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Alternative Yoga Exercise on Fasting Blood Glucose and Cholesterol Levels among Patients with Type 2 Diabetes Mellitus

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Abstract. Diabetes mellitus is a public health problem. The study used systematic literature reviews (SLR), which is a synthesis of a systematic literature study that is clear, comprehensive, by identifying, analyzing, evaluating through the collection of existing data with an explicit search method and involving the processes that have been critical in the selection of studies. The results found that 20 relevant articles have been reviewed and showed most of the evidence was significant on reducing fasting blood sugar and cholesterol levels. One study was not substantial on lowering cholesterol levels. Those 19 review studies showed that the study was a good category with an effect size value was 1.99 (robust) and a good JBI value. This was due to giving yoga interventions or the methods used during the training process is appropriate following the standard of intervention. Providing the yoga practice should involve movement and concentration. If the movement is correct, even if the intervention is given for only a month, it will show better results. The conclusion of 20 studies systematic literature reviewing yoga interventions has a significant value on reducing fasting blood glucose and cholesterol levels. Yoga practice involves movement and concentration. If the activities are suitable, it shows effective results.

Keywords: yoga exercise, fasting blood glucose, cholesterol, type 2 diabetes mellitus.

INTRODUCTION

Diabetes mellitus is a metabolic disease characterized by an increase in blood sugar levels (hyperglycemic) due to abnormalities in insulin secretion, insulin action, or both. Increased blood sugar levels exceeding normal limits is a sign of diabetes mellitus (DM). Diabetes mellitus can cause complications, one of which is chronic and acute complications, which are still common and become a significant health problem globally, estimated to be one death every 6 seconds worldwide (1). More than 90 percent of the population of diabetes mellitus have type 2 diabetes which is characterized by reduced insulin hormone from beta cells in the pancreas or due to insulin disturbances (2).

The prevalence of IDF (data International Diabetes Federation) in 2017 states that the prevalence of diabetes mellitus is 451 million people. From this data, Indonesia is ranked 6th globally with 10.3 million people and will continue to increase until 2045, which is estimated to be 693 million souls. Diabetes mellitus is the most common type of diabetes, with 90-95% (3-4).

The prevalence of diabetes mellitus in Indonesia is ranked 4th for chronic diseases with 10.9% (Basic Health Research 2018). In Central Java, according to the Basic Health Research. the prevalence of diabetes mellitus is in second place after hypertension, amounting to 96,794% of the population. In 2017 in Semarang, diabetes mellitus was one of the highest cases of non-communicable diseases (PTM) with 17,037 cases. In a previous study in 2018, the prevalence of DM sufferers in the *Srondol* Community Health Center was 661 diabetes respondents, with an average monthly visit of around 63 people. DM type 2 is second only to hypertension from 5 non-communicable diseases in the *Srondol* Community Health Center. Basic Health Research data explains that the prevalence of DM patients is more increasing in women than men, where there is an increase in diabetes mellitus with increasing age.

Diabetes mellitus can be classified into several types, namely type 1 diabetes, type 2 diabetes. Of the several types that exist, type 2 diabetes is one of the most common types, namely from 90-95%. The triggering factors of type 2 diabetes are obesity, consuming instant food, too much carbohydrate food, smoking, and stress, damage to pancreatic cells, and hormonal disorders(6).

Increased blood sugar levels that continue to increase in diabetes mellitus will become more severe and chronic. Disorders of imbalance in blood sugar levels in a short time, namely hyperglycemia, diabetic ketoacidosis, and hyperosmolar hyperglycemic non-ketotic syndrome. Long-term hyperglycemic complications risk blurred vision, peripheral neuropathy leading to renal failure: peripheral neuropathy with a risk of leg ulcers, autonomic neuropathy with gastrointestinal symptoms, and renal and cardiovascular failure(7).

