

## Aerobic Exercise Vs Resisted Exercise on Blood Glucose and Health Related Quality of Life Among Coastal Patients with Type 2 Diabetes Mellitus- A Randomized Trial

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### Keywords:

type 2 diabetes mellitus, coast, aerobic exercise, resisted exercise, blood glucose, health related quality of life.

### Abstract:

More than 95% of diabetics have type 2 diabetes mellitus, which is brought on by the body's improper usage of insulin. Type 2 diabetes has been linked to sedentary habits, smoking, binge drinking, and excessive alcohol use, among other lifestyle factors. This disorder can significantly lower a person's quality of life, with health-related aspects of life (HRQOL) representing the main concern.

The aim of the study was to evaluate how aerobic and resistance exercise affected the patients with type 2 diabetics regarding blood glucose levels and health-related quality of life. Based on predetermined selection criteria, 30 volunteers between the ages of 30 and 50 were involved. They were then randomly split into two groups: the Aerobic exercise group (n=15) and the Resisted exercise group. (n=15). Both groups continued to take their medications throughout the 6-week intervention period, which consisted of 40-minute daily sessions for three days per week. Blood glucose levels and HRQOL (as measured by the EQ-5D-5L) were assessed before and after the intervention.

The results showed that both groups' quality of life and levels of glucose in their blood substantially improved. (p 0.05). However, it was discovered that participants in the resistive exercise group improved their HRQOL and blood glucose levels more than those in the aerobic exercise group when comparing the mean difference between the two groups.

In conclusion, it was discovered that resistive exercise, as opposed to an aerobic exercise program, had a greater positive effect on blood glucose levels, HRQOL, and disability in people with type 2 diabetes. These results imply that resistance training may be a valuable supplement to conventional diabetes care techniques, especially in terms of enhancing HRQOL and lowering disability in this population.

### 1. Introduction:

Type 2 diabetes is a medical condition caused by the body's improper utilisation of the hormone insulin, which regulates the body's glucose levels. Over 95% of diabetics have type 2 diabetes, which is mostly brought on by weight and inactivity. Type 2 diabetes symptoms can resemble type 1 diabetes symptoms, although they are typically less severe, delaying diagnosis and raising

the risk of complications. People with type 2 diabetes can benefit from a coastal lifestyle by being encouraged to engage in regular activity through sports like swimming, surfing, and beach walks<sup>1-10</sup>. The salty sea air can also help to alleviate stress and improve overall well-being, but maintaining a healthy diet and monitoring blood sugar levels is still critical.

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The term "health-related Quality of Life" (HRQOL) refers to a person's whole state of physical, mental, and emotional well-being. Poor HRQOL is linked to physical limits brought on by pain, a lack of energy, a reduced capacity to engage in social activities, and an increase in depressive or anxious symptoms. Assessing HRQOL frequently can improve patient communication, support therapeutic decision-making, and forecast therapy response. People with type 2 diabetes who manage their diabetes well see both short- and long-term improvements in their HRQOL. To enhance HRQOL, healthcare workers should have a thorough understanding of their patients<sup>11-20</sup>.

Aerobic exercise is any form of physical activity that engages the entire body, can be performed continuously, and has a rhythm. It depends on aerobic metabolism to obtain energy from amino acids, carbohydrates, and fatty acids and is recognized as an approach to glycemic management and cardiovascular risk factors.. It enhances insulin sensitivity, enhances glucose management, and improves risk factors for cardiovascular disease like visceral adiposity, lipid profile, arterial stiffness, and endothelial function in patients with type 2 diabetes. It also has positive effects on the metabolic profile of these patients. The American Diabetes Association recommends breaking up your weekly exercise into at least three different days and no more than two consecutive ones, for a total of at least 150 minutes of moderate-intensity aerobic activity or a minimum of 90 minutes of vigorous aerobic activity.

