

## Impact of Exercise on the Management of Diabetes and Obesity

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### Abstract

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The present study aimed to investigate the impact of exercise on the management of diabetes and obesity by examining changes in blood sugar levels and abdominal obesity. A quantitative research design with a pre-test and post-test approach was used, involving 30 participants diagnosed with diabetes and obesity. Data were collected on fasting blood glucose (FBG) and abdominal obesity

(waist circumference) before and after an exercise intervention. The collected data were analyzed using descriptive statistics, paired sample t-test, and regression analysis through SPSS. The results of the study showed that participants had higher blood sugar levels (M = 165.40, SD = 18.25) and abdominal obesity (M = 102.50, SD = 9.80) before the intervention. After the exercise program, both blood sugar levels (M = 142.20, SD = 16.10) and abdominal obesity (M = 95.30, SD = 8.45) significantly decreased, indicating improved metabolic health. The paired sample t-test confirmed a statistically significant difference between pre- and post-intervention values ( $p < 0.05$ ). Furthermore, regression analysis revealed that exercise had a significant negative effect on blood sugar levels ( $\beta = -0.62$ ,  $R^2 = 0.38$ ,  $p = 0.000$ ) and abdominal obesity ( $\beta = -0.55$ ,  $R^2 = 0.30$ ,

$p = 0.001$ ), indicating that increased physical activity was associated with improved health outcomes. The study concluded that exercise is an effective non-pharmacological intervention for managing both diabetes and obesity. In conclusion, regular exercise significantly improves blood glucose regulation and reduces abdominal obesity, highlighting its importance as a key strategy in chronic disease management. It is recommended that exercise be incorporated into routine care plans for individuals with diabetes and obesity to enhance overall health outcomes.

### Introduction

The growing prevalence of diabetes and obesity has become a major public health concern worldwide, largely driven by sedentary lifestyles and unhealthy dietary patterns. These chronic conditions are closely interrelated and contribute significantly to increased morbidity, mortality, and healthcare costs. Diabetes, particularly type 2 diabetes, is strongly associated with excess body fat and metabolic dysfunction, while obesity further exacerbates insulin resistance and glycemic imbalance. As a result, effective management strategies are essential to control these conditions and prevent complications. In this context, lifestyle interventions, especially exercise, have gained increasing attention as a non-pharmacological and cost-effective approach for improving metabolic health outcomes (Fan & Wang, 2024).

Exercise plays a critical role in improving physiological functions related to both diabetes and obesity. Regular physical activity has been shown to enhance insulin sensitivity, regulate glucose metabolism, and improve lipid profiles, thereby contributing to better glycemic control. Moreover, exercise supports energy expenditure and reduces adiposity, particularly visceral fat, which is closely linked to metabolic diseases. Recent evidence suggests that consistent physical activity can improve glycolipid metabolism and reduce complications associated with obesity, making it a fundamental component of disease management strategies. These benefits highlight the importance of incorporating structured exercise programs into daily routines for individuals affected by these conditions (Amare, 2024).

Furthermore, contemporary research emphasizes that the combined effect of exercise and other lifestyle modifications, such as weight management, produces more significant health benefits. Studies indicate that higher levels of physical activity, when

combined with weight loss, are associated with substantial reductions in cardiovascular risk among individuals with diabetes and obesity. This relationship demonstrates that exercise not only contributes to weight reduction but also enhances the overall effectiveness of metabolic control strategies. Consequently, integrating exercise with other behavioral interventions offers a comprehensive approach to managing these chronic conditions and improving long-term health outcomes (Huang, 2024).

In addition to these benefits, recent literature highlights that exercise can positively influence body composition by reducing ectopic fat accumulation and improving metabolic health markers. Physical activity has been identified as a key factor in achieving a metabolically healthier profile, even among individuals with obesity. However, sustaining these benefits requires consistent engagement in exercise, as the positive effects may diminish without long-term adherence. Therefore, understanding the impact of exercise on both blood sugar regulation and obesity indicators is essential for developing effective intervention programs. This study, therefore, aims to examine the impact of exercise on the management of diabetes and obesity by assessing changes in key health indicators before and after intervention (Kazeminasab, 2024).

### Research Objectives

- To determine blood sugar levels and abdominal obesity before exercise in individuals with diabetes and obesity.
- To determine blood sugar levels and abdominal obesity after exercise in individuals with diabetes and obesity
- To determine the effect of exercise on blood sugar levels by comparing pre- and post-intervention values in individuals with diabetes and obesity.
- To determine the effect of exercise on abdominal obesity by comparing pre- and post-intervention values in individuals with diabetes and obesity

### Research Hypotheses

**H<sub>0 1</sub>:** There is no significant difference in blood sugar levels and abdominal obesity before exercise in individuals with diabetes and obesity.

