

The Correlation Between the Duration of Diabetes Exercise Series 5 and Blood Sugar Levels Among Members of the Indonesian Diabetes Association (PERSADIA) at Mayapada Hospital Bogor

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Received : September 15, 2024

Accepted : October 08, 2024

Published : October 26, 2024

Citation: Pitdayani., Desvita, E., Herawati, L., Aryanti, E., & Syahwa, A. S. (2024). The Correlation Between the Duration of Diabetes Exercise Series 5 and Blood Sugar Levels Among Members of the Indonesian Diabetes Association (PERSADIA) at Mayapada Hospital Bogor. *Medicor : Journal of Health Informatics and Health Policy*, 2(4), 203-218.

<https://doi.org/10.61978/medicor.v2i4.395>

ABSTRACT: Diabetes Mellitus (DM) is a metabolic condition characterized by elevated blood glucose levels (hyperglycemia), caused by insufficient insulin secretion, impaired insulin activity, or both. One of the management strategies for Diabetes Mellitus is physical exercise. Diabetes exercise is a low-impact aerobic workout recommended by PERSADIA. The fifth series of diabetes exercise, with a duration of 40-60 minutes, is beneficial in converting glucose into energy, thus slowing the progression of diabetes. This study aims to determine the relationship between the duration of the fifth series of diabetes exercise and blood sugar levels in members of PERSADIA at Mayapada Hospital Bogor. The study uses a quantitative descriptive design with a quasi-experimental approach through a one-group pre-posttest design. The research subjects were members of PERSADIA who participated in diabetes exercise, with a total sample of 30 respondents. The results showed that almost all members of PERSADIA at Mayapada Hospital Bogor experienced a reduction in random blood sugar levels (93.3%) after performing diabetes exercise according to the standard operating procedure (40-60 minutes), while 2 members (6.7%) who did not follow the SOP and exercised for less than 40 minutes experienced an increase in blood sugar levels. Statistical analysis using the chi-square test showed a p-value of 0.000, indicating a significant relationship between the duration of the fifth series of diabetes exercise and blood sugar levels in PERSADIA members at Mayapada Hospital Bogor. Conclusion: Diabetes exercise can play a role in regulating blood glucose levels if conducted according to the principles of diabetes exercise, which include meeting the standards of frequency, intensity, duration, and type of exercise.

Keywords: Diabetes Mellitus, Duration of Diabetes Exercise Series 5, Blood Sugar Levels.



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INTRODUCTION

Health is one of the key factors in the development of a country's human resources. One factor that influences a region's health is lifestyle and three other factors: environment, healthcare services, and genetics. H. L. Bloom stated that four factors affect the level of health, namely: 1) lifestyle, 2) environment, 3) healthcare services, and 4) genetic (hereditary) factors (Ministry of

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Health, RI, 2019). These four determinants interact and influence a person's health status. The shift in disease patterns (epidemiological transition) over the past 30 years has been caused by societal lifestyle changes (A.C, 2018). In principle, the epidemiological transition process is marked by a shift in causes of death, which were previously dominated by infectious diseases and malnutrition (Piovani et al., 2022), to causes of death due to non-infectious diseases, known as non-communicable diseases (NCDs). Non-communicable diseases (NCDs) are the leading cause of death worldwide. One of the diseases classified as an NCD is Diabetes Mellitus. Diabetes Mellitus is a metabolic disorder characterized by chronic hyperglycemia caused by impaired or deficient insulin secretion, impaired response to the insulin hormone, or both (Damayanti, 2019). Diabetes mellitus is classified into four types: Type 1 DM, Type 2 DM, gestational DM, and other specific types of DM (Ega Safitri et al., 2022). The most common type of diabetes in the population is Type 2 Diabetes Mellitus, as this type tends to be related to a person's lifestyle and dietary habits (Fadilah et al., 2018).

WHO data shows that around 422 million people worldwide have diabetes, with the majority being in low- and middle-income countries (Fitriani & Fadilla, 2020). The International Diabetes Federation (2019) reports that the global number of diabetes mellitus sufferers has increased to 463 million people aged 20-79 years, equivalent to a prevalence rate of 9.3% of the total population in the same age group. Southeast Asia ranks third as the region with the highest number of diabetes mellitus (DM) sufferers globally, reaching 90.2 million people. Indonesia ranks fifth among the ten Southeast Asian countries, with 19.5 million people suffering from DM (Ginanjar et al., 2022). The 2018 Riskesdas data indicates that the prevalence of diabetes in Indonesia, based on doctor diagnoses in individuals aged ≥ 15 years, is 2%, an increase compared to the 2013 Riskesdas result of 1.5%. For West Java Province, the prevalence is 1.3%. West Java Province ranks 12th out of 34 provinces regarding diabetes mellitus prevalence. The prevalence of DM in West Java Province, based on doctor diagnoses in residents aged ≥ 15 years, is 1.7%. It is also mentioned that the prevalence of diabetes mellitus based on doctor diagnoses in residents aged > 15 years for the city of Bogor is 2.05%, an increase from 1.1% in 2013⁸. From the RISKESDAS data, it can be concluded that there is an increase in prevalence each year, with West Java Province and Bogor City having a prevalence above 1%, a relatively high figure compared to other regions (Kemenkes, 2019).

