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Low interval intensity training for cardiorespiratory system and blood sugar level in patients with diabetes 2

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Abstract

Type 2 diabetes mellitus is an important global health matter which impacts around 382 million individuals globally. Sport workout has been viewed as the "gold standard" for treating type 2 diabetes. However, people with diabetes still has a low level of exercise. The current study's goal is to determine how type 2 diabetes patients' blood sugar levels and cardiorespiratory systems are affected by low intensity interval training. A fifty patients who volunteered to take part in this study were referred by medical professionals and were appearing at an additional session held by the authorities of Al-Hillah City/Babylon at a local medical hospital. They had been diagnosed with diabetes 2 and were between the ages of 40 and 50. Blood seems to be more affected by LIIT.

Keywords: training , cardiorespiratory system , diabetes

1. Introduction:

There's increasing understanding of the impact exercise provides in improving both physical as well as overall health. Exercise has been shown to considerably improve physiological variables including blood sugar and cardiovascular fitness, according to the majority of studies conducted to date. Scheewe et al. (2013) and Rosenbaum, Tiedemann, Sherrington, Curtis, & Ward (2014).

Low-intensity interval training (LIT) is a type of exercise that alternates between brief periods of high activity and low-intensity exercise. LIT is highly varied, and the physiological changes brought about by this kind of training are dependent on a wide range of factors, such as the specifics of the exercise stimulus (Hurst, Weston, & Weston, 2019). As a quick workout technique to raise overall population fitness and health, low intensity interval training is becoming more and more popular when matched-work training is conducted in comparison to standard endurance training, or when the anticipated energy expenditure is the same. Increased muscle deoxygenation, enhanced oxygen uptake, and enhanced exercise performance are the outcomes of LIIT (Jacobs et al., 2013; McKay, Paterson, & Kowalchuk, 2009). It has been demonstrated that LIIT improves blood pressure control, weight loss, blood sugar regulation, and cardiorespiratory fitness (Finn, 1996; Byrd *et al*., 2019).

Interval training may present physiological and physical risks, causing an avoidant response and retreat, according to several research. Additionally, in order to reach the right level of intensity, LIIT participants must practice self-control and self-discipline. (Hardcastle *et al*., 2014; Viana *et al*., 2018). The purpose of the study is to determine how low-intensity interval training affects blood sugar levels. The researchers chose to look into and understand the effects of low-interval training on blood sugar and cardiorespiratory function in diabetes 2 because they knew that certain types of training are essential for the physiological variables.

2. Methods and Procedures:

2.1 Participants:

Referred by medical professionals, fifty patients who were gave their consent to participate in this study and were seen at a subsequent clinic at an area health clinic in Al-Hillah City, Babylon province.. They were about forty and fifty years old, and a specialist physician had diagnosed them with diabetes type 2 (blood sugar level of 180 mg/mol) more than a year prior. According to the worldwide effort for diabetes recommendations, Patients who satisfied the criteria for type 2 diabetes were included; these criteria included meeting the criteria for diagnosis, physical examination, and medical history (Clinical recommendations Task Force global Guideline for Type 2 Diabetes, 2012). Participants had to be in a clinically stable state, free from infections or increasing symptoms of diabetes, and not have changed medications in the two months prior to the commencement of the trial. The University of Babylon's Institutional Review Board (IRB) in Iraq gave its clearance to the study on January 3, 2021. Before the investigation started, participants who met the inclusion criteria gave their written informed consent. Participants were thoroughly informed about all tests and upper and lower torso training procedures using equipment. Table (1) illustrates the initial characteristics of the research's sample.

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Variables	Mean	SD
Age, yr	43.17	5.12
Weight, kg	60.12	6.23
High, cm	173.31	9.62
Blood sugar test	175.37	11.75
FEV1, % of predicted	78.24	9.32
Heart rate at rest	82.46	9.36

2.2. Experimental Design

Our study compared general training vs low interval intensity training using a prospective, randomized trial design including two groups. 50 individuals were enlisted, and each of the two intervention groups—group 1 using GT and group 2 using LIIT—contained 50 patients with type 2 diabetes. The participants were assigned at random. Researchers with a special training certificate who are knowledgeable in blood sugar testing, respiratory muscle work, and cardiorespiratory physiology did all pre- and post-intervention assessments.

