugar level values before and after treatment in the hypothesis II test of the group of *isometric handgrip xercise* addition in elderly gymnastics using *paired sample t-test* obtained a value of p=0.000, this shows that p<0.05 so that the Ha data is accepted and Ho is rejected. The data from the measurement of blood sugar levels with *Easy Touch GCU* before treatment obtained a blood sugar level value with a *mean* of 205.06 mg/dl and after treatment a blood sugar level value with a *mean* of 189.82 mg/dl. So it can be concluded that there is an influence of elderly gymnastics on reducing blood sugar levels in the elderly in the Mutiara Sari Kebumen Elderly Community.

The addition of *isometric handgrip exercise* in elderly exercise has an effect on reducing blood sugar levels through physiological mechanisms involving increased blood flow and glucose metabolism. Isometric exercises, which involve static muscle contractions without movement, contribute to an increase in local blood pressure and blood flow to peripheral tissues, including skeletal muscles. This triggers the secretion of insulin-like hormones from the pancreas and increases insulin seccivitycity in the body's cells, thus facilitating a more efficient absorption of glucose by muscles for energy. In the elderly, who often experience insulin resistance due to aging, this exercise plays a role in lowering blood glucose levels by increasing glucose consumption during physical activity and optimizing hormonal regulation.

According to Amalia & Fayasari, (2025) that isometric exercises use *Grip*, can have a positive effect on the management of blood sugar levels. This exercise involves muscle contractions without any change in muscle length, which can increase muscle strength. Regular isometric exercise can help improve blood sugar level control, as stronger, active muscles can improve insulin sensitivity and improve glucose metabolism.

Then supported by research by Divya *et al.,* (2025) that isometric exercise can lower HbA1c levels, which is considered an average indicator of blood sugar levels over the past three months. This decrease occurs through increased insulin sensitivity and increased the body's ability to regulate glucose more efficiently. In addition, this exercise also helps to reduce weight and improve metabolic function, which contributes to the overall decrease in blood sugar levels. When performing isometric exercises, the muscles work without experiencing changes in length, which helps to increase muscle mass. This increase in muscle mass plays an important role because muscles are the main place of glucose use, thereby increasing the body's capacity to absorb and utilize glucose from the blood.

Difference in the Effect of *Adding Isometric Handgrip Exercise* on Elderly Gymnastics with Elderly Gymnastics on Blood Sugar Levels and Blood Pressure in the Elderly

Difference in the Effect of *Adding Isometric Handgrip Exercise* on Elderly Gymnastics and Elderly Gymnastics on Blood Sugar Levels

The difference in the effect of adding *isometric handgrip exercise* on elderly gymnastics with elderly gymnastics in hypothesis test III was carried out by *independent sample t-test*, where p=0.894 was obtained, this shows that $p > 0.05$ so it is concluded that there is no significant difference between elderly gymnastics and the addition of *isometric handgrip exercise* in the exercise of the elderly against the reduction of blood sugar levels in the elderly. This is because both interventions are equally effective in lowering blood sugar levels, where both groups do physical activity, not in a state of silence or without exercise.

However, if you look at the *mean* value, the difference is the most in the group of adding *isometric handgrip exercises* in elderly gymnastics, so it is concluded that on average the addition of *isometric hangdrip exercise* is better than just elderly gymnastics.

A decrease in blood sugar levels indicates a small but significant change in the body's glucose regulation. This decrease may reflect an increase in insulin sensitivity or the effectiveness of noninsulin mechanisms such as the activation of the AMPK pathway that helps increase the absorption of glucose by the body's cells, especially the muscles and liver. *Insulin Signaling* is the process by which insulin binds to its receptors on the cell surface, then activates pathways such as PI3K-Akt that facilitate the transport of glucose into cells via GLUT4. In the context of diabetes management, a decrease in blood sugar levels of this magnitude can help reduce the risk of long-term complications, such as damage to blood vessels and vital organs, as well as improve overall glucose control. In addition, the body is able to adapt well to factors such as physical exercise and lifestyle changes that increase glucose metabolism. Regular and measured exercise can increase the AMPK pathway and improve GLUT4 function, thus helping to lower blood sugar levels effectively without relying entirely on insulin (Zhang *et al.,* 2025).

Regular physical activity, such as gymnastics for the elderly, can increase insulin sensitivity, thereby improving the effectiveness of insulin's work in facilitating glucose absorption by cells. In the elderly, increased insulin sensitivity plays a role in regulating blood glucose levels which tend to rise due to the aging process and decreased metabolic function.

The addition of isometric exercise still contributed to muscle activation, but did not produce a significant difference in decreased blood glucose levels, as the mechanism of glucose regulation in both intervention groups took place through similar physiological pathways.