Diabetes, especially Type 2 Diabetes (T2DM), can be caused by various risk factors, such as an unhealthy lifestyle, the habit of consuming certain foods, poor sleep patterns, lack of physical activity, etc. The incidence of T2DM remains high due to individual habits and other factors such as heredity and an unhealthy lifestyle (Clara, 2018). Controlling blood sugar levels is a crucial aspect that must be considered for individuals with diabetes mellitus, as imbalances in blood sugar, whether too high or too low, can lead to potentially life-threatening complications. Possible impacts include vision problems such as cataracts, heart issues, kidney disorders, sexual dysfunction, wounds that are slow to heal and may even develop into gangrene, lung infections, vascular disorders, stroke, and more (Rhys & et al, 2021). Proper monitoring and management of Diabetes Mellitus are essential to prevent or reduce the risk of these complications. One of the steps in managing diabetes mellitus is non-pharmacological management, which includes meal

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planning and physical. Exercise or physical activity management is also one of the five pillars of diabetes management, alongside diet, medication, education, and monitoring. Physical activity involves body movements to increase and expend energy, which helps control blood sugar by converting glucose into energy (Primadi, 2021; RI, 2020).

In Indonesia, exercise programs for people with diabetes have been specially developed by the Indonesian Diabetes Association (PERSADIA), known as diabetes exercise. Diabetes exercise is an aerobic physical activity for diabetes patients, consisting of a series of movements selected to be performed to music, creating rhythmic patterns, continuity, and specific duration to achieve certain goals. The diabetes exercise program was developed by specialists in diabetes-related fields, including medical rehabilitation, internal medicine, health sports, nutritionists, and fitness experts. Diabetes exercise is performed regularly for thirty to sixty minutes, about three to five times a week (Lubis & Kanzasabilla, 2021). It is expected that with a regular and quality exercise routine, there will be a relationship between physical activity patterns and blood sugar levels. Mayapada Hospital Bogor is a private hospital in the city of Bogor and is one of the branches of the Mayapada Healthcare Group. It has a vision of being a leading healthcare service destination known for its high-quality services. With a mission dedicated to providing comprehensive and compassionate integrated healthcare services, Mayapada Hospital Bogor aims to become a superior healthcare facility, particularly in managing diabetes mellitus (DM). To achieve this, the hospital collaborates with PERSADIA Bogor City through the Marketing Commercial Department to implement physical activity programs for diabetes patients and the general public, specifically the diabetes exercise program.

Based on a preliminary study conducted by the researchers at Mayapada Hospital Bogor, it was found that the number of diabetes mellitus (DM) patients receiving outpatient care in August 2023 was 330 individuals. In September 2023, this number decreased to 303 individuals; in October 2023, it increased again to 319 individuals. The management strategies employed by the hospital to address this issue, in addition to pharmacotherapy management, include non-pharmacological management through a diabetes exercise program. The number of participants registered with PERSADIA at Mayapada Hospital is 64 individuals. The frequency diabetes exercise at Mayapada Hospital Bogor is conducted twice a month, led by instructors, for 40-60 minutes. The series of diabetes exercises routinely used by the instructors is Series 5.

The results of previous research by Kanzasabilla (2021) indicate that aerobic exercise can reduce blood glucose levels by up to 30 mg/dl. The average decrease of about 2% is associated with the exercise's volume, intensity, frequency, and repetition. It is essential to engage in physical activity regularly, at least three times a week, with aerobic exercises such as exercise classes and 30 minutes per session to influence blood sugar levels in individuals with type 2 diabetes (Kurdanti, 2018). However, there are also findings from Wittmeier (2010) and Saputra (2018), which indicate that the majority of respondents, after exercising, had blood glucose levels in the high category, accounting for 65.7%. Several factors identified in the research include dietary and activity patterns that are difficult to change (Lathifah, 2017).

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Based on the description above discusses changes in activity patterns in society leading to epidemiological transitions resulting in an increase in non-communicable diseases, one of which is diabetes mellitus (DM), caused by elevated blood sugar levels due to changes in community activity patterns. From several studies, it can be concluded that physical activity significantly affects blood sugar levels in patients with Type II DM. However, it remains to be seen whether the implementation of diabetes exercise has a relationship with the reduction of blood sugar levels in members of PERSADIA at Mayapada Hospital Bogor. Therefore, the researchers chose "The Relationship Between the Duration of Series 5 Diabetes Exercise and Blood Sugar Levels in Members of the Indonesian Diabetes Association (PERSADIA) at Mayapada Hospital Bogor." This study aims to determine The Relationship Between The Duration of Series 5 Diabetes Exercise and Blood Sugar Levels in Members of the Indonesian Diabetes Association (PERSADIA) at Mayapada Hospital Bogor.