2.3 Measurement Procedures

Outcome Measures

2.2.1Blood Sugar Test:

Blood sugar levels of under 120 mg/dL (7.8 mmol/L) are accepted as healthy. Diabetes can be diagnosed by a result of more than 200 mg/dL (11.1 mmol/L) following a period of two hours. A result around 130 and 199 mg/dL (7.8 mmol/L and 11.0 mmol/L) is indicative of pre-diabetes. Our subjects worked hard to finish the measurement process.

2.2.2 Lung function measurements:

To assess the health of the lungs, FEV1 was performed., A device called a spirometer has been utilized to calculate each value of the forced vital capacity (FVC), the volume of forced expiration in 1 second (FEV1), and the ratio of FEV1 to FVC (as described by Burt *et al.*, 1995) following the three permissible FVC movements. A straightforward test that is crucial for diagnosing airway blockage is the spirometer. Since the results are mostly dependent on how regularly patients and technicians perform, spirometric measures are more variable than most other clinical laboratory tests (Crapo, 1994). Additionally, each participant will undergo testing in accordance with the American Thoracic Society's guidelines, which recommend measuring the level of obstruction of the airways by using FEV1

2.2.3 Heart Rate Measurement:

Cardiorespiratory fitness is often assessed using resting heart rate. Adults' resting heart rate (HR) and cardiorespiratory fitness are inversely correlated, based on studies which are descriptive. In untrained men and women, aerobic training decreased resting heart rate regardless of patients' age (< 41 or 41-60 years) or period of intervention exposure (< 3, 4-6, or > 6 months). Numerous physically trained persons may also experience electrophysiologic alterations intrinsic to the sinus node, even if this link may be at least partially explained by increased resting cardiac vagal activity.

An individual may determine and view their pulse in actual time or store it for analysis afterwards with the use of a heart rate monitor (HRM). It is utilized primarily to capture data on heart rate during rest. (Heart+rate+monitor+system at https://biw).

2.3 Low intensity interval training procedure:

The two groups (experimental 1 and experimental 2) that participants with diabetes 2 were randomly assigned to. During an hour-long familiarization session, participants received instructions on the specific training regimen, as well as the appropriate training equipment and exercise adherence journal. Exercise regimens carried out outside of a hospital. Cycling on an ergometer kicked off every session. 50–70% was the target training intensity in experimental group 1, and 75–85% was the target training intensity in experimental group 2. In experimental group 1, the intervals lasted five minutes, but in experimental group 2, the intervals lasted three minutes. There were (4) "downhills," (5) "uphills," and a warming-up and cooling-down phase in every training session. The total cycle length was forty minutes. Exercise load should always be maintained as high as is tolerable, ideally higher than the target values. Additionally, Training plans comprised of a range of upper and lower body exercises, including sprinting, jumping, walking, leg and arm motions, and stretching exercises for the abdominal muscles (20 repetitions, three sets of exercise, at around 50–70% of 1 RM) and (8 repetitions, 4 sets, at roughly 75–85% of 1 RM) in addition to the chest, neck, shoulders, arms, and the legs. Each patient completed a pre- and post-measurement assessment.

2.4 statistical Analysis:

An independent and dependent sample test was used to analyze the data that was entered into the SPSS program and the findings (T-test).

3. Results and Discussion:

Table (2) displays the pre- and post-test mean, standard deviation, t-test, signal, and significance for Group 1.

Variables	Pre-test		Post-test		T-test		Significant
	Mean	SD	Mean	SD	Accountable	Signal	
Blood sugar test	175.37	11.75	21.140	7.45	3.03	0.004	S
FEV1, % of predicted	78.24	9.32	93.52	6.71	4.13	00.00	S
Heart rate at rest	82.46	9.36	77.24	4.81	4.07	0.000	S

Research sample size (24), as well as the degree of significance (0.05)

Table (2) indicates a substantial variance among the two tests pre and post at the percentage of errors (5%) and the level of freedom (24), while assessing the blood sugar test, FEV1, and heart rate at rest. Progress in all research tests for group 1 is indicated by the calculated T value in all tests (3.03, 4.13, 4.07), which is higher than the value of T tabular (2.05).

Table (3) displays the pre- and post-test mean, standard deviation, t-test, signal, and significance for Group 2.