Blood glucose levels in the elderly are influenced by various external factors, such as food consumption patterns, adherence to pharmacological therapies, and individual metabolic conditions. These factors can cause variations in blood glucose levels between subjects and affect the measurement results.

Supported by research by Imron *et al.,* (2025) that isometric exercise can help lower blood sugar levels by improving insulin sensitivity and improving glucose metabolism. Through muscle contractions without any change in length, this exercise stimulates the absorption of glucose by the muscles more efficiently, thus helping to reduce glucose levels in the blood. In addition, isometric exercise can also improve blood flow and improve vascular function, which contributes to better glucose regulation.

Then supported by research by Saeroji *et al.,* (2022) In the Karang Mulya Health Center Area, Pangkalan Banteng District, West Kotawaringin Regency, that elderly gymnastics carried out for 4 weeks was able to lower blood sugar levels with the average blood sugar level before doing elderly gymnastics was 286.52 mg/dl and the average blood sugar level after doing elderly gymnastics was 262.56 mg/dl. This decrease shows that physical activity in the form of gymnastics for the elderly is effective in helping to control blood glucose levels in the elderly. The decrease in blood sugar levels after doing gymnastics for the elderly occurs because physical activity increases the burning of glucose in the muscles as energy, so that glucose levels in the blood are reduced. In addition, exercise also increases insulin sensitivity, which helps the body use glucose more efficiently.

Therefore, it can be concluded that the elderly gymnastics group and the addition of *isometric handgrip exercises* to elderly gymnastics have the same effect on reducing blood sugar levels in the elderly in the Mutiara Sari Kebumen Elderly Community.

Difference in the Effect of *Adding Isometric Handgrip Exercise* on Elderly Gymnastics and Elderly Gymnastics on Blood Pressure

The difference in the effect of adding *isometric handgrip exercise* on elderly gymnastics with elderly gymnastics in hypothesis test III was carried out by *independent sample t-test*, where p= 0.619 was obtained for systolic and p= 0.130 for diastolic, this shows that $p > 0.05$ so it is concluded that there is no significant difference between elderly gymnastics and the addition of *isometric handgrip exercise* on elderly gymnastics against blood pressure reduction in the elderly. This is because both intervention groups do physical activity that can increase the work of the heart and blood vessels, thereby facilitating blood flow and helping to lower blood pressure. In addition, the success of the intervention was also influenced by the participation of the elderly who were cooperative and able to participate in exercises guided by researchers on a regular basis.

Elderly gymnastics and *isometric handgrip exercise* are forms of low- to moderate-intensity physical activity that are safe for the elderly. Both types of exercises integrate the physiological elements of the exercise, including muscle stretching, strengthening, and breathing regulation, which contribute to increased vascular elasticity and decreased peripheral resistance. During exercise, the perfusion of blood to the muscles and tissues increases, accompanied by peripheral vasodilation, which results in a gradual decrease in blood pressure.

According to research by Bahtiar *et al.,* (2023) systolic blood pressure and diastole *Post intervention isometric handgrip exercise* who were given the intervention for 2 times a week for 2 weeks in the afternoon decreased, meaning that there was an effect of action *Isometric Handgrip Exercise* against a decrease in blood pressure. Isometric exercises result in muscle compression on blood vessels, which creates ischemic stimulus and *Shear Stress*. This ischemic stimulus induces increased flow of the brachial artery to reduce the effects of ischemia. When pressure is released, blood flow in the lower blood vessels of the arm increases due to distal dilation, thus causing *Shear Stress* in the brachial artery. *Shear stress* triggers the release of *Nitric oxide* (NO) of endothelial cells, which act as the main vasodilator.

Then supported by research by Safarina *et al.,* (2022) That elderly gymnastics which was carried out for 2 weeks with a frequency of gymnastics 3 times a week found a significant decrease in systolic blood pressure and diastolic blood pressure in hypertensive patients after intervention. The results of blood pressure reduction in respondents varied, because there were other factors that caused blood pressure to drop. Physical exercise such as gymnastics for the elderly will improve heart function so that it can increase the pumping power of the heart muscle, by increasing the strength of the heart muscle, then the elasticity of blood vessels is maintained, so that blood flow becomes smooth and there is a decrease in blood.

Therefore, it can be concluded that the elderly gymnastics group and the addition of *isometric handgrip exercise* to the elderly have the same effect on reducing blood pressure in the elderly in the Mutiara Sari Kebumen Elderly Community.