METHOD

This research is a descriptive study with a quantitative nature, using a quasi-experimental research design with a one-group pre-post test design. This study was conducted at Mayapada Hospital Bogor from October 2023 to January 2024. The population in this study consists of all PERSADIA Mayapada Hospital Bogor members who participate in a single exercise session. The sampling technique used is purposive sampling, resulting in a total sample of 30 individuals. In this study, the tools used are a diabetes exercise SPO, a stopwatch, a glucometer, and an observation sheet. The research flow involves checking the respondents' blood sugar levels before they undergo diabetes exercise, after which the respondents are given treatment through a series of 5 diabetes exercises lasting 40-60 minutes while being observed for how long each respondent can participate in this diabetes exercise. After completing the series of 5 diabetes exercises, the respondents' blood sugar levels are rechecked and recorded on the observation sheet to analyze whether there was a decrease or increase in blood sugar levels corresponding to the duration of each respondent's exercise.

The results of this study used univariate analysis, which includes the characteristics of each variable, consisting of respondent characteristics, including gender, age of respondents, duration of suffering from diabetes mellitus (DM), time/duration of participating in diabetes exercise, and blood sugar levels before and after performing diabetes exercises. The distribution of statistical frequencies is presented in the form of tables and diagrams. Meanwhile, the bivariate analysis in this study used non-parametric statistical tests, employing the chi-square statistical test with a significance level of 0.05 if the results of this study show a probability value or Sig. < 0.05 indicates a significant difference between the duration of exercise and the blood sugar levels, meaning there is a relationship between the duration of diabetes exercise and the reduction in blood sugar levels.

RESULT AND DISCUSSION

Characteristics of PERSADIA Members at Mayapada Hospital Bogor

1. Gender

Figure 1. Frequency Distribution of PERSADIA Members by Gender at Mayapada Hospital Bogor (n=30)

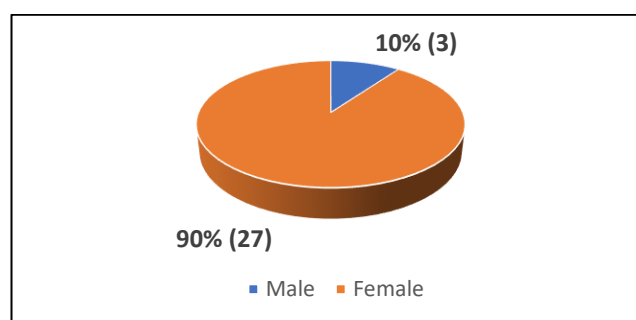


Figure 1 shows that nearly all members of PERSADIA at Mayapada Hospital Bogor are female (90%) or 27 members.

This data is consistent with the study by Febri (2020), which states that the subjects with type II diabetes mellitus in the study had a higher proportion of female respondents, totaling 17 respondents (56.7%), while male respondents totaled 13 (43.3%) out of the entire sample of 30 (Gunawan & Rahmawati, 2021).

Women are more likely to develop Diabetes Mellitus than men due to hormonal and metabolic factors, in which women experience monthly cycles and a decrease in estrogen hormones due to menopause. Estrogen hormone receptors on pancreatic β cells cause the release of insulin, the most crucial hormone in blood glucose homeostasis, and progesterone hormones, which have anti-insulin properties and can make cells less sensitive to insulin). In addition, the amount of fat in men is 15-20% of body weight, while women are 20-25% of body weight.

In addition, the amount of fat in men is 15-20% of body weight, while women are 20-25% of body weight. Thus, the increase in fat content in women is higher than that of men, so the factor of diabetes mellitus in women is 3-7 times higher than that of men, which is 2-3 times (Nurbaiti et al., 2020). Females have a higher risk of developing Diabetes Mellitus than males due to various factors, including hormonal influences and metabolic differences. The monthly cycle and the decline in estrogen hormone during menopause play a significant role (Nurvita et al., 2022). Additionally, estrogen receptors on pancreatic β cells are involved in insulin secretion, essential for maintaining blood glucose balance. Progesterone hormone also has an anti-insulin effect, which can make cells less responsive to insulin (Oktavianisya & Aliftitah, 2022). Women are also more likely to have a higher percentage of body fat than men, which can increase the risk of developing Diabetes Mellitus. According to research, this risk can be 3-7 times higher in females than in males, according to Imelda (2019). Based on the results of the study, researchers assume that women tend

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to be more at risk of developing type 2 Diabetes Mellitus because, in addition to hormonal factors, it is also because women tend to be too lazy to move, making the body not spend much carbohydrate and glucose for physical activity. This can trigger the arrival of metabolic diseases, one of which is Diabetes Mellitus.