Whatever you do to make your muscles flex against outside force is called resistance training. For resistance, people often utilise weight machines, dumbbells, and barbells. Resistance exercise increases the whole-body use of glucose by causing a hypertrophy response and a change in the type of muscle fibre in the working muscles. It enhances flexibility and body composition, increases physical strength and endurance, and lowers the risk of cardiovascular disease. Resistance training has been found to be a safe and effective treatment alternative for the management of a number of chronic illnesses, and it is also safe and beneficial for elderly and obese individuals. It has been demonstrated to increase daily energy expenditure, insulin sensitivity, and quality of

life, and it has the ability to increase physical strength, lean muscle mass, and mineral density of bones<sup>21-49</sup>.

## 2. Methodology:

It is a clinical research study that compares the effects of aerobic exercise and resistance training on blood sugar levels and health-related quality of life in people with type 2 diabetes.. 30 participants who were aged between 30 and 50 diagnosed with type 2 diabetes mellitus were selected and enrolled in this study. The diagnosis was made by the physician in the Department of General Medicine, of our institute. Participants included for the study were persons with type 2 diabetes mellitus aged between 30 and 50, both males and females, participants not performed any exercise for last six weeks, BMI less than 31, participants who can achieve 65% of their VO<sub>2</sub> max and participants who were willing to participate in the study till the completion. The exclusion criteria were participants with uncontrolled hypertension, unstable angina, any cardiovascular, neurological and respiratory disorders, severe retinopathy, neuropathy and nephropathy, severe musculoskeletal problems restricting physical activity, any other systemic illness, any medication which can affect laboratory test, walking more than 1km daily, persons having vigorous activity. A total of 30 participants who satisfied the selection criteria were divided into two groups i.e., Aerobic exercise group and resisted exercise group through randomization. Each group consist of 15 participants, Aerobic exercise group (n=15) and Resisted exercise group (n=15). Baseline assessment of fasting plasma glucose, post prandial blood glucose and quality of life were performed and assessed before the start of the first session of exercise training.

## 3. Exercise Protocol:

### Aerobic exercise:

Participants in the aerobic exercise group engaged in moderately intense aerobic exercise on a bicycle ergometer. The exercise programme began with a 20-minute duration and was gradually raised to 30 minutes per session over the course of six weeks, three days per week..

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**Table 1: Description of aerobic exercise**

	Week 1 &2	Week 3&4	Week 5&6
<b>Warm up</b>	10 minutes	10 minutes	10 minutes
<b>Frequency</b>	3 days/week	3 days/ week	3days/ week
<b>Intensity</b>	Moderate intensity	Moderate intensity	Moderate intensity
<b>Time</b>	20 minutes/day	30 minutes/day	40 minutes/day
<b>Mode of training</b>	Bicycle ergometer	Bicycle ergometer	Bicycle ergometer
<b>Cool down</b>	10 minutes	10 minutes	10 minutes

## RESISTED EXERCISE:

Participants in the resisted exercise group completed a set of resisted exercises consisting of seated biceps curls, abdominal crunches, bench presses with dumbbells, resistance band sitting rows, and overhead triceps extensions. These exercise routines were

followed for a total of six weeks. Three days a week for six weeks, each session lasts 40 minutes and includes a warm-up and cool-down period. All of the outcome indicators were reviewed for both groups after the 6-week exercise regimen was complete.

**Table 2: Description of resisted exercise**

	Week 1,2&3	Week 4,5&6
<b>Warm up</b>	10 minutes	10 minutes
<b>Exercises</b>	-Seated biceps curl, -Abdominal crunches, -Bench press with dumbbells, -Resistance band seated row	-Seated biceps curl, -Abdominal crunches, -Bench press with dumbbells, -Resistance band seated row, -Overhead triceps extension
<b>Frequency</b>	3 sets/10 repetition	3 sets/10 repetition
<b>Intensity</b>	60% of 1Repetition maximum	75% of 1Repetition maximum
<b>Cool down</b>	10 minutes	10 minutes

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## Statistical analysis:

The statistical analysis was done using SPSS-17 software. Intragroup calculation of FPG, PPG and Health questionnaire (EQ-5D-5L) score was analyzed using paired t test.