CONCLUSION

Based on the discussion of the research results on the comparison between elderly gymnastics alone and the addition of isometric handgrip exercises to elderly gymnastics in reducing blood sugar levels and blood pressure among the elderly in the Mutiara Sari Kebumen Elderly Community, it can be concluded that there is a significant effect of elderly gymnastics on reducing blood sugar levels and blood pressure in the elderly. Similarly, there is a significant effect of adding isometric handgrip exercise to elderly gymnastics on reducing blood sugar levels and blood pressure in the elderly. However, there was no significant difference in the effect between elderly gymnastics alone and the addition of isometric handgrip exercise to elderly gymnastics in reducing blood sugar levels and blood pressure, indicating that both interventions are equally effective. Furthermore, no relationship was found between physical activity and blood sugar levels and blood pressure in the elderly in this community.

Based on the findings of this study, several suggestions can be made. For the Mutiara Sari Kebumen Elderly Community, it is recommended to continue implementing regular elderly gymnastics programs as an effective and accessible intervention for maintaining blood sugar levels and blood pressure within normal ranges. For healthcare professionals, particularly physiotherapists, both interventions can be considered viable options in designing exercise programs for the elderly, with the choice depending on individual preferences and conditions. For future researchers, it is recommended to conduct studies with longer intervention periods, larger sample sizes, and more diverse populations to obtain more comprehensive results. Additionally, further research could explore the combination of isometric handgrip exercise with other types of physical activity and investigate the long-term effects of these interventions

on the health status of the elderly. Regular monitoring and evaluation of physical activity programs are also essential to ensure their effectiveness and sustainability in managing degenerative diseases in the aging population.

REFERENCES

Amalia, V., & Fayasari, A. (2025). Monitoring of Diabetes Mellitus Diet Compliance and Handgrip Strength with Pre-Elderly Blood Sugar Levels in the Working Area of Pandak 2 Health Center. 9, 106–117. https://doi.org/10.20884/1.jgipas.2025.9.1.14736

Amir, F., Suhartutik, S., & Lutf, M. (2021). Application of Elderly Gymnastics in Increasing Eustress and Blood Glucose Control in Type 2 Diabetes Mellitus Patients. Scientific Journal of Nursing.

Andi, S., Lilla, M., & Dafir, F. A. (2023). Factors that affect the stability of blood sugar in people with diabetes mellitus in adulthood and the elderly. Scientific Journal of Health Media Husada, 12 (November), 98–106.

Azmilia, U., Setiawan, R. A., & Oktavia, A. R. (2024). The Effect Of Isometric Handgrip Exercise And Watermelon Juice On Reducing Blood Pressure In Hypertension Sufferers In The RT 07 RW 06 Salinization Sawangan Depok Area. Journal of Eduhealth, 15(02), 1481–1494. https://doi.org/10.54209/eduhealth.v15i02

Bahtiar, H., Ariyanti, M., Nur, D., Purqoti, S., Nurainun, B., & Idris, A. (2023). Differences in the Effectiveness of Isometric Handgrip Exercises and Autogenic Relaxation on Changes in Blood Pressure in Hypertensive Patients. Journal of Prima Studies, 9(2), 16–28.

BPS. (2023). Statistics of the Elderly Population in 2023. In the Central Bureau of Statistics (Vol. 20).

BPS. (2024). Statistics of the Elderly Population in 2024 (Vol. 21). Central Statistics Agency.

BPS Central Java. (2021). Health Profile of Central Java Province 2021. Central Statistics Agency of Central Java Province.

Central Java Health Office. (2024). Health Profile of Central Java Province in 2023. In Central Java Provincial Health Office (Vol. 14). BPS Central Java Province.

Divya, N., Kumar, V. M., Sabu, A., Winnie, T. E., & Shri, P. P. (2025). Effect of Isometric and Dynamic Resistance Exercises on Functional Performance and Glycoprotein-bound Haemoglobin of Type 2 Diabetes Mellitus Patients with Knee Osteoarthritis : An Interventional Study. https://doi.org/10.7860/JCDR/2024/71185.20216

Elfaria, Y., & Retnani, C. T. (2025). Health education recognizes the concept of aging in the elderly: understanding the concept of aging in the elderly. Journal of Addiction, 2(1), 24–27.

Fahdhienie, F., Savitri, H., & Darwis, A. (2022). Education on the Prevention of Infectious and Non-Communicable Diseases in the Community in Aceh Besar Regency. Journal of Solar Society, 7(1), 53–59. https://doi.org/https://doi.org/10.26714/jsm.7.1.2024.53-59

Febriza, A., Nurmila, N., Sahabuddin, R., Ibrahim, J., Faidah, N., Khairunnisa, Anurogo, D., Mappanyompa, F., Nelly, Syahrir, A., Fitria, A., Samsani, & Bahjah, D. (2025). Increasing Awareness and Early Detection of Hypertension and Diabetes Mellitus in the Elderly in Baruga Hamlet, Maros Regency through Counseling and Health Examinations. Journal of Community Service: Empowerment, Innovation and Change,

5(5), 43–51. https://doi.org/10.59818/jpm.v5i5.1935

Fitrina, Y., Andri, Putri, E. J., & Putra, A. S. (2025). The Effect of Elderly Gymnastics on Blood Pressure in Hypertensive Elderly in the Working Area of the Muaro Paiti Health Center in 2024. Journal of Medical Science, 16, 178–188.