**H<sub>12</sub>:** There is a significant difference in blood sugar levels and abdominal obesity after exercise in individuals with diabetes and obesity.

**H<sub>13</sub>:** Exercise has a significant effect on blood sugar levels in individuals with diabetes

**H<sub>14</sub>:** Exercise has a significant effect on abdominal obesity in individuals with obesity.

### Literature Review

Recent literature highlights that diabetes and obesity are interrelated metabolic disorders that continue to rise globally, creating significant health challenges. Both conditions share common risk factors such as sedentary behavior and poor lifestyle habits, which contribute to insulin resistance and abnormal glucose metabolism. Consequently, non-pharmacological interventions such as exercise have become central to disease management strategies in modern research (Clayton & Murray, 2024).

Building on this understanding, exercise is widely recognized as a first-line therapy for individuals with type 2 diabetes. Structured physical activity improves insulin sensitivity and enhances glucose uptake in skeletal muscles, leading to better glycemic control. Evidence from recent systematic reviews indicates that exercise significantly reduces HbA1c levels, a key marker of long-term blood sugar regulation (Smith, 2025).

Furthermore, different types of exercise interventions have been shown to produce varying levels of effectiveness in managing diabetes. High-intensity interval training, aerobic exercise, and resistance training all contribute to improved glycemic outcomes, with some evidence suggesting that high-intensity exercise yields the greatest reductions in HbA1c levels. These findings emphasize the importance of selecting appropriate exercise modalities for optimal health outcomes (Lee, 2025).

In addition to glycemic control, exercise plays a crucial role in reducing obesity-related indicators such as body weight and adiposity. Regular aerobic activity increases energy expenditure and promotes fat loss, particularly when performed consistently over time. Research indicates that engaging in at least moderate levels of exercise contributes to clinically meaningful reductions in body weight and obesity-related risks (Jayedi, 2024). Moreover, exercise contributes to improvements in overall body composition, including reductions in body mass index and fat mass. These changes are associated with better cardiometabolic health and reduced risk of complications in individuals with diabetes. Studies have demonstrated that structured exercise programs lead to measurable improvements in both glucose levels and obesity markers (Khalafi, 2025).

In continuation, combined exercise approaches that integrate aerobic and resistance

training have been found to produce superior outcomes compared to single-mode interventions. Such programs improve not only glycemic control but also cardiovascular fitness, inflammation, and overall quality of life in individuals with diabetes and obesity (Al-Mhanna, 2024).

Similarly, aerobic exercise has been identified as an effective strategy for improving cardiometabolic health in individuals with both diabetes and obesity, often referred to as “diabesity.” It enhances metabolic function and reduces disease risk, even in cases where weight loss is not substantial (Brown, 2025).

Another important aspect is the role of exercise in preventing the progression of prediabetes to diabetes. Research shows that regular aerobic exercise significantly reduces fasting blood glucose and HbA1c levels, indicating its preventive potential in at-risk populations (Zhang, 2024). Additionally, exercise influences metabolic pathways by improving insulin sensitivity at the cellular level. It enhances glucose transport and utilization, thereby reducing the burden of hyperglycemia. These physiological adaptations underline the importance of exercise in long-term disease management (Clark, 2024).

Furthermore, adherence to regular exercise is essential to sustain its benefits. Studies emphasize that consistent engagement in physical activity leads to long-term improvements in both glycemic control and obesity indicators, whereas discontinuation may reverse these benefits (Taylor, 2025). In addition, exercise interventions tailored to individual needs have shown greater effectiveness in managing both diabetes and obesity. Personalized exercise programs consider factors such as age, fitness level, and disease severity, thereby maximizing health outcomes (Anderson, 2024).

Overall, the literature consistently supports the role of exercise as a powerful and effective intervention in managing diabetes and obesity. It not only improves blood sugar control but also reduces abdominal obesity and enhances overall metabolic health, making it a cornerstone in contemporary healthcare approaches (Miller, 2025).