## 4. Result Analysis:

The FPG, PPG, HEALTH QUESTIONNAIRE(EQ-5D-5L) pre and post test scores of aerobic exercises were represented in table 1,2,3 respectively. The FPG, PPG, HEALTH QUESTIONNAIRE(EQ-5D-5L) pre and post test scores of resisted exercises were represented in table 5,6,7 respectively.

## AEROBIC EXERCISE GROUP:

**Table 1:** Analysis of Fasting Plasma Glucose (FPG)

FPG	Mean	Standard deviation	T value	p-value
Pre-test	117.93	16.871	5.035	0.001
Post-test	101.00	21.798		

**Table 2:** Analysis of post prandial blood glucose (PPG)

PPG	Mean	Standard deviation	T -value	p-value
Pre-test	211.80	25.217	3.611	0.002
Post-test	190.33	30.777		

**Table 3:** Analysis of health questionnaire(EQ-5D-5L)

Domains	Pre-test/post-test	Mean	S. D	T value	p-value
Mobility	Pre-test	1.87	0.743	3.162	0.006
	Post-test	1.20	0.414		
Self-care	Pre-test	2.20	0.775	5.245	0.0001
	Post-test	1.33	0.488		
Usual activities	Pre-test	2.40	0.632	5.526	0.0007
	Post-test	1.60	0.737		
Pain/Discomfort	Pre-test	2.00	0.655	5.526	0.0007
	Post-test	1.20	0.414		
Anxiety/Depression	Pre-test	2.00	0.535	6.5	0.0001
	Post-test	1.13	0.352		
Overall health rating	Pre-test	53.33	5.055	3.5	0.003
	Post-test	55.66	4.027		



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## RESISTED EXERCISE GROUP:

**Table 5:** Analysis of fasting plasma glucose (FPG)

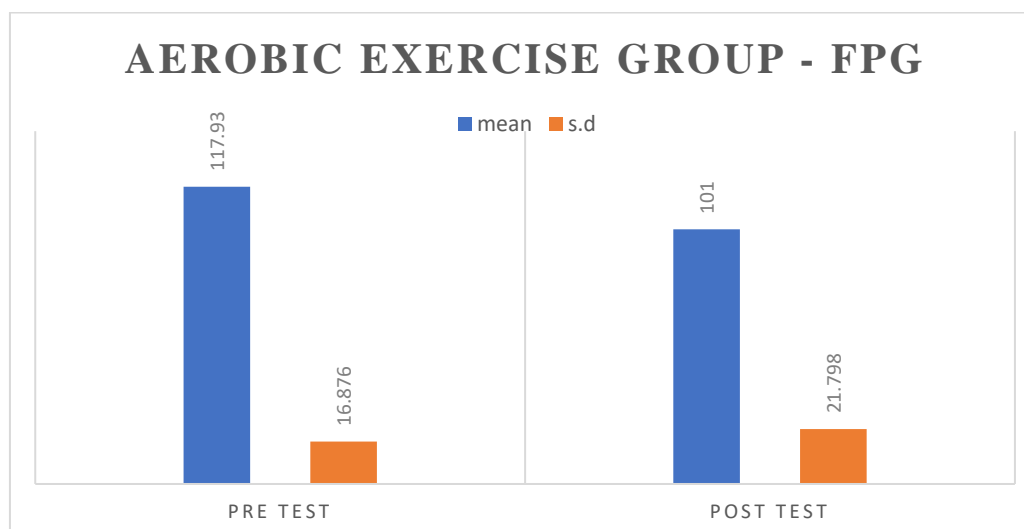
FPG	Mean	Standard deviation	T value	p-value
Pre-test	118.00	21.105	11.64	0.0001
Post-test	96.60	17.504		