2. Age of respondent

Figure 2. Frequency Distribution of PERSADIA Members by Age at Mayapada Hospital Bogor (n=30)

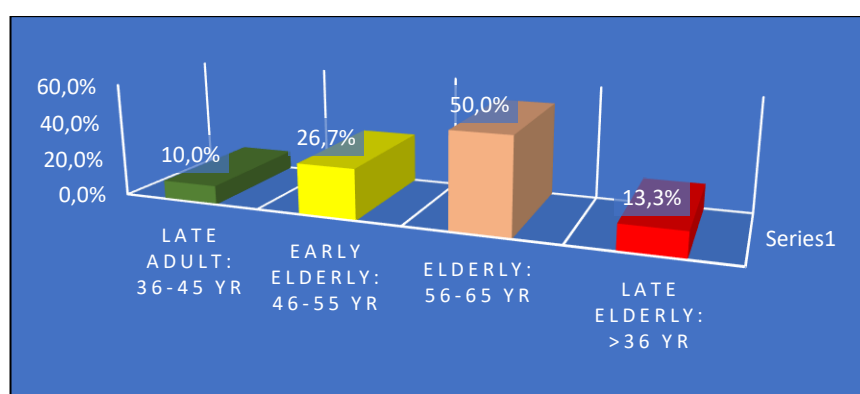


Figure 2 shows that half of the PERSADIA members at Mayapada Hospital Bogor are elderly (50%) or 15 members. Age is a significant risk factor in the development of diabetes mellitus. The incidence of type 2 DM tends to peak after the age of 40 years, as this age group has a higher risk of decreased glucose tolerance, which is associated with decreased peripheral cell sensitivity to insulin. The theory suggests that individuals above or equal to 45 years of age have a higher risk of developing diabetes mellitus and glucose intolerance due to degenerative factors that result in decreased body function in processing glucose. Age is not only the cause of this condition but also affects the length of time a person can survive the condition (Milita et al., 2021).

The results of this study are in line with research conducted by Nur Lailatul Latifah (2017), which shows that most people with type 2 diabetes mellitus are > 58 years old (52%). The theory states that a person aged ≥ 45 has a high level of risk for diabetes mellitus and glucose intolerance due to degenerative factors, namely the decline in body function for glucose metabolism. Age is the cause of this condition and how long the patient can survive.

Diabetes mellitus often appears after a person enters the vulnerable age range, namely after the age of 45 years. The results of the 2018 regional health research analysis conducted by Milita, Handayani, and Setiaji showed that of the 3,953 respondents who suffered from type 2 DM, the age range of 60-64 years was 1,533 respondents (8%) while the age range ≥ 65 years was 2,420 respondents (6.3%). There was a significant relationship between age and the incidence of type 2 DM with a p-value < 0.001 . Concerning Amalia's research (2014), the early elderly have a risk of 2.28 times greater than older people for the incidence of type 2 DM (p-value = 0.000).

3. Education of the respondent

Figure 3. Frequency Distribution of PERSADIA Members Based on Education Level at Mayapada Hospital Bogor (n=30)

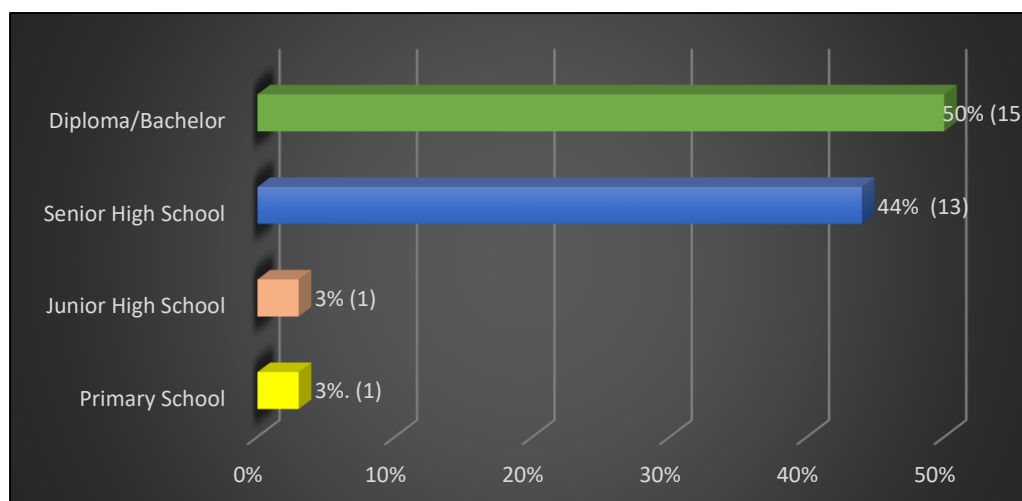


Figure 3 shows that half of PERSADIA Mayapada Hospital Bogor members have a Diploma or Bachelor's degree (50%) or 15 members. Someone with a high education is undoubtedly expected also to have extensive knowledge. However, this is not absolute because someone with a low educational background does not necessarily have low knowledge. Knowledge can come from non-formal sources, not necessarily from formal education (Silalahi, 2019). Researchers assume that the higher the education, the more knowledge the person will receive, which means the more significant the motivation of a person to maintain their health.

