



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

# IJDR

International Journal of Development Research  
Vol. 10, Issue, 03, pp. 34129-34131, March, 2020



RESEARCH ARTICLE

OPEN ACCESS

## EFFECT OF DIFFERENT INTENSITIES OF AEROBIC EXERCISE ON SELECTED PHYSIOLOGICAL VARIABLES AMONG DIABETIC PATIENTS

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### ARTICLE INFO

#### Article History:

Received 19<sup>th</sup> December, 2019  
Received in revised form  
26<sup>th</sup> January, 2020  
Accepted 18<sup>th</sup> February, 2020  
Published online 30<sup>th</sup> March, 2020

#### Key Words:

Diabetic Patients, Resting Pulse Rate, Mean Arterial Blood Pressure, Low, Medium and High Intensities of Aerobic Exercises.

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### ABSTRACT

The aim of this study is to find out the effect of different intensities of aerobic exercises on selected physiological variables among diabetic patients. Randomly selected 60 (N=60) diabetic patients whose blood glucose levels were more than 140 mmHg and who were undergoing treatment for diabetics in Government General Hospital, Nagercoil were treated as subjects for this study. They were randomly assigned into four groups consisting of 15 in each group. Group I was considered as low intensity aerobic exercises group (LIAE), group II was considered as medium intensity aerobic exercises group (MIAE), group III was considered as high intensity aerobic exercises group (HIAE) and the fourth group served as control group. Pre and post test scores on resting pulse rate and blood pressure were collected and statistically analyzed. The results of the study proved that medium intensity aerobic exercises is significantly better than control group in altering resting pulse rate. The differences due to low and high intensity aerobic exercises in altering resting pulse rate were not found to be significant. As for mean arterial blood pressure, medium and high intensity aerobic exercises significantly altered compared to control group. The effect of low intensity aerobic exercise was not significant. It was concluded that aerobic exercises of medium intensities may be recommended for diabetic patients in managing diabetics

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Citation: Purushothaman, S. and Dr. N. Bright Selva Kumar, 2021. "Effect of different intensities of aerobic exercise on selected physiological variables among diabetic patients" *International Journal of Development Research*, 10, (03), 34129-34131.

## INTRODUCTION

Diabetes develops due to a diminished production of insulin (in type 1) or resistance to its effects (in type 2 and gestational). Both lead to hyperglycemia, which largely causes the acute signs of diabetes excessive urine production, resulting compensatory thirst and increased fluid intake, blurred vision, unexplained weight loss, lethargy, and changes in energy metabolism. Type 1 diabetes mellitus is characterized by loss of the insulin-producing beta cells of the islets of Langerhans in the pancreas, leading to a deficiency of insulin. This type of diabetes can be further classified as immune-mediated or idiopathic. (Baillie, 2008) Type 2 diabetes mellitus is characterized differently and is due to insulin resistance or reduced insulin sensitivity, combined with relatively reduced insulin secretion which in some cases becomes absolute. The defective responsiveness of body tissues to insulin almost certainly involves the insulin receptor in cell membranes. Type 2 diabetes is usually first treated by increasing physical activity, decreasing carbohydrate intake, and losing weight. These can restore insulin sensitivity even when the weight loss is modest, for example around 5 kg, most especially when it is in

abdominal fat deposits. It is sometimes possible to achieve long-term, satisfactory glucose control with these measures alone. However, the underlying tendency to insulin resistance is not lost, and so attention to diet, exercise, and weight loss must continue (Lang, Jain, 2008). The usual next step, if necessary, is treatment with oral antidiabetic drugs. Insulin production is initially only moderately impaired in type 2 diabetes, so oral medication (often used in various combinations) can be used to improve insulin production (e.g., sulfonylureas), to regulate inappropriate release of glucose by the liver and attenuate insulin resistance to some extent (e.g., metformin), and to substantially attenuate insulin resistance (e.g., thiazolidinediones). Over weight patients treated with metformin compared with diet alone, had relative risk reductions of 32% for any diabetes endpoint, 42% for diabetes related death and 36% for all cause mortality and stroke. Oral medication may eventually fail due to further impairment of beta cell insulin secretion. At this point, insulin therapy is necessary to maintain normal or near normal glucose levels. Aerobic exercise refers to exercise that involves or improves oxygen consumption by the body. Aerobic means "with oxygen", and refers to the use of oxygen in the body's metabolic or energy-generating process (Cambridge Oxford English Dictionary). Many types of exercise

are aerobic, and by definition are performed at moderate levels of intensity for extended periods of time. To obtain the best results, an aerobic exercise session involves a warming up period, followed by at least 20 minutes of moderate to intense exercise involving large muscle groups, and a cooling down period at the end.