**Table 6:** Analysis of post prandial blood glucose (PPG)

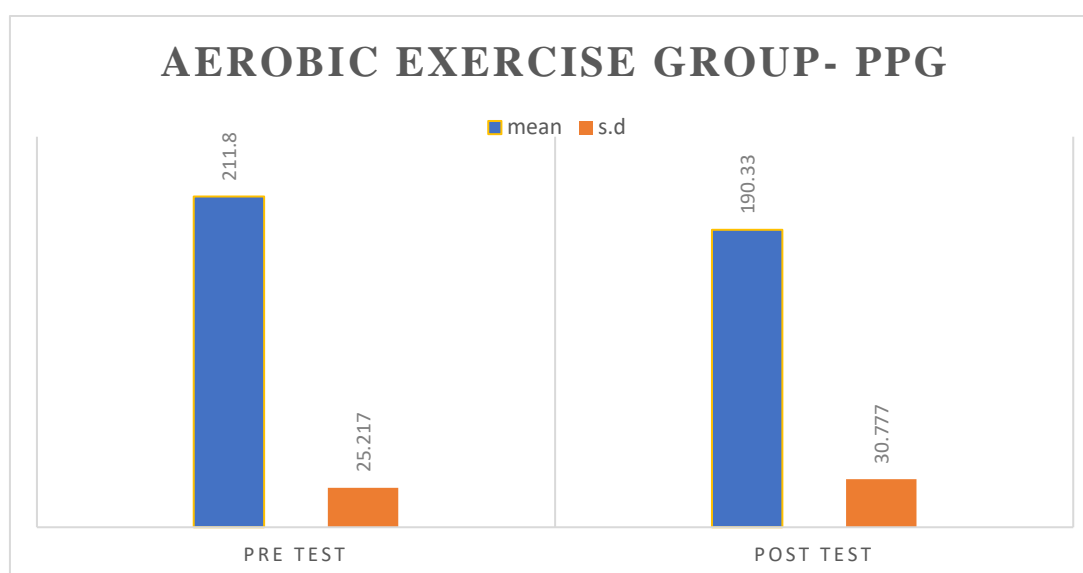
PPG	Mean	Standard deviation	T value	p-value
Pre-test	204.53	28.243	12.611	0.0001
Post-test	178.40	22.513		

**Table 7:** Analysis of health questionnaire(EQ-5D-5L)

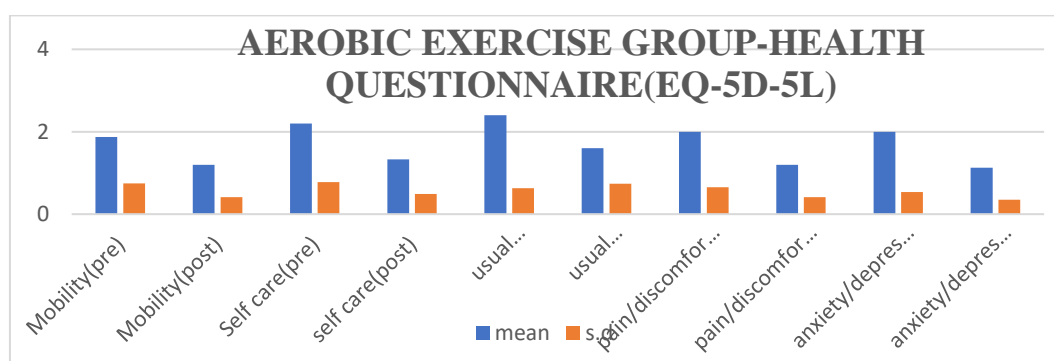
Domains		Mean	Standard deviation	T value	p-value
Mobility	Pre-test	2.27	0.884	5.136	0.0001
	Post-test	1.33	0.488		
Self-care	Pre-test	2.13	0.915	5.135	0.0001
	Post-test	1.20	0.414		
Usual activities	Pre-test	2.27	0.884	6.5	0.0001
	Post-test	1.40	0.632		
Pain/Discomfort	Pre-test	2.13	0.834	5.526	0.0007
	Post-test	1.33	0.617		
Anxiety/Depression	Pre-test	2.20	0.775	6.089	0.0003
	Post-test	1.27	0.458		
Overall health rating	Pre-test	58.67	6.114	3.317	0.001
	Post-test	62.33	5.936		