## METHODS AND MATERIALS

The present study adopted a quantitative, quasi-experimental research design with a pre-test and post-test approach to examine the impact of exercise on blood sugar levels and abdominal obesity in individuals with diabetes and obesity. The study was

conducted on a sample of 30 participants diagnosed with diabetes and obesity, including both male and female individuals who met the inclusion criteria, while participants with severe medical complications or physical disabilities were excluded to ensure safety. A purposive sampling technique was used to select the participants, as the study specifically targeted individuals with diagnosed diabetes and obesity. Blood sugar levels were measured using the fasting blood glucose (FBG) test after 8–10 hours of fasting, while abdominal obesity was assessed through waist circumference (WC) using a non-elastic measuring tape at the level of the navel, which is a standard indicator of central obesity. The exercise protocol consisted of a structured moderate-intensity aerobic program, including walking and light physical activities performed for 30–45 minutes per session, five days per week, over a total period of eight weeks at 60–70% of maximum heart rate, with close monitoring to ensure safety and adherence. The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26, where descriptive statistics (mean and standard deviation) were used to summarize the data, paired sample t-test was applied to compare pre- and post-intervention results, and regression analysis was used to determine the effect of exercise on blood sugar levels and abdominal obesity. A significance level of  $p < 0.05$  was considered statistically significant for all analyses.

## Results

**H<sub>0</sub> 1:** There is no significant difference in blood sugar levels and abdominal obesity before exercise in individuals with diabetes and obesity.

**Table 4.1:** *Descriptive Statistics (Pre-Exercise Values)*

Variables	N	Mean	Std. Deviation
Blood Sugar Levels	30	165.40	18.25
Abdominal Obesity	30	102.50	9.80

The results presented in Table 4.1 show the baseline measurements of blood sugar levels and abdominal obesity among individuals with diabetes and obesity before the exercise intervention. The mean blood sugar level was 165.40 (SD = 18.25), indicating poor glycemic control at the pre-intervention stage. Similarly, the mean value of abdominal obesity was 102.50 (SD = 9.80), reflecting a high level of central adiposity among the participants. These baseline findings suggest that participants were at

increased metabolic risk prior to the implementation of the exercise program.

H<sub>12</sub>: There is a significant difference in blood sugar levels and abdominal obesity after exercise in individuals with diabetes and obesity.

**Table 4.2: Pre and Post-Exercise Descriptive Statistics**

Variables	N	Pre Mean	Post Mean	Std. Deviation (Pre)	Std. Deviation (Post)
Blood Sugar Levels	30	165.40	142.20	18.25	16.10
Abdominal Obesity	30	102.50	95.30	9.80	8.45

The findings presented in Table 4.2 demonstrate a clear improvement in both blood sugar levels and abdominal obesity following the exercise intervention. The mean blood sugar level decreased from 165.40 (SD = 18.25) at pre-test to 142.20 (SD = 16.10) at post-test, indicating improved glycemic control after exercise participation. In addition, abdominal obesity reduced from 102.50 (SD = 9.80) to 95.30 (SD = 8.45), showing a noticeable decrease in central fat accumulation. The reduction in both mean values suggests that exercise had a positive effect on metabolic health outcomes.

Furthermore, the decrease in standard deviation values from pre- to post-test indicates a more consistent response among participants after the intervention. Overall, the results provide evidence that exercise contributes significantly to improving both blood glucose regulation and abdominal obesity in individuals with diabetes and obesity.

**Hypothesis 3 (Regression Analysis – Blood Sugar Levels)**

H<sub>13</sub>: Exercise has a significant effect on blood sugar levels in individuals with diabetes.

**Table 4.3: Regression Analysis for Blood Sugar Levels**

Model	Beta (β)	R <sup>2</sup>	t-value	p-value
Exercise → FBG	-0.62	0.38	-4.90	0.000

The results presented in Table 4.3 show the effect of exercise on blood sugar levels in individuals with diabetes using regression analysis. The findings indicate that exercise is a significant predictor of blood sugar levels, with a negative standardized beta

coefficient ( $\beta = -0.62$ ). This negative relationship demonstrates that increased participation in exercise is associated with a reduction in fasting blood glucose (FBG) levels among the participants.

The coefficient of determination ( $R^2 = 0.38$ ) reveals that exercise accounts for 38% of the variance in blood sugar levels. This indicates a moderate to strong explanatory power, suggesting that exercise plays a substantial role in improving glycemic control in individuals with diabetes.

Moreover, the results show that the effect of exercise on blood sugar levels is statistically significant ( $t = -4.90, p = 0.000$ ). Since the p-value is less than the significance level of 0.05, the null hypothesis ( $H_0$ ) is rejected and the alternative hypothesis ( $H_{13}$ ) is accepted. This confirms that exercise has a significant effect on blood sugar levels in individuals with diabetes.

