

## ORIGINAL ARTICLE

# Effect of Benson Relaxation and Aromatherapy on Blood Glucose Levels in Patients With Type II Diabetes Mellitus

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## ABSTRACT

**Introduction:** Diabetes characterized by hyperglycemia can cause long term damages and malfunction of different organ and systems, especially the eye, kidney, nerve and cardiovascular systems. The main problem in Diabetes Mellitus patients is a difficulty in regulating blood glucose levels. Various attempts were made to reduce blood sugar levels so that patients can be free from insulin. Exercise and diet are the primary therapies in DM patients, but apart from that, relaxation techniques can help patients reduce stress and anxiety levels, which will ultimately have a good effect on lowering glucose levels in the blood. Benson relaxation techniques modified with aromatherapy are expected to provide a relaxing effect so that this condition can have a better impact on reducing blood glucose. The present study aims to look at the effect of Benson relaxation exercises and aromatherapy on blood glucose levels.

**Methods:** The researchers intervened in two groups of respondents. The intervention group conducted Benson relaxation exercises and aromatherapy while the control group only conducted Benson relaxation. **Results:** Differences in the average blood glucose levels before and after exercise in the intervention group and in the control group has been observed. Relaxation conditions will provide a good impact for DM patients because at the time of relaxation stress hormones that trigger an increase in blood glucose levels, will not be released by the body. **Conclusion:** Present study shows that Benson relaxation exercise and aromatherapy is effective for lowering glucose levels.

**Keywords:** Diabetes Mellitus, Blood Glucose Levels, Benson Relaxation Exercise, Aromatherapy

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## INTRODUCTION

The American Diabetic Association (1) explain that diabetes is a group of metabolic diseases characterized by hyperglycemia that occurs due to a disturbance in insulin secretion, insulin action, or both. Chronic hyperglycemia in diabetic patients can cause long term damages, dysfunctions, and malfunctions of different organs, like eyes, kidneys, nerves, and cardiovascular system.

Based on a survey by the World Health Organization (WHO), in 2017, Indonesia occupies ranked fourth-largest in the number of people with diabetes mellitus (DM). This increased to 8.6% of the total population and is expected to continue to grow along with lifestyle changes, mainly due to unbalanced eating patterns (2). In addition to the increasing number of sufferers, another thing to look out for in diabetes mellitus is the danger of complications that can arise if blood sugar is not controlled.

WHO explains that DM is one of the major priority in Non-Communicable Diseases (NCD) and is a major cause for blindness, heart attacks, strokes, kidney failure, and leg amputations. In 2015, 415 million adults with diabetes had a 4-fold increase from 108 million in the 1980s. By 2040 the number is estimated to be 642 million. Ogurtsova et al reported that the increase of diabetes cases in developing countries occurred due to inflation in population, aging, improper diet, obesity, and sedentary lifestyle. By the year 2025, most of the population will suffer from diabetes in their productive years in the age group of 65years or older in developed countries and 45-64 years age group in developing countries (3).

Diabetes has now become one of the biggest causes of death in Indonesia and whole world. Primary health research data shows there is an increase in the prevalence of diabetes in Indonesia from 2007 to 2013 with 5.7% to 6.9% or around 9.1 million. Data Sample Registration Survey in 2014 shows that Diabetes is a cause of death ranking 3rd largest in Indonesia with a percentage of 6.7%, following Strokes (21.1%), and Coronary Heart Diseases (12.9%). This issue if not addressed, it can cause a decrease in productivity, disability, and premature death (4).

Based on data from the Hospital Medical Records Dr. Soekardjo of Tasikmalaya City in 2017 it was found that the Diabetes Mellitus case numbers reached 334 people, with the average age group of patients being 45-65 years. Female patients were more reaching as many as 204 people compared to men as many as 130.

Diabetes requires proper treatment so that it does not cause more severe complications. Smeltzer and Bare (5) explained that diabetes therapy, in principle, aims to balance between insulin activity and blood glucose level resulting in reduction in vascular and neuropathic complication. The diabetic therapy aims to normalize the blood glucose levels without causing hypoglycemia and to prevent severe interference with activity patterns of the patient. Five components in managing diabetes are diet, exercise, monitoring, therapy if needed, and education.