Variables	Pre-test		Post-test		T-test		Significant
	Mean	SD	Mean	SD	Accountable	Signal	
Blood sugar test	176.37	10.32	166.67	7.67	2.63	0.000	S
FEV1, % of predicted	79.24	6.15	84.44	5.83	2.68	00.00	S
Heart rate at rest	81.46	6.20	78.35	6.95	2.81	0.000	S

Research sample size (24), as well as the degree of significance (0.05)

Table (3) illustrates an important distinction across the two tests pre and post at the error rate (5%) and level of freedom (24), while measuring blood sugar levels, FEV1, and heart rate at rest.

Advancement in all study tests for group 2 is indicated by the estimated T values in all tests (2.63, 2.68, and 2.81), which are greater than the value of T tabular (2.05).

Table (4) displays the post-test mean, SD, T-test, signal, and significance for both groups.

Variables	Group 1		Group 2		T-test		Significant
	Mean	SD	Mean	SD	Accountable	Signal	
Blood sugar test	21.140	7.45	166.67	7.67	1.18	0.08	No S
FEV1, % of predicted	93.52	6.71	84.44	5.83	1.20	0.07	No S
Heart rate at rest	77.24	4.81	78.35	6.95	1.23	0.09	No S

Research sample size (48), as well as the degree of significance (0.05)

Table (4) shows that there is not a substantial distinction amongst the two groups in post-tests at the level of freedom (48), rate of error (1%) and blood sugar levels, FEV1, and heart rate at rest. In each of the tests, the predicted T value is 1.18, 1.20, and 1.23, greater than the T tabular value of 1.57, suggesting which no previous test results show an important distinction within the two groups.

Diabetes type 2 has been linked to decreased performance on endurance exercises (Wilkerson et al., 2011; O'Connor et al., 2012). Additionally, people with type 2 diabetes are more likely to experience cardiorespiratory problems and early death when they have a higher resting heart rate. Graham and colleagues, 2012). Additionally, a new research paper that has been published in the Journal of Diabetes Care suggested that individuals with type 2 diabetes have a higher risk of developing pulmonary fibrosis by 54%, chronic obstructive pulmonary disease (COPD) by 22%, asthma by 8%, and pneumonia hospitalization by almost twice as much (https://floridachest.com/pulmonary-blog/how-diabetes-impacts-your-lung-health). Nonetheless, individuals with type 2 diabetes may benefit from low-intensity interval training routines, such as aerobic and anaerobic training.

Diabetic individuals can safely engage in low-intensity interval aerobic training that targets major muscle groups. This type of training usually includes low-intensity aerobic interval training, like cycling, walking, and running (Thent et al., 2013).

The current study's findings shown improvements in both groups' resting heart rates, FEV1, percentage of expected value, and blood sugar test. These improvements were, however, the result of low intensity interval training (LIIT). A recent study (Monique & Jonathan 2015) found that LIIT can assistance patients with type 2 diabetes improve their blood sugar levels and cardiorespiratory health. Other studies, (Paffenbarger 1996, Wei *et al*., 2000, Church *et al*., 2004) however, showed that poor cardiorespiratory fitness is an important predictor of death in individuals with diabetes and is a recognized risk factor for chronic illnesses like type 2 diabetes.

Terada *et al*. (2013) also found that over a 12-week training program, low-intensity interval exercise resulted in greater immediate decreases in blood sugar as determined by taking samples of the arm veins both prior to and following each training session. Roberts et al. (2013) have demonstrated that low intensity interval training (LIIT) raises blood sugar levels by increasing muscle fiber recruitment and rapidly lowering muscle glycogen stores. This, in turn, stimulates a greater increase in post-exercise muscle insulin sensitivity, which lasts for 24-48 hours following a single bout of exercise. Furthermore, LIIT may be an extremely effective strategy for improving sugar control over an extended period of time. Extended LIIT sessions (e.g., 12–16 weeks) may result in increased lower-body muscle mass as well as the additional reduction of abdominal adipose tissue (Gillen *et al*., 2013). It has been demonstrated that low intensity interval training affects FEV1 and heart rate. LIIT has been shown to improve heart rate and pulmonary function (David *et al*., 2020), whereas training with LII for 12 weeks improved resting heart rate (RHR) and fasting glucose readings (FG) (Parpa *et al*., 2009).

4. Conclusion:

In terms of heart rate and FEV1, patients with type 2 diabetes benefit from general and low-intensity interval exercise. The kind of exercise selected for diabetes treatment should be suitable for the patient's clinical profile. Furthermore, more investigation is needed to understand the impact of prolonged exercise on blood sugar levels in individuals with type 1 diabetes.

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