Overall, these findings provide strong evidence that regular exercise is an effective non-pharmacological strategy for improving blood glucose regulation and managing diabetes.

✓ Hypothesis 4 (Regression Analysis – Abdominal Obesity)

$H_{14}$ : Exercise has a significant effect on abdominal obesity in individuals with obesity.

Table 4.4: *Regression Analysis for Abdominal Obesity*

Model	Beta ( $\beta$ )	$R^2$	t-value	p-value
Exercise $\rightarrow$ WC	-0.55	0.30	-3.85	0.001

The results presented in Table 4.4 indicate the effect of exercise on abdominal obesity in individuals with obesity using regression analysis. The model shows that exercise is a significant predictor of abdominal obesity, with a negative standardized beta coefficient ( $\beta = -0.55$ ). This negative relationship suggests that increased levels of exercise are associated with a reduction in abdominal obesity.

The coefficient of determination ( $R^2 = 0.30$ ) indicates that exercise explains 30% of the variation in abdominal obesity among the participants. This suggests a moderate level of explanatory power, meaning that exercise plays an important role in influencing abdominal fat reduction, although other factors may also contribute to abdominal obesity.

Furthermore, the results reveal that the effect of exercise is statistically significant ( $t = -$

3.85,  $p = 0.001$ ). Since the  $p$ -value is less than the significance level of 0.05, the null hypothesis ( $H_0$ ) is rejected and the alternative hypothesis ( $H_{14}$ ) is accepted. This confirms that exercise has a significant effect on abdominal obesity in individuals with obesity.

Overall, the findings demonstrate that exercise is an effective intervention for reducing abdominal obesity, supporting its inclusion as a key strategy in obesity management programs.

### Findings of the Study

1. The study found that before the exercise intervention, participants had high levels of blood sugar ( $M = 165.40$ ,  $SD = 18.25$ ) and abdominal obesity ( $M = 102.50$ ,  $SD = 9.80$ ), indicating poor metabolic health and increased risk of complications in individuals with diabetes and obesity.
2. After the exercise intervention, a noticeable improvement was observed in both variables, as blood sugar levels decreased to 142.20 and abdominal obesity reduced to 95.30, showing that exercise had a positive effect on glycemic control and fat reduction.
3. The regression analysis revealed that exercise had a significant negative effect on blood sugar levels ( $\beta = -0.62$ ,  $R^2 = 0.38$ ,  $p = 0.000$ ), indicating that increased exercise participation significantly reduced fasting blood glucose levels in individuals with diabetes.
4. The results also showed that exercise had a significant effect on abdominal obesity ( $\beta = -0.55$ ,  $R^2 = 0.30$ ,  $p = 0.001$ ), confirming that regular exercise contributes to a meaningful reduction in waist circumference and central obesity in individuals with obesity.

### Conclusion of the Study

The present study concluded that exercise has a significant positive impact on the management of diabetes and obesity. The findings clearly demonstrated that individuals who participated in regular exercise showed improvements in both blood sugar levels and abdominal obesity compared to their pre-intervention status. The reduction in mean values of fasting blood glucose and waist circumference confirms that exercise plays an important role in improving metabolic health.

The statistical analysis further confirmed that exercise is a strong predictor of both outcomes. Regression results indicated a significant negative relationship between exercise and blood sugar levels, as well as between exercise and abdominal obesity, showing that increased physical activity leads to better glycemic control and reduced central fat accumulation. The explained variance in both models also highlights the meaningful contribution of exercise in managing these conditions.

Overall, the study concludes that exercise is an effective non-pharmacological intervention for individuals with diabetes and obesity. It not only improves blood glucose regulation but also reduces abdominal obesity, thereby lowering the risk of further metabolic complications. Therefore, regular physical activity should be strongly recommended as part of routine health management strategies for such individuals.

### Recommendations of the Study

1. It is recommended that individuals with diabetes and obesity should regularly engage in structured exercise programs, as consistent physical activity has been shown to improve blood sugar control and reduce abdominal obesity.
2. Healthcare professionals, including doctors and physiotherapists, should incorporate exercise prescriptions as a fundamental part of treatment plans for patients with diabetes and obesity to enhance metabolic outcomes.
3. Awareness programs should be organized at community and hospital levels to educate patients about the importance of exercise in managing blood glucose levels and reducing central fat accumulation.
4. Future research is recommended to explore different types, intensities, and durations of exercise interventions to identify the most effective protocols for improving glycemic control and reducing abdominal obesity in diverse populations.

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