Chronic diseases often occur, one of which is diabetes mellitus. A study state that living with diabetes mellitus has a negative effect on the quality of life of sufferers (8). Nugroho's 2010 study stated that stressful conditions cause uncontrolled blood sugar levels. The higher a person's stress level, the worse his blood sugar levels will be(9). The same opinion was expressed by Vitaliano, showing that subjects with a high stressor level had a significantly higher sugar level than subjects with a lower stressor level(10)

DM type 2 can be controlled and its complications avoided through timely treatment, regular medical control, metabolic control through laboratory tests, dietary restrictions, and increased physical activity (11). Previous studies have stated that diabetes mellitus in the community is due to having a family history of diabetes mellitus, age, obesity, high blood pressure, lack of physical activity or exercise, and absence of controlling blood glucose through laboratory tests (12).

Pharmacological oral anti-diabetic therapy and insulin have the effect of controlling blood sugar levels by their respective mechanisms. Patients with type 2 diabetes mellitus who were taking oral anti-diabetic had more anxiety about their condition than patients who received only diet therapy. Biguanide (metformin) group 3 pharmacological therapy acts directly on the liver (liver), decreasing hepatic glucose production. It does not stimulate insulin secretion by the pancreatic gland. The duration of action is up to 24 hours, is not related to plasma protein, does not occur a metabolism, and is secreted by the kidneys as a compound(13).

Management in controlling type 2 diabetes mellitus apart from treatment is physical exercise. Physical exercise is a significant part of diabetes mellitus management and education, medicine, and diet. A study showed that physical exercise is beneficial for increasing the sensitivity of body cells (activating receptors) to control blood glucose levels and reduce the risk of cardiovascular and neurological complications in people with type 2 diabetes mellitus (14). Therefore, efforts from physical exercise for type 2 DM patients need to be done to control blood glucose levels, such as non-pharmacological therapy, one of which is physical activity, namely Yoga(15).

Yoga is a physical activity that can be used as an alternative to lowering blood glucose in people with type 2 diabetes mellitus, which is also suitable for exercising breathing so that the lungs and heart become healthier. Yoga movements were carried out in various studies; namely, *Tatha* yoga, which include several branches, namely particular exercises (*asanas*), training the motor nervous system work, and stimulation of the work of the autonomic nerves, breath control (*Prayana*), concentration (*Dharana*) can increase and decrease epinephrine stimulation. Hand movements (Mudras) to increase the sensibility of the peripheral nervous system(16).

Yoga has a mechanism in the union of the body (body), mind (mind), and soul (soul). Yoga combines breathing techniques, relaxation, and meditation, as well as stretching exercises. The goal of Yoga is to lead to a calm mind. Concentration on parts of the body will be more effortless if it can be felt. After that, it will slowly enter the mind (mind)(17).

When doing physical activity, there is a contraction in the skeletal muscles that stimulates glucose transport into the body's cells, and metabolism works through independent insulin pathways. Physical exercise also has another effect: it increases insulin's ability to activate the transformation of glucose into muscles. Opening the capillaries so that there are many insulin and insulin receptors available to work more effectively, which in turn will affect the decrease in blood glucose levels(18).

Hatha yoga practice is recommended for people with type 2 diabetes. Hatha yoga practice causes the muscles to absorb excess blood glucose. Hatha yoga helps the pancreas and liver to function effectively by regulating blood sugar levels. The hatha yoga movements that are carried out are hatha yoga movements that aim to stimulate the function of the pancreas. The function of these movements will increase blood flow to the pancreas, rejuvenate the organ cells and increase the ability of the pancreas to produce insulin (19).

Insulin production is generally not disrupted, especially in people living with early type 2 diabetes. Lack of receptors on insulin is a significant problem in type 2 diabetes mellitus; because of this disorder, insulin cannot help transfer glucose into cells. When exercising, insulin resistance decreases. On the other hand, insulin sensitivity increases. This causes the need for insulin in type 2 diabetes mellitus. This response only occurs every time you exercise and is not a permanent or long-lasting effect. Therefore, for people with type 2 diabetes, exercise must be done regularly(20).

Yoga exercise increases the ability of insulin to work. Yoga also has other effects on the body, namely losing weight, because when physical activity burns fat and carbohydrates, it increases cardiovascular function and respiration. The heart's effectiveness increases lung capacity, decreases LDL, and increases HDL to prevent coronary heart disease and stimulate

the hormones epinephrine and norepinephrine. Therefore, it can lower blood pressure, reduce the need for oral drugs and insulin use, and prevent early diabetes, especially for people with a family history of DM patients or those in the pre-group. -DM. Yoga will be beneficial if it is done properly and regularly. (21)

With a statement like the above, the researcher wants to carry out a systematic review of the literature entitled "Alternative, complementary services in combination with Yoga on blood glucose and cholesterol levels in Type II Diabetes Mellitus Patients" by analyzing each of the available variables.