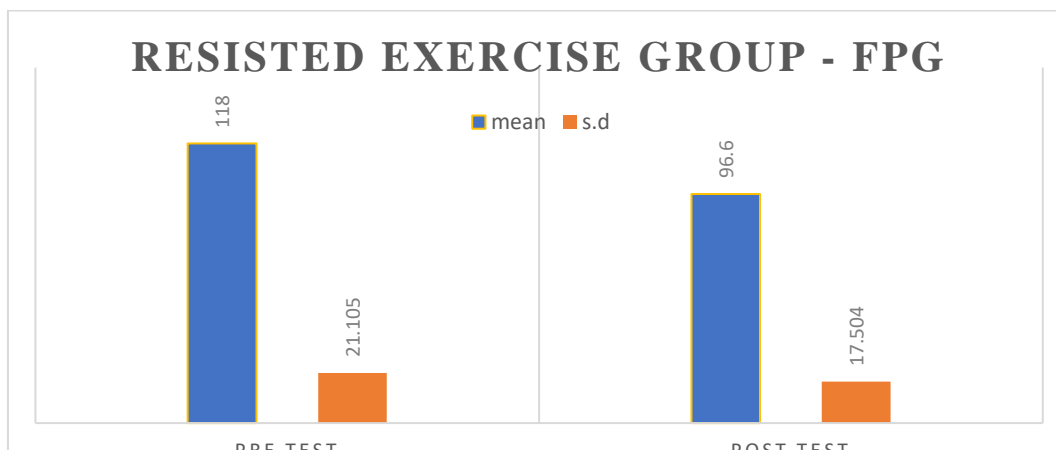
**Graph 1:** Analysis of Fasting Plasma Glucose



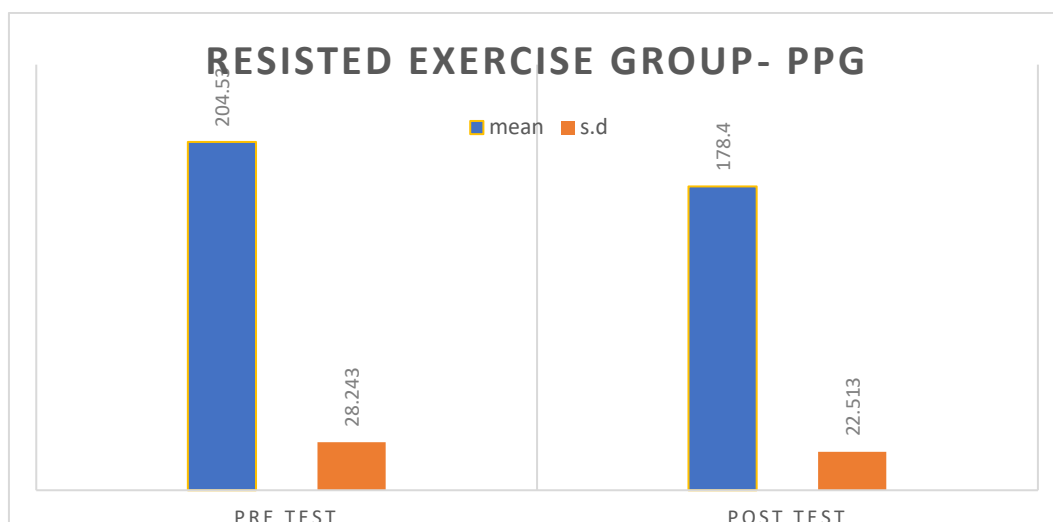
**Graph 2:** Analysis of Post Prandial blood Glucose