Physical exercise is one of the five main pillars of the management of diabetes mellitus. Physical activity can improve in controlling the blood glucose level in type 2 DM patients, reduce cardiovascular risk, help lose weight, and promote the welfare of DM patients (6). Physical exercise can lower blood glucose levels because physical activity will increase the use of glucose by the active muscles (7). Physical exercise will also improve blood circulation, increases glucose uptake into skeletal muscle and makes the working muscles more sensitive to insulin. The insulin receptors become more active which will ultimately affect the decrease in blood glucose in diabetic patients (8).

In addition to the above efforts, to overcome high blood sugar levels in DM patients, some complementary efforts can be made, one of which is through the relaxation method. Research on the effects of relaxation for decreasing blood glucose levels in DM patients has also been done. The results showed that there was a significant decrease in blood glucose level among DM patients after relaxation. Benson relaxation is a complementary therapy and an excellent modality performed by DM patients. Benson's relaxation, as well as other relaxation techniques, are proven to cause a decrease in physical and psychological stress, which conceptually can decrease epinephrine, decrease cortisol, decrease glucagon and decrease hormone thyroid. All of these have a positive effect on reducing blood glucose levels (9).

Reduction in stress levels and the attainment of a relaxed condition in DM patients have positive effect on reducing blood sugar levels. Therefore, various efforts were made to make DM patients comfortable and remain relaxed. In addition to the Benson relaxation techniques described above, aromatherapy is believed to provide a relaxing effect on the patient. Lavender aromatherapy is a therapy that uses essential oils that are considered to help reduce and even overcome psychological disorders

and discomforts such as anxiety, stress, depression, and so on (10).

According to scientific research, the aroma therapy affects the brain. For example, lavender aromatherapy increase frequency of alpha waves that play an important role in networking between neurons resulting in relaxation (11), (12). Other research also proves that lavender aromatherapy can help reduce and even overcome psychological disorders and discomfort disorders such as anxiety, stress, depression, insomnia, and so on (13).

Research on the use of relaxation and aromatherapy techniques has been done by several researchers, only in a separate study or modification with other methods. Like aromatherapy, Benson's relaxation has also proven effective in dealing with stress, anxiety, and other psychological disorders so that this therapy is often used to overcome physiological and psychological disorders caused by stress (14). These two interventions, when combined for DM patients, can conceptually have a better impact on controlling patient's blood sugar levels. Also, the need to conduct this research as well as to provide choices for clients with diabetes to control blood glucose levels.

## MATERIALS AND METHODS

### Research Design

Type of research is quantitative with quasi-experimental designs pre and post-test and using a control group. Present study has been intended to analyze the effect of Benson relaxation exercises and aromatherapy on blood sugar levels of type 2 DM patients. Sampling was done by consecutive sampling and obtained 66 respondents consisting of 34 control groups and 32 intervention groups. The study was conducted at Dr. Soekardjo Hospital of Tasikmalaya. Ethical approval for this study was obtained from the Ethics Committee, Poltekkes Kemenkes Tasikmalaya Ministry of Health, Indonesia (Ref No: 2019/KEPK/PE/VII/0014).

### Population and Sample

The inclusion criteria of this study sample were patient with Type II DM, aged 40-60 years, getting oral anti-diabetic drugs, regularly going to the hospital, willing to do Benson relaxation techniques for at least 4x / week for four weeks, not allergic to aromatherapy and willing to participate in the study. The exclusion criteria of this study included unstable metabolic conditions, patients who are absent from relaxation activities, and those patients experiencing health problems with programmed aromatherapy interventions. To determine a sample size, a power analysis was conducted using 0.05 as the level of significance at 0.90 power level.

The sample size is obtained from the sampling formula with variable pairs from Lemeshow in sopiyudin (15), as follows:

$$n = \left[ \frac{\sigma (Z1 - \alpha + Z1 - \beta)}{(\mu1 - \mu2)} \right]^2$$

Note:

$\sigma$ : Standard deviation of the mean difference in the previous pair (51.24)

$\mu1 - \mu2$ : The desired average difference (minimum = 30)

Z1 -  $\alpha$ : Z value at 5% significance level 1.96

Z1 -  $\beta$ : Z value at the test strength of 90% = 1.28

The standard deviation of the difference in the average paired previously and the desired average difference refers to the results of the study (16).