OBJECTIVE

The study aimed to examine the complimentary yoga practice services to decrease fasting blood glucose and cholesterol levels among type 2 diabetes mellitus patients.

METHODS

Literature search

To obtain the relevant articles, the researcher searched the articles using the databases, including Google Scholar database, Science Direct, PubMed, Wiley Online Library, and Research Gate from 2016 to 2020 with the PRISMA method. In addition, researchers conducted data searches through website portal-journals that could be accessed: academic search complete, Garuda portal, National Library of Indonesia, Elsevier (SCOPUS) using selected keywords, namely: yoga practice, lavender aromatherapy, blood glucose, and cholesterol levels in type 2 diabetes mellitus patients.

Selection of Literature

The creating the keywords in this study were “yoga practice," “lavender aromatherapy," “blood glucose," and “cholesterol levels," "type 2 diabetes mellitus”. Furthermore, the articles found from the process would be screened, and the data also should be extracted. The data analysis process was done by combining all data that meets the inclusion criteria using techniques either quantitatively, qualitatively, or both.

Eligibility of Criteria

The selection of articles was based on the inclusion criteria, such as articles focused on the effect of Yoga in reducing blood glucose and cholesterol levels in type 2 diabetes mellitus patients. Updating articles from 2015 to 2020 and Indonesian and English language also were included in this study. Furthermore, original articles with full text were also had to find the relevant articles. The exclusion criteria including 1) the absence of statistical results, 2) descriptive research or only using the interview stage.

Data collection

Title: Complementary Service Alternative Yoga Exercise On Fasting Blood Glucose And Cholesterol Levels In Type 2 Diabetes Mellitus Patients

Type of article: Research article, Systematic review

Publication Year: 2015 - 2020

Keywords: Yoga Exercise, Fasting Blood Glucose, Cholesterol, Type 2 Diabetes Mellitus.

Research Methods: Randomized control trial, quasi-experiment, meta-analysis systematic review.