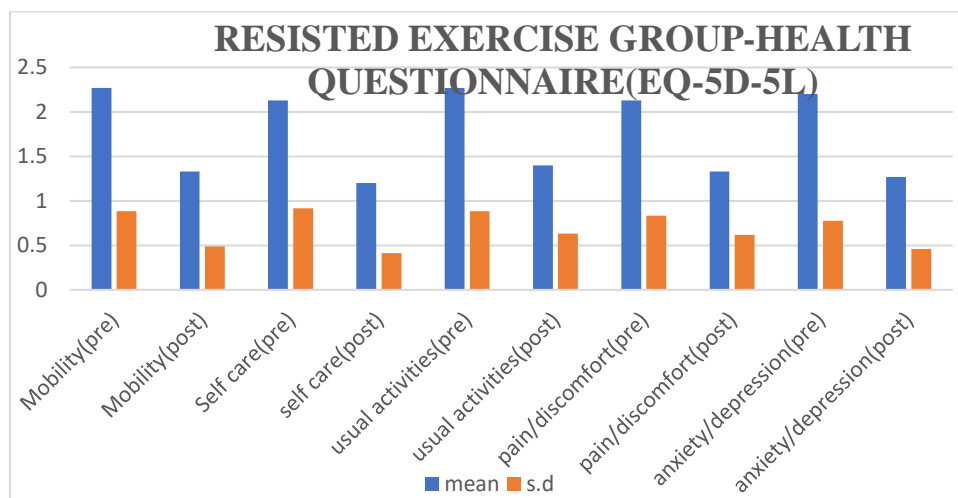
**Graph 3:** Analysis of health questionnaire (EQ-5D-5L)



**Graph 5:** Analysis of fasting plasma glucose (FPG)



**Graph 6:** Analysis of post prandial blood glucose (PPG)



**Graph 7:** Analysis of health questionnaire (EQ-5D-5L)

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## 5. Discussion:

It is interesting to see that both aerobic exercise and resisted exercise have shown improvements in blood glucose and health-related quality of life in people with type 2 diabetes mellitus. However, your study has found that resisted exercise has provided greater benefits in terms of these outcomes when compared to aerobic exercise.

It is significant to remember that physical exercise is essential for controlling and avoiding type 2 diabetes mellitus because it can support and maintain healthy levels of lipids, blood pressure, and blood glucose. Chronic problems include cardiovascular disease, blindness, kidney and nerve illness, and amputation may be avoided as a result.

It's crucial to consider health-related quality of life as an outcome metric when evaluating how managing chronic diseases affects patients' physical and psychological burdens. The EQ-5D-5L, which has been found to have more discriminative power than the three-level scale in patients with T2DM, was utilised in your study to measure HRQoL.

It is also interesting to note the findings of Qadri et al. (2021), who reviewed the impacts of resistance training and diet modification on HbA1c, fasting plasma glucose, body fat percentage, and lipid profiles in patients at risk of type 2 diabetes mellitus. Their findings support the use of resistance training alone in improving glycemic control, body fat percentage, and blood lipids in these patients<sup>50-54</sup>.

Overall, the study has provided valuable insights into the effectiveness of different types of exercise in improving blood glucose levels and health-related quality of life in people with type 2 diabetes mellitus.

## LIMITATION:

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There are some limitations to the current investigation. There was no passive control group in this study, and the study population was somewhat small. Future research can be conducted to assess the effects of exercise on glycemic control as this study was only conducted for a brief period of time, making it impossible to analyse the glycemic control. Its ideal to conduct a study on the effects of combined aerobic and resistance training on diabetes health.

## 6. Conclusion:

People with type 2 diabetes can benefit from a coastal lifestyle by being encouraged to regularly exercise through sports like swimming, surfing, and beach walks. Additionally, the salty sea air helps reduce stress and enhance general wellbeing. However, it is essential to keep up a balanced diet and keep an eye on your blood sugar levels. Based on its findings, this study came to the conclusion that type 2 diabetics can benefit from both aerobic and resistive exercise for decreasing blood sugar and enhancing quality of life. However, resistive exercise outperforms aerobic exercise in terms of reducing blood glucose and enhancing the health of those with type 2 diabetes mellitus.

## Conflict of Interest: Nil

Ethical approval – Yes

## FUNDING:

Nil

## Author Contribution:

Velkumar.V designed the methodology and supervised throughout the study. Gowtham. R conceived the concept, designed and performed the treatments, data collection and wrote the paper. Interpretation of results was done by Shanaz Banu. E.Shanmugananth overall supervision and design suggestion.

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