### Instruments Research

The instruments used in this study are the blood glucose test strip to measure pre and post blood glucose levels following exercise and standard operational procedure (SOP) for implementing Benson relaxation exercises. The measurement results are expressed in scores by the unit of measurement mg /dl. For different variables, the measurement results are shown in numeric and categorical form.

### Data Collection Procedure

The study begins by selecting respondents according to the criteria. Then the patient is taught the Benson Relaxation exercise until the patient can do it independently. Patients in the intervention group were advised to do Benson Relaxation at least 4x per week for four weeks and the given aromatherapy which must be used at least for four nights/week for four weeks, by dripping 2-3 drops of lavender aromatherapy oil on a pillow at least 30 minutes before bedtime. The control group is only recommended to do Benson relaxation exercises at least 4x / week for four weeks without accompanied by aromatherapy. Monitoring the implementation of interventions at home is carried out by the patient's family members and research assistants, as well as the use of observation sheets. Measurement of blood sugar levels as before and after the patient intervened using a blood glucose test strip.

### Statistical Analysis

The analysis used in this study is univariate analysis to describe each variable, namely age, gender, diet compliance, physical exercise, blood glucose monitoring, pre and post intervention blood glucose levels. Bivariate analysis (test *t dependent* and *t independent*) is used to find out the relationship between the two variables (dependent and independent variables). As for knowing the relationships between factors affecting blood glucose level with the dependent variable (blood sugar level), bivariate analysis has been performed with a t test and correlation test.

## RESULTS

### Characteristics of Respondents

The age of the control group and the intervention group are quite varied. Among 34 respondents in the control group, the mean age is 55.29±7.6 years, while the intervention group with mean age of 53.97±7.84 years. The youngest in the control group was 36 years while in the intervention group 35 years. The oldest in the control group was 82 years and in the intervention group was 66 years. Based on gender, most of respondents in the intervention group were female as many as 22 people (68.8%). In the control group, the both male and female was equal 17 people (50%). Most respondents adhere to the dietary rules, as many as 24 people (70.6%) in the control group and 17 respondents (53.1%) in the intervention group. The majority of respondents routinely carry out physical activities, as many as 25 people (73.5%) in the control group and 20 respondents (62.5%) in the intervention group. The majority of routine physical activity is as many as 25 people (73.5%) in the control group and 20 respondents (62.5%) in the intervention group (Table I).

Table I: Characteristics of Respondents

Variable	Control	Intervention
Mean Age ±SD	55.29±7.62	53.97±7.84
<b>Gender</b>		
Male	50%	31.2%
Female	50%	68.8%
<b>Diet Compliance</b>		
Yes	70.6%	53.1%
No	29.4%	46.9%
<b>Physical Activity</b>		
Yes	73.5%	62.5%
No	26.5%	37.5%
<b>Blood Glucose Check</b>		
Routine Check up	38.2%	31.2%
No	61.8%	68.8%

### Blood Glucose

The mean value of blood glucose level of the control group before the intervention was 237.74±121.03 mg/dl, and after the intervention it was 202.03±77.48 mg /dl. Mean value of blood glucose level in the intervention group before and after the intervention has been 218.00±81.02 mg/dl and 170.31± 71.70 mg/dl respectively. Statistical test results obtained p-value of 0.063. No significant difference between pre and post intervention blood glucose level in the control group (p=0.063) while significant differences between blood glucose in pre and post intervention in the intervention group were observed (p-value 0.001) (Table II).

The mean blood glucose in the control group before the intervention was 237.74±121.03 mg/dl and after

**Table II: Univariate Analysis of Mean Blood Glucose Levels Before and After Interventions in the Control and Intervention Group**

Blood Glucose Levels	Mean (mg/dl)	SD	SE	<i>p-Value</i>
Control:				
1. Before	237.74	121.03	0.02	0.063
2. After	202.03	77.48		
Intervention:				
1. Before	218.00	81.02	0.03	0.001
2. After	170.31	71.70		

the intervention the mean blood glucose reduced to 202.03±77.48 mg /dl. So, it can be concluded even though statistically through the t-test it was found that there were no significant differences but in terms of average blood glucose levels decreased after conducted intervention with Benson relaxation exercises with the intervention of aromatherapy (Table III and Table IV).