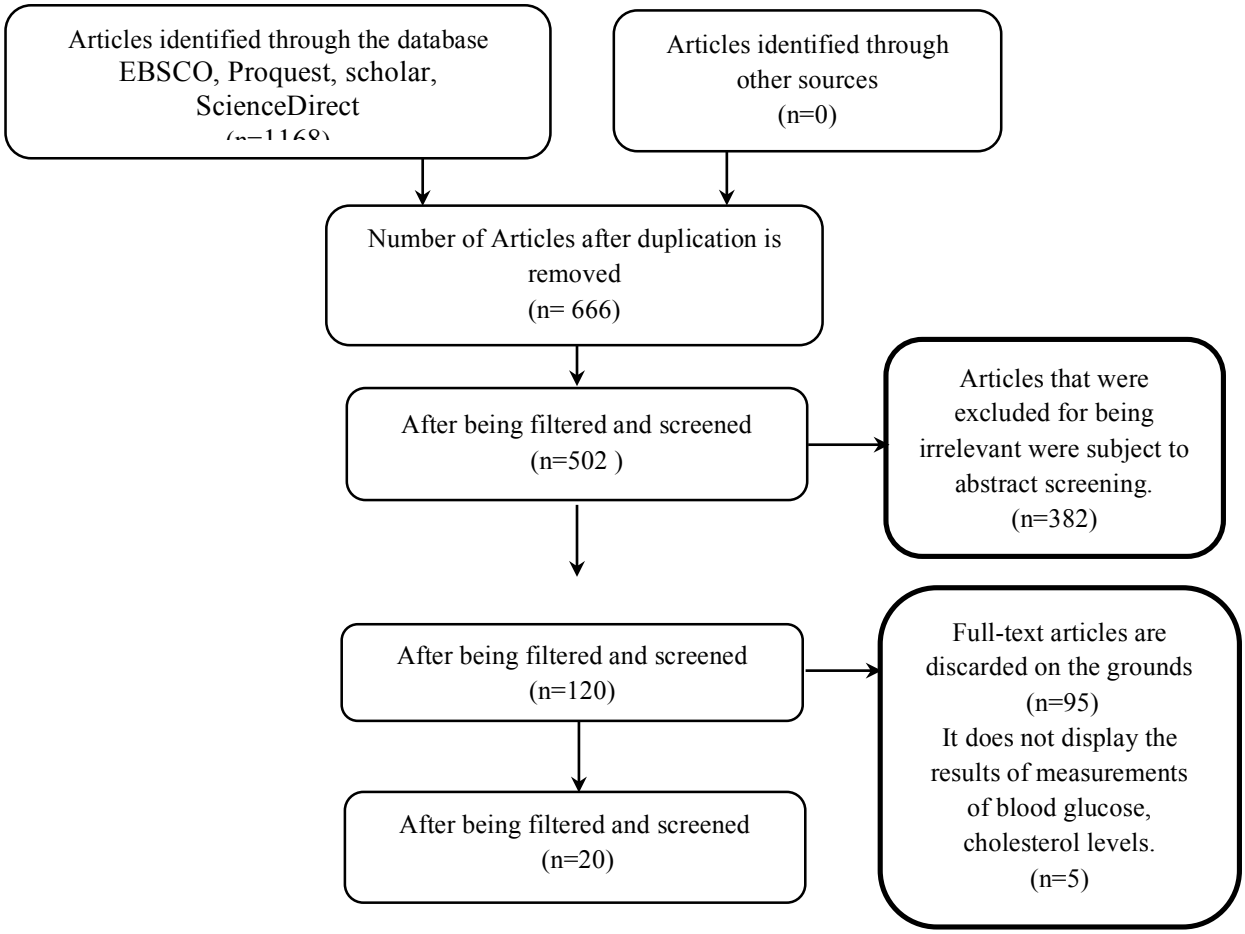

Figure 3.2 Flow diagram of the search for yoga intervention literature on blood glucose and cholesterol levels in type 2 diabetes mellitus patients

RESULTS AND DISCUSSION

Search Process

The results search process displayed in table 1 is grouped by journal type to make it easier to see the type of data or journal types obtained through the search process.

Results of selection criteria for inclusion and exclusion

The search process results will be selected based on criteria restrictions and inclusion (inclusion and exclusion criteria). This process gets 20 journals and then scanning the data.

The study literature collected was 20 studies that met the criteria for systematic review (table 4.1). The results were six articles using a quasi-experimental design and 14 study articles using A Randomized Controlled Trial. Based on the overall studies summarized, all studies show the results of data analysis and significant testing of the intervention given. A total of 4 journals were rated as low risk for bias with selective outcome reporting. A comprehensive presentation of all results provided included differences that were statistically significant and insignificant. Some studies that include a quasi-experimental design are also at high risk for bias because only before and after the intervention is given. The increased risk of bias is also due to several factors from outside the variables. Most of the studies included in systematic reviews use modified questionnaires so that the instrument requires reliability and validity.

The effectiveness of yoga exercise interventions on fasting blood sugar levels

Systematic review literature on yoga from the analysis of 16 studies based on the value effect size and the JBI-based assessment classification all showed that the results of yoga practice were effective in reducing fasting blood glucose levels. The results of 16 studies of literature that show the value of the effect size and JBI excellent that research conducted by Asha (2017) which uses design research quasi-experiment with a sample of 80 respondents, were divided into two groups. The intervention group of 40 respondents was given the intervention in yoga practice every five days a week for 12 weeks with a duration of 45-60 minutes. Meanwhile, the control group with 40 respondents only received drug therapy and daily physical activity without any additional physical activity in Yoga.

The results of the paired t-test showed that there was a significant decrease in the value of fasting blood glucose post-prandial and HbA1c with p = 0.001. In the intervention group with the provision of Yoga, there was a higher decrease compared to the control group; namely, in the intervention group, the average value of pre-test fasting blood glucose was 139.2 to 99.8 (post-test) with a difference of -39.4 (2, 02%). While in the control group, the average pre-test fasting blood glucose value of 142.7 increased to 144.7 (post-test) with an increase of 2 (1.40%). This shows that the intervention group with the provision of yoga exercises was more effective in reducing blood sugar levels than the control group, who only received drug therapy.