This research is in line with the research of Milita, Handayani, and Setiaji, namely older people with a low education (2,783 respondents) and those with a high education (1,170 respondents). From the statistical test results, the p-value is 0.000, meaning that there is a significant relationship between education level and the occurrence of type 2 DM in older people in Indonesia. An OR value of 0.403 is obtained. This means that respondents with a high level of education have a 40.3% risk of developing type 2 DM greater than respondents with low education. Education is related to awareness, especially in health issues—the lower the education level, the less likely to know the symptoms of type 2 diabetes mellitus.

4. Occupation of the respondent

Figure 4. Frequency Distribution of PERSADIA Members Based on Occupation at Mayapada Hospital Bogor (n=30)

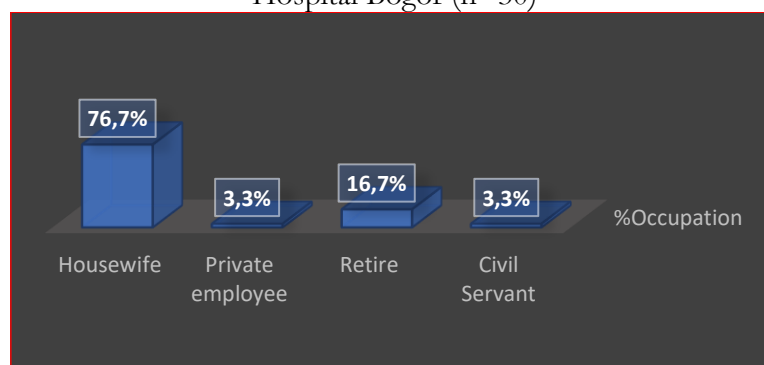


Figure 4 shows that almost all PERSADIA Mayapada Hospital Bogor members are housewives (76.7%) or 23 members.

In line with the research of Naufanesa Q, Nurhasnah, Nurfadildah S, and Ekaputri NW, respondents with DM were primarily housewives, as many as 58 people (36.25%), and entrepreneurs, as many as 33 people (20.63%)(Naufanesa et al., 2021). In Malita, Handayani, and Setiaji's research, respondents with light-medium jobs, 8.8% of them had type 2 DM. Meanwhile, only 3.1% of respondents with heavy work experienced type 2 DM. The p-value of 0.000 states that job type has a significant relationship with the occurrence of type 2 DM in older people in Indonesia. Respondents with light-moderate occupations had a three times greater chance of developing type 2 DM than those with heavy occupations (OR=3.010, 95% CI: 2.759-3.283).

People's increasingly unhealthy lifestyles due to busy work schedules, resulting in less time to eat healthy food and no opportunity to exercise, can significantly worsen health conditions. This can lead to more serious health problems. Achieving a healthy life requires a balanced lifestyle, both physically and mentally. A healthy lifestyle includes paying attention to a good diet, exercising regularly, and getting adequate rest. Lack of physical exercise in one's work can lead to the accumulation of fat in the body that is not reduced, which in turn can lead to weight gain and potentially trigger type 2 Diabetes Mellitus.

Length of time with diabetes mellitus

Figure 5. Frequency Distribution of PERSADIA Members Based on Duration of DM Suffering at Mayapada Hospital Bogor (n=30)

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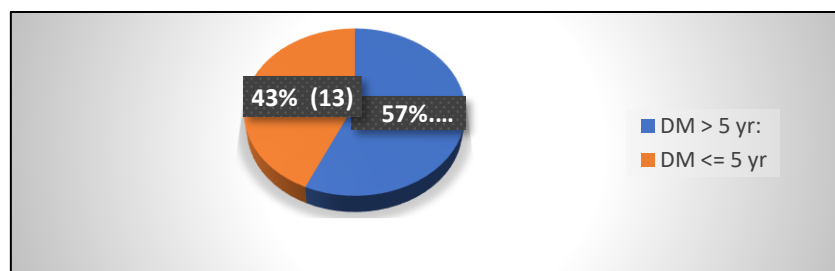