**Table III: Bivariate Analysis (dependent t-test) to determine differences blood glucose levels before and after intervention in the intervention and the control group**

Group	Mean (mg/dl)	SD	SE	<i>p-Value</i>
Control	202.03	77.48	12.67	0.001
Intervention	170.31	71.70	13.29	

**Table IV: Comparison of Changes in Mean Blood Glucose Levels Before and After Intervention on Control Group and Intervention**

Groups	Mean Before (mg/dl)	Mean After (mg/dl)	Changes (mg/dl)	Meaning
Control	237.74	202.03	35.71	Blood glucose decreased
Intervention	218.00	170.31	47.69	Blood glucose decreased

**Analysis of Factors Affecting Blood Glucose Level**

In order to evaluate the role of factor altering blood glucose, t-dependent test was used for both the sex with respect to adherence to the diet, physical activity/ exercise, inspection, and routine blood glucose levels and correlation test was done for the variable of age. The result in Table V show that p-value >0.05, it means that the variables do not have a significant relationship to the respondents' blood glucose levels .

**Table V: Analysis of Factors Affecting Blood Glucose Level**

Variables	<i>P-Value</i>	Statistic Test
Age	0.338	Corelate test
Gender	0.168	Independent t test
Compliance Diet	0.182	Independent t test
Physical Activity	0.482	Independent t test
Checking Blood Glucose	0.651	Independent t test

**DISCUSSION**

The results showed that the age of the respondents in

the control and the intervention group were varied but there was no difference in ages between the two groups. The results showed that the mean age is 55.29±7.6 years in the control group, and 53.97±7.84 years in the intervention group. The youngest individual suffering from DM was found in the intervention group, aged 35 years. According to (17) the risk of developing Type II DM is increased among patients older than 45 years. WHO survey results in developing countries showed that the incidence of DM is more common in the productive age, specially among the age group of 45-64 years.

According to (5), it was shown that individuals aged 65 years suffer from insulin resistance. This insulin resistance causes a decrease in insulin sensitivity thereby elevates blood glucose levels. This is due to the reduction of the ability of muscle and fat tissue for glucose uptake. This mechanism causes blood glucose levels to increase continuously. However, age is not the only factor that can increase the risk of developing DM. This study found several respondents aged under 45 years, even some aged 35 and 36 years also suffered from DM. The results of this study are in line with research conducted by Kandou (2013) which shows, the age of most respondents who experience DM is in the age range of 45-64 years (18).

Based on the age characteristics, in the control group, both the sexes were equal amounting to 17 people (50%), while in the intervention group most of the DM patient were women amounting to 22 people (68.8%). This is in line with the findings of Ferucha et al. (2016) which shows that women have a tendency to suffer from DM more because it is associated with the presence of monthly cycle (premenstrual syndrome) and postmenopausal symptoms like the accumulation of fat at different parts of the body due to the hormonal changes. As a result women are at greater risk of suffering from diabetes mellitus mainly DM type II (19).

Based on diet adherence, most respondents both in the control and intervention group complained regarding the predetermined diet. Diet and weight control are the basis of diabetes management. The diet control is one of the keys to success for patients with Diabetes Mellitus, because meal planning is one of the main pillar in managing type II diabetes mellitus (20).

Most respondents perform routine physical activities (73.5%) in control and 62.5% in intervention group. Physical exercise is useful for controlling blood glucose levels as this reduces the risk of cardiovascular diseases, helps in losing weight, creating a feeling of pleasure and confidence, and improving quality of life. Before doing physical exercise, DM patients undergo medical evaluation to identify the possibility of micro and macroangiopathy problems that can worsen with physical activity. The recommended types of exercise are aerobics, rhythmic, recreational and moderate

gymnastics, jogging, swimming, and cycling. The information that needs to be conveyed to the patients is the examination of blood glucose before and after physical exercise, eating and drinking before doing physical activity, providing food with glucose such as snacks, sweets and stopping exercise if the patient feel dizzy, weak, and sweat a lot (17).