Based on research conducted by Vinod (2015) with a decrease in fasting blood glucose in the intervention group pre-test of 91.0 and a post-test of 83.4, with a difference of -7.6 (8.35%). Meanwhile, in the control group, the blood glucose results were examined post-prandial pre-test of 9.4 and the post-test of 12.2, which indicates that the value of blood glucose levels in the control group did not experience a decrease but an increase. Thus, it can be concluded that the intervention group was more effective in reducing blood sugar levels than the control group with a p-value <0.05 and the effect size 0.41, which was still classified as moderate.

This is in line with research conducted by Chimkode (2015), it was found that the average value of blood glucose during the pre-test was 134.13, decreasing to 141.42 with a reduction difference of -7.29 (5.34%) and for the mean value. -Mean blood glucose levels post-prandial pre-test amounting to 181.13 and the post-test of 162.32 with a difference of -18.6. Meanwhile, the control group that only received drug therapy showed a decrease in pre-test blood glucose levels by 84.38, decreasing to 82.14 with a difference of -2.24 (2.65%) and for the glucose level values post-prandial pre-test of 84.78 and post-test 81.34.

As for several other studies related to blood sugar levels, yoga practice effectively reduces blood glucose levels. Increased blood sugar levels exceeding normal limits is a sign of diabetes mellitus (DM). Diabetes mellitus can cause complications, one of which is chronic and acute complications, which are still common and become a significant health problem globally. So, one way to overcome this is to practice one of them is yoga practice.

Yoga practice has a mechanism for the union of the body, mind, and soul. Yoga combines breathing techniques, relaxation, and meditation, as well as stretching exercises. The goal of Yoga is to lead to a calm mind. Concentration on parts of the body will be more effortless if it can be felt. After that, it will slowly enter the mind (mind).17

When doing physical activity, there is a contraction in the skeletal muscles, which stimulates glucose transport into the body's cells, and metabolism works through independent insulin pathways. Physical exercise also has another effect: it increases the ability of insulin to activate the transformation of glucose into muscles. Thus, opening the capillaries so that there are many insulin and insulin receptors available to work more effectively, which in turn will affect the decrease in blood glucose levels(18).

The effectiveness of yoga exercise interventions on cholesterol

Systematic literature review from the results of the analysis of 2studies review based on the value effect size and the JBI-based assessment classification found one review study that showed yoga practice was effective in reducing cholesterol and one thought was ineffective on cholesterol. The results of an effective review, namely research conducted by Raj Kumar (2015) on 101 respondents with yoga intervention, obtained a p-value = 0.001, which means that yoga practice effectively lowers cholesterol.

Intan (2017) carried out an ineffective review with a quasi-experimental design with an intervention group that was given Yoga for two months within 30 minutes to 25 respondents. The criteria of respondents who had blood glucose levels> 250 mg/dl and respondents who had blood sugar levels <250 mg/dl, the results obtained on the cholesterol level examination showed that the p-value = 0.605. Thus, it was indicated that yoga exercises had no effect or difference in reducing cholesterol levels. It was consistent with previous studies showed that an intervention has positive effect on blood glucose level and total cholesterol level (22-23)

An increase in cholesterol levels in people with diabetes mellitus will cause complications in the form of atherosclerotic vascular disease. Yoga is one of the exercises used in lowering cholesterol levels because the movements in yoga practice, when done regularly and are measured, can stimulate the activations of the lipase enzyme, which will break down fat into free fatty acids. The beta-oxidation process of these free fatty acids will produce Acetyl Co-A, which will then be converted into water, CO2, and ATP in the energy formation process. The more cholesterol is broken down into energy, the serum cholesterol level will also decrease (24)**.**

CONCLUSION

Systematic literature review showed a significant value on reducing fasting blood sugar and cholesterol levels and one literature review study with insignificant results on lowering cholesterol levels. Of the 19studies review effective, Asha's research was categorized as good, judged by an effect size of 1.99 (intense), and a good JBI score shows that giving yoga exercise is more effective in reducing the value of fasting blood glucose levels compared to cholesterol.

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