Hidayat, S. (2025). In 2026 the Number of Elderly in Kebumen is Estimated to Reach 223,360 People, DPRD Encourages Elderly Welfare Regulation. https://kebumen.sorot.co/berita-11647-tahun-2026-jumlah-lansia-di-kebumen-diperkirakan-capai-223360-jiwa-dprd-dorong-perda-kesejahteraan-lansia.html

Imron, M. A., Adiatmika, I. P. G., & Jawi, I. M. (2025a). Exercise and Chronic Diseases: A Scoping Review. 5572, 5–10. https://doi.org/10.22146/rpcpe.103256

Imron, M. A., Adiatmika, I. P. G., & Jawi, I. M. (2025b). Isotonic and Isometric Muscle Contraction Exercises to Reduce Interleukin-6 and Enzyme Cox-2 in Post-Exercise Muscle Injury. 54(2).

Jehaman, I., Asiyah, N., Berampu, S., & Siahaan, T. (2021). The effect of Otago Exercise and Gaze Stability Exercise on balance in the elderly. Journal of Nursing and Physiotherapy (JKF), 4(1), 47–56. https://doi.org/10.35451/jkf.v4i1.823

Maldini, M. G., & Surabaya, U. N. (2024). The Relationship of Elderly Gymnastics on Blood Pressure and Blood Sugar of the Elderly in Kalitengah Blitar Village. 3(2013), 25–40.

Nopriani, Y. (2025). Comparison of Isometric Handgrip Exercise and Walking on Blood Pressure in Hypertension Patients at the Sekip Palembang Health Center. Journal of Community Service and Educational Research, 4(1), 4674–4682. https://doi.org/10.31004/jerkin.v4i1.2371

Patandean, D., Dwi, K., & Asnuddin, S. (2025). Optimization of Elderly Posyandu Through Health Checks in Sumare Village, Mamuju Regency Abstract. 1(1), 12–22.

Putri, F., Dasuki, & Astuti, A. (2024). The Effect of Isometric Handgrip Exercise on Blood Pressure Changes. Journal of Nursing Science, 5(3), 130. http://lib.ui.ac.id/detail?id=20404253&lokasi=lokal

Rahma, A. N., Khasanah, S., & Susanti, I. H. (2025). Overview of Blood Sugar Levels and Blood Pressure of Type 2 Diabetes Mellitus at Kalibagor Health Center. Journal of Medical Sciences Research, 4(1), 96–109. https://doi.org/10.55606/jurrike.v4i1.4445

Rahmiati, C., & Zurijah, T. I. (2020). The Effect of Elderly Gymnastics on Blood Pressure in the Elderly with Hypertension. Journal of Physical Therapy, 7(1), 15–27.

Saeroji, M., Syahleman, R., & Supriyatna, Y. (2022). The Effect of Elderly Gymnastics on Blood Sugar Levels During Type II Diabetes Mellitus Patients in Menopausal Women in the Karang Mulya Health Center Area, Pangkalan Banteng District, West Kotawaringin Regency. Journal of Borneo Scholars, 6(1), 34–45.

Safarina, L., Fuji, N., & Pragholapati, A. (2022). Elderly Exercise Against Blood Pressure In Elderly With Hypertension. Silampari Journal of Nursing, 5, 1284–1291.

Sukmara, U. P., & An-Ti, S. (2025). Raising Awareness of Non-Communicable Disease Prevention in Hypertension and Diabetes Mellitus through Education in the Community. Journal of Medicine, 4(3), 436–441.

Wikandari, R. J., Rosidah, U., Auliya, Q. A., & Qomariyah, N. (2025). Optimizing the Health of the Elderly through Elderly Gymnastics, Blood Pressure, Blood Sugar and Gout Checks. Journal of Community Service of the Nation, 3(3), 999–1005.

https://doi.org/10.59837/jpmba.v3i3.2347

Zhang, T., Liu, Y., Yang, Y., Luo, J., & Hao, C. (2025). The Effect and Mechanism of Regular Exercise on Improving Insulin Impedance : Based on the Perspective of Cellular and Molecular Levels. International Journal of Molecular Sciences, 1–14. https://doi.org/https://doi.org/10.3390/ijms26094199