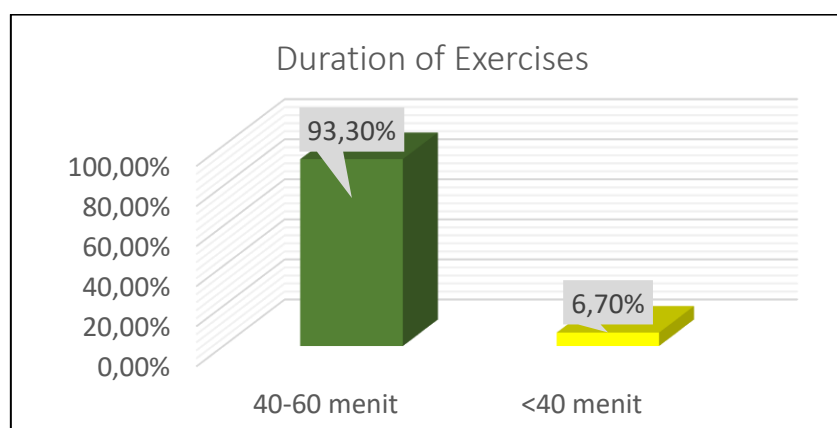
Figure 5 shows that most PERSADIA Mayapada Hospital Bogor members experience chronic DM conditions, namely 56.7% or 17 members who have had them for more than 5 years.

According to Lathifah's research (2017), it was found that 34 respondents (68%) had suffered from DM for > 6.5 years. This study shows that the risk of complications will increase as a person suffers from DM for longer. Diabetes mellitus causes complications that end in death. The duration of diabetes shows how long the patient has suffered from diabetes mellitus since the diagnosis of the disease. The length of diabetes mellitus suffered is associated with the risk of several complications that arise afterward. The main factor triggering complications in diabetes mellitus, besides the duration or length of suffering, is the severity of diabetes. It can be concluded that the longer a person suffers from diabetes mellitus, the greater the person also experiences various complications. Based on the results of the above study, the researcher assumes that certain environmental risk factors cause high rates of chronic diabetes mellitus. This may involve lifestyle, diet, or genetic factors that can increase the risk of diabetes mellitus over time.

The duration of suffering from type 2 DM shows the duration of time since the diagnosis of type 2 DM was made. The duration of type 2 DM is associated with risk factors for complications, both acute and chronic. Several other factors trigger the incidence of complications in addition to the length of suffering, including compliance with the treatment program and the severity of diabetes. However, if the duration of diabetes is balanced with a healthy lifestyle, it will create a good quality of life, which can prevent or delay long-term complications (Setiyorini & Wulandari, 2017).

Duration of Diabetes Exercise

Figure 6. Frequency Distribution of PERSADIA Members Based on Duration of Diabetes Gymnastics at Mayapada Hospital Bogor (n=30)



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Figure 6 shows that almost all PERSADIA Mayapada Hospital Bogor members perform diabetes exercises according to SPO for 40-60 minutes: 93.3% or 28 members.

The results of Kurdanti's research showed that the average post-test blood sugar level based on HbA1c measurement in group A was $7.92 \pm 1.56\%$, while group B was $7.13 \pm 0.99\%$. Both groups' mean pre-test - and post-test blood sugar levels differed significantly ($p < 0.05$). The treatment of diabetic gymnastics for 6 weeks with a frequency of 3 times every week can reduce blood glucose levels by $-2.5 \pm 0.96\%$ in group A, while group B has increased by $0.02 \pm 0.29\%$. The two groups significantly differed in HbA1c levels before and after 6 weeks of treatment ($p = 0.021$). So, treating diabetes gymnastics with a duration of 30 minutes for 6 weeks, 3 times every week, can reduce blood glucose levels (HbA1c) by $-2.5 \pm 0.96\%$ while the 60-minute gymnastics duration group increased by $0.02 \pm 0.29\%$. The two groups significantly differed in HbA1c levels before and after 6 weeks of treatment.

In members who experience a decrease in blood sugar levels, doing diabetes gymnastics following the procedure, namely following the gymnastics properly and correctly according to the duration in the SPO (40-60 minutes). In members who experience increased blood sugar levels, it is because doing gymnastics is not by SPO, which is under 40 minutes, so the body lacks movement. The food that enters the body will not be processed perfectly into energy. The remaining unused food will eventually be stored in a pile of fat. If this goes on for a long time, it will cause overweight or obesity, which is where excess body fat can cause inflammation that triggers insulin resistance. Insulin problems cause the body to be unable to process sugar, so it will increase blood sugar levels to above average.

Blood Sugar Level Before Diabetes Gymnastics

Table 1. Frequency Distribution of PERSADIA Members Based on Blood Sugar Levels Before Diabetes Gymnastics at Mayapada Hospital Bogor (n=30)

Descriptive Statistics						
	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
GDS Pre	30	136	225	184.63	4.567	25.017
Valid N (listwise)	30					

Based on table 1 shows that the mean results before doing diabetic gymnastics with 30 respondents were 184.63 mg/dl, and the results of std. Deviation before diabetic gymnastics was 25.017 mg/dl.