Based on the routine examination of blood glucose levels, the results in the control and intervention group showed that most of the respondents did not do routine checks, namely 61.8% in the control group and 68.8% in the intervention group. By monitoring blood glucose levels independently (SMBG; Self-Monitoring Blood Glucose), diabetic persons can now manage their therapy to control blood glucose levels optimally. This method enables the detection and prevention of hypoglycemia and plays a role in determining normal blood glucose levels which are likely to reduce long-term diabetes complications (4).

The mean of the results of examination of blood glucose levels of the control group before the intervention was  $237.74 \pm 121.03$  mg/dl and after the intervention  $202.03 \pm 77.48$  mg /dl, whereas in the intervention group mean blood glucose levels before exercise  $218.00 \pm 81.02$ mg/dl and  $170.31 \pm 71.70$  mg/dl after the intervention. From the above results, it can be seen that there is a decrease in the mean value of blood glucose after intervention in both the control group and the intervention group.

The results of the study depicted the average blood glucose level before the intervention in the control group as 237.74 mg/dl, and after the intervention was 202.03 mg/dl. Results obtained by statistical analysis showed that p-value 0.063. So, it can be concluded there is no significant difference between blood glucose before and after the intervention in the control group. The average blood glucose level before intervention in the intervention group was 218.00 mg/dl while the average blood glucose after the intervention was 170.31 mg/dl. Results obtained by statistical analysis, p-value was 0.001. It can be concluded that there are significant differences between blood glucose before and after the intervention in the intervention group.

The control was given Benson relaxation exercises intervention at least 4x/ week for four weeks. Before the intervention, the average blood glucose level of the respondents was 237.72 mg/dl and after the intervention, the average blood glucose level was 202.03 mg/dl. Although statistically there was no significant difference between blood glucose before exercise and after exercise, it can be seen the average value of blood Glucose decreased by 35.71 mg/dl among the respondents. This is a positive result as the decrease blood glucose level among DM patients has a good impact on their physiology.

Benson exercise is a relaxation technique that involves breathing relaxation. Benson's relaxation therapy is a technique, which includes deep relaxation, slowed heartbeat and breathing causing reduced oxygen consumption and increased skin resistance. Reducing stress and anxiety brings serenity for the patients so that pursuing medical therapy would be accompanied with more tranquility. Relaxation therapy by Benson combines relaxation techniques to bring calmness inside and introduced non-cultic form of meditation and surveyed the essential elements of meditational practice in philosophic, religious and psychotherapeutic process. If humans is already in a calm condition, parasympathetic nerves will be stimulated while the sympathetic nerves will inhibit stimulation, so a sense of comfort will prevail (21).

Herbert Benson (22) reported that the combination of relaxation techniques and the strength of good beliefs leads to success in relaxation. The element of belief that will be used in the intervention is the element of religious belief. Previous studies reported that the element of belief included in the recitation of words or sentences that are pertinent to every religious belief accompanied by acceptance (23). Relaxation conditions will provide a good impact for DM patients because at the time of relaxation stress hormones that trigger an increase in blood glucose levels will not be released by the body.

Benson's relaxation exercises are known as a relaxation technique that can provide a feeling of relaxation and tranquility. If this condition is maintained for a long time, then blood glucose level can be stable. This is in aligns with the study by Ratnawati et al. 2018 (24), which shows that modified Benson relaxation exercises can reduce anxiety and control patients' blood glucose levels more effectively. The results of the study conducted by the researchers statistically did not provide significant results with a P value of 0.063 but quantitatively there was a decrease in blood glucose levels. This shows that Benson relaxation can quantitatively reduce blood glucose levels in DM patients. But other intervention is necessary along with this so that the decline that occurs is more significant to provide better statistical analysis results. Other initiatives that are likely to promote more reduction in blood Glucose is with proper regulation, regular exercise, and consistent blood glucose control, or can be combined with other techniques that can have a better impact on reducing blood glucose DM patients.

Other efforts that are expected to provide better results in reducing blood glucose levels in DM patients include modification by administering aromatherapy as practiced by respondents in the intervention group. In the intervention group, the average blood glucose level before and after the intervention was 218 mg/dl, 170.31 mg/dl respectively, with a decrease in blood glucose of 81.02 mg/dl. Statistical analysis results showed P-value 0.001. Base on statistical analysis, there are significant

differences in the average blood Glucose before and after the intervention in the intervention group.