Anggraini's research showed that the average blood sugar level before doing diabetic exercises was 174.88 mg/dL. The median blood sugar level before doing diabetic exercises is 186.50 mg/dL, the highest blood sugar level before doing diabetic exercises is 201 mg/dL, the lowest blood sugar level before doing diabetic exercises is 114 mg/dL and the highest is 230 mg/dL (min-max: 114

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mg/dl – 230 mg/dl)(Anggraini, 2017). ADA (American Diabetes Association) states that a lack of insulin secretion or reduced tissue response to insulin³ causes insulin deficiency. Judging from the factors that influence high blood sugar levels due to lack of physical activity (gymnastics), as many as eight respondents (50%) only do physical activity 2 times a week. According to the theory of Damayanti (2015), when doing physical exercise, the work of insulin becomes better, and the less optimal becomes even better. However, the effect produced from physical exercise after 2 x 24 hours is lost; therefore, to obtain this effect, physical exercise needs to be done every 2 days or 3 times a week. Based on the theory, less physical activity (gymnastics) causes insulin resistance. Physical activity (gymnastics) can activate insulin bonds and receptors in the plasma membrane to reduce blood glucose levels.

The researcher assumes that the results of blood sugar during type 2 diabetes mellitus patients before doing diabetes gymnastics tend to be high, with an average GDS value of 184.63 mg/dl. This average value shows that patients with type 2 diabetes mellitus before treatment experience high sugar levels due to impaired beta cell sensitivity, which causes insulin to fail to compensate for insulin resistance.

Blood Sugar Levels After Diabetes Gymnastics

Table 2. Frequency Distribution of PERSADIA Members Based on Blood Sugar Levels After Diabetes Gymnastics at Mayapada Hospital Bogor (n=30)

Descriptive Statistics						
	N	Minimum	Maximum	Mean		Std. Deviation
		Statistic	Statistic	Statistic	Std. Error	Statistic
GDS Post	30	104	212	146.93	4.570	25.030
Valid N (listwise)	30					

Based on table 2 shows that the mean results after doing diabetes gymnastics with 30 respondents were 146.93 mg/dl, and the results of std. Deviation after diabetes gymnastics was 25.030 mg/dl.

This study follows research conducted by Febri (2020), which shows that of the 30 respondents, 25 (83.3%) had normal blood sugar levels, with an average of 1.16 and a standard deviation of 0.37.

Anggraini's research on 16 respondents in the Tawangrejo Health Center Working Area, Madiun City, found that the average blood sugar level after doing diabetes gymnastics was 141.06 mg/dL. The lowest blood sugar level after doing diabetic exercises was 96 mg/dL, and the highest was 182 mg/dL. Respondents with the highest blood sugar level value of 182 mg/dL are one respondent with female gender, age 65 and above, long-suffering from DM for 1-2 years, and doing physical activity (exercise) 2 times a week. Respondents who, after doing diabetic gymnastics, have low blood sugar levels of 96 mg / dL with female gender, age 55 - 65 years, long-suffering from DM for 1-2 years, and doing physical activity (exercise) every day.

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Blood sugar levels that have decreased after diabetes gymnastics result from active muscle contractions, resulting in calorie burning where insulin receptor sensitivity occurs.

Blood Sugar Level Results (Comparison Before and After Diabetes Gymnastics)

Figure 7. Frequency Distribution of PERSADIA Members Based on Blood Sugar Level Results (Comparison Before and After Diabetes Gymnastics) at Mayapada Hospital Bogor (n=30)

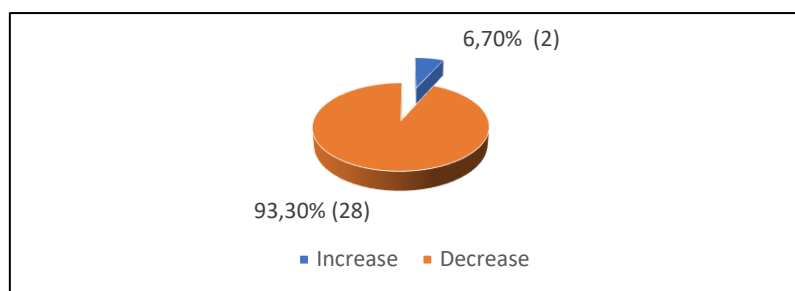


Figure 7 shows that almost all PERSADIA Mayapada Hospital Bogor members experienced decreased blood sugar levels at any time (93.3%) after being given diabetes gymnastics activities, according to SPO (40-60 minutes).

According to the theory contained in the book “Diabetes Mellitus and Nursing Management,” physical exercise has a vital role in regulating blood sugar levels in type 2 diabetes mellitus. This is due to an increase in membrane permeability in muscles that are contracting during physical exercise. As a result, when doing physical exercise, insulin resistance can be reduced while insulin sensitivity increases. In addition, during physical exercise, the body requires more fuel drawn from active muscles, and it causes bodily reactions involving circulatory, metabolic, and autonomic nervous system functions.