Conceptually, Benson's relaxation training has a good effect on controlling blood glucose levels of DM patients so that with the addition of aroma therapy modification the result of controlling DM blood glucose levels will be more effective. Aromatherapy essential oils can be given through tissue paper, both hands (in an emergency), vaporizers (vaporizer), etc. The process of smell is a speedy and effective way to deal with emotional problems such as stress or depression, as well as several headaches. This is because the nasal cavity has a direct relationship with the central nervous system that is responsible for the action of essential oils. The nose itself is not only an olfactory organ, but also regulates the temperature and humidity of the incoming air and act as a barrier to the entry of foreign matter through breathing. When essential oils are inhaled, volatile molecules will carry the aromatic elements present in the oil to the top of the nose. The vibrating hair inside, which functions as a receptor, will deliver electrochemical messages to the central nervous system. This message will activate the emotional center and one's memory which will then deliver messages back to the whole body through the circulatory system. Messages delivered throughout the body will be converted into action by the release of neurochemical substances in the form of feelings of pleasure, relaxation or calmness (25).

This study results matches with the study by Salarzaei (2017) (26), where it is stated that the aromatherapy carried out by DM patients can reduce anxiety. The decrease in anxiety levels in DM patients has a positive correlation in controlling the patient's blood glucose level. Researchers intervened in the intervention group in the form of Benson relaxation exercises modified with therapy scents. The combination of these two interventions can conceptually reduce blood glucose in DM patients.

Results showed that the average blood glucose level after the intervention in the control group was 202.03 mg/dl, while the average blood glucose level after the intervention in the intervention group was 170.31 mg/dl. Statistical test results obtained p-value 0.001, meaning that at 5% there was a significant difference in the average blood glucose levels before the intervention in the two groups of respondents.

The results revealed that both groups experienced a decrease in blood glucose levels after the intervention, although statistically only the intervention group gave significant results. There were differences in the average blood glucose of the respondents before the intervention and after the intervention. But quantitatively, there was a decrease in blood glucose of 35.71 mg/dl in the control and 47.69 mg/dl in the intervention group.

The results of the statistical analysis showed that Benson's relaxation training accompanied by aromatherapy was shown to significantly reduce blood glucose levels in Type II DM patients. Relaxation exercises modified with aromatherapy provide a more significant effect in creating relaxed conditions in DM patients. The relaxation, strength and comfort conditions experienced by Type II DM patients have a good outcome by inhibiting the release of the hormone cortisol which is one of the causes of increasing blood glucose levels. Decreasing stress levels and achieving relaxed conditions in DM patients have a good effect on reducing blood glucose levels (27).

The aroma of lavender therapy uses essential oils that help to reduce and even overcome psychological disorders and discomforts such as anxiety, stress, depression, and so on. According to scientific research, the aroma or the smell affects the brain and this condition is associated with relaxation. Therefore, by giving relaxation techniques, the aroma of lavender oil can reduce the level of stress that was initially traumatic.

Changes in blood glucose levels of DM patients are influenced by various factors that are very complex. Apart from being influenced by patient compliance in managing the diet, routine physical activity, or even anti-diabetic drugs are needed to control blood glucose level. In this study, researchers analyzed factors that could conceptually influence the interventions carried out. The analysis was carried out to see whether the decrease in blood glucose levels in the respondent was caused by the intervention carried out or whether there was an influence of these factors.

The analysis showed that age, gender, education level, marital status, occupation, diet adherence, physical activity/sports, routine blood glucose level examination and p-value >0.05 means that the eight variables did not have a significant relationship to levels respondent's blood Glucose. This analysis shows that the decrease in blood glucose levels that occurred in the group of respondents is the result of interventions conducted in the form of relaxation exercises and aromatherapy.

## CONCLUSION

Significant differences in the average blood glucose levels before and after the intervention in the intervention group have been observed. No significant difference in the average blood glucose levels before and after the intervention in the control group has been found. There were significant differences in average blood glucose levels after the intervention in the control group and the intervention group. There are no influence of factors like age, sex, adherence to the diet, physical activity/sports, examination, and routine blood glucose levels on blood glucose levels of DM patients. The research show that

Benson relaxation exercise and aromatherapy have a good effect on lowering glucose levels.

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