Relationship between Diabetes Gymnastics Duration and Blood Sugar Levels

Table 3. Results of the analysis of the Relationship Between Gymnastics Duration and Blood Sugar Levels of PERSADIA Mayapada Hospital Bogor Members (n=30)

Duration of Diabetes Gymnastics	GDS Result				Total		OR 95%	P Value
	Decrease		Increase					
	N	%	N	%	N	%		
Following SPO (40-60 minutes)	28	100%	0	0%	28	100%	3.000	0,000
Not following SPO (<40 minutes)	0	0%	2	66,7%	2	100%	(0,606-	
Total	28	93,3%	2	6,7%	30	100%	14.864)	

The results of the analysis of the relationship between the duration of diabetes gymnastics series 5 with blood sugar levels in PERSADIA Mayapada Hospital Bogor members obtained that there were 28 members (93.3%) doing diabetes gymnastics series five following the SPO obtained the results of blood sugar levels decreased. In contrast, PERSADIA members who were not appropriate to do diabetes gymnastics duration < 40 minutes, as many as two people (6.7%) experienced an increase in blood sugar levels. The results of the chi-square static test obtained a

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p-value of value: 0.000. It can be concluded that there is a significant difference between the value of blood sugar levels before and after doing diabetes exercises, which means that there is a relationship between the duration of the 5th series of diabetes exercises with blood sugar levels in PERSADIA Mayapada Hospital Bogor members. From the analysis, the OR value = 3.000 was also obtained, which means that the duration of exercise according to SPO (40-60 minutes) has a chance of about 3 times higher to reduce blood sugar levels compared to the duration of exercise that does not comply with SPO (< 40 minutes).

Exercise is beneficial for people with diabetes. It can reduce fat around the abdomen and help them lose weight. It can also improve sensitivity to insulin and control blood sugar levels. The basic principles of exercise for people with diabetes mellitus align with the principles of exercise for healthy individuals, both new and old, who suffer from diabetes. The purpose of exercise is to burn body calories so that blood glucose can be used as an energy source, ultimately decreasing blood sugar levels.

Based on the study's results, the researcher assumes that the exercise duration following SPO, 40-60 minutes, significantly reduces blood glucose levels. Diabetes gymnastics can play a role in regulating blood glucose levels if done according to the principles of diabetes gymnastics, namely meeting frequency standards, intensity, duration, and type of gymnastics. According to Persadia, diabetes exercises are designed according to age and physical status and are part of treating diabetes mellitus. The main problem in patients with type 2 DM is the lack of response to insulin (insulin resistance). The presence of these disorders causes insulin to be unable to help transfer glucose into cells. Membrane permeability increases in contracted muscles, so insulin resistance decreases during physical activity (gymnastics) while insulin sensitivity increases. When a person does physical exercise, there will be an increase in the body's fuel needs by active muscles and a complex body reaction including circulatory function, metabolism, and autonomic nervous system. Where glucose is stored in the muscles and liver as glycogen, glycogen is quickly accessed to be used as an energy source in physical exercise, especially in the first few or the beginning of physical exercise, starting after 10 minutes of physical exercise, there will be an increase in glucose 15 times the usual needs. After 60 minutes, it will increase to 35 times.

In line with research by Rahayuningrum (2018) on the Effectiveness of Giving Physical Exercise: Diabetes Gymnastics Against Controlling Blood Sugar Levels in Patients with Diabetes Mellitus, where the results showed the average difference in blood sugar in case respondents was 21.400 with a standard deviation of 30.933. The statistical test results obtained a p-value of 0.018, which means there is a difference between blood sugar before and after diabetic gymnastics. Meanwhile, the average difference in blood sugar for control respondents was -3,800, with a standard deviation of 21,157. The statistical test results obtained a p-value of 0.568, which means no difference between blood sugar before and after. So it can be concluded that H_0 is rejected and H_a is accepted, which means that diabetic gymnastics is effective in controlling blood sugar levels in patients with Diabetes Mellitus in the Paraman Ampalu Health Center Working Area, West Pasaman Regency (Rahayuningrum & Yenni, 2018).

CONCLUSION

Diabetes exercises are designed according to age and physical status and are part of treating diabetes mellitus. Exercise will increase insulin sensitivity through improved glucose and fat metabolism. High-intensity exercise will enhance insulin sensitivity mainly through improved glucose metabolism.

This study obtained the following results: there is a relationship between the duration of diabetes exercise series 5 and blood sugar levels in PERSADIA Mayapada Hospital Bogor members with chi-square statistical test $p\text{-value} < 0.05$ ($p\text{-value} = 0.000$).

The results of this study are expected to deepen further research on other variables related to controlling blood sugar levels in patients with diabetes mellitus. Researchers also hope that diabetes mellitus sufferers will be more enthusiastic about doing diabetes gymnastics regularly, either independently or in groups, to improve health conditions, reduce blood glucose levels, and improve quality of life.

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