Canabal Torres (1994) made a study on "Exercise, Physical Activity and Diabetes Mellitus" and reported that vigorous regular exercise is a recommended inclusion in the management of diabetes of persons with diabetes of the both types regardless of age. Exercise in the management of non-insulin-dependent diabetes mellitus was constructed by Wallberg-Henrikson (1998) and found exercise training also improves many other physiological and metabolic abnormalities that are associated with NIDDM such as lowering body fat, reducing blood pressure and normalizing dyslipoproteinaemia. A study on insulin sensitivity was constructed by Ryan (2000) resistance a reduction in the rate of glucose disposal elicited by a given insulin concentration, and presented in individuals who were obese and those with diabetes mellitus and may develop with aging methods which were utilised to measure insulin sensitivity included the hyperinsulinaemic-euglycaemic and hyperglycaemic clamped and the intravenous glucose tolerance tests. Researches showed that aerobic exercises in the form of walking has been shown to reduce cholesterol levels, have a protective effect from coronary heart disease, reduce body weight, reduce blood pressure and improve circulation in medical patients. Walking about 30 minutes after eating has been beneficial in keeping post prandial blood sugars in control for many patients. They feel that they can accomplish a 20 to 30 minutes walks 2 or 3 times per day and over a couple of months, they feel better. Many have reduced their medication levels during their tenure in their walking programme (Girish and Sridhar, 2007).

Among the causes outlined for increasing diabetes, the problem of physical inactivity can be addressed effectively by suggesting different sets of physical activities. Among the different physical activities suggested, aerobic exercises are considered to be more effective for patients with diabetes. (Gaziano et.al. 2007) Aerobic is a system of exercises designed to promote the supply and use of oxygen in the body. Some of these exercises include running, dancing, rowing, skating and walking. Aerobic exercise increases cardio respiratory fitness, which is the heart's ability to pump blood and deliver oxygen throughout the body. Some benefits of cardio respiratory fitness are increased endurance and energy, weight control decreased blood pressure, decreased heart rate, decreased cholesterol levels, and an increased ability to manage stress. This paper attempts to address the research questions, such as, what kind of aerobic exercise is more effective to alter selected physiological variables? What intensity of aerobic exercise would be better in influencing the selected physiological variables? Hence, the investigator was interested to find out the effect of varied intensities of aerobic exercises on selected physiological variables among diabetic patients.

## METHODOLOGY

Randomly selected 60 (N=60) diabetic patients whose blood glucose levels were more than 140 mmHg and who were undergoing treatment for diabetics in Government General Hospital, Nagercoil were treated as subjects for this study. They were randomly assigned into four groups consisting of 15 in each group. Group I was considered as low intensity aerobic exercises group (LIAE), group II was considered as medium intensity aerobic exercises group (MIAE), group III was considered as high intensity aerobic exercises group (HIAE) and the fourth group served as control group. Prior to the experimental treatments all the subjects were measured of their physiological variables such as, resting heart rate, and mean arterial blood pressure which formed the initial scores of the subjects. The subjects were treated in respective experimental treatment for 12 weeks and immediately on completion of the experimental treatments, all the subjects were tested on the criterion measures which formed the final scores of the study. The difference between initial and final scores

was considered as the effect of different intensities of aerobic exercises. To ascertain the statistical significance of the differences in means, statistical tool ANCOVA was employed. In all cases 0.05 level was fixed to test the hypothesis of the study.

## RESULTS

The descriptive statistics on resting pulse rate and mean arterial blood pressure proved that there existed mean differences due varied intensities of aerobic training and to test statistical significance, ANCOVA were computed and the results presented in Table 2. The results proved that obtained F values of 3.68 and 6.34 on adjusted means were greater than the required F value to be significant at 0.05 level. Hence, post hoc analysis was made and results presented in Table 3.

**Table 1: Descriptive Statistics on Resting Pulse Rate and Mean Arterial Blood Pressure due to different intensities of aerobic training, namely, Low intensity aerobic training (LIAE), Medium intensity aerobic training (MIAE), High intensity aerobic training (HIAE) and Control Groups (CG)**

Groups	Test	Mean	Standard Deviation	RANGE	
				Min	Max
<b>RESTING HEART RATE</b>					
Low intensity aerobic training	Initial	74.80	7.12	62.00	<b>86.00</b>
	Final	72.53	5.50	62.00	<b>79.00</b>
	Adjusted Mean	72.46			
Medium intensity aerobic training	Initial	74.47	4.70	69.00	<b>86.00</b>
	Final	69.60	3.89	64.00	<b>76.00</b>
	Adjusted Mean	69.67			
High intensity aerobic training	Initial	74.53	5.91	67.00	<b>86.00</b>
	Final	72.13	4.90	64.00	<b>82.00</b>
	Adjusted Mean	72.18			
Control Group	Initial	74.73	7.70	63.00	<b>88.00</b>
	Final	74.67	5.07	66.00	<b>83.00</b>
	Adjusted Mean	74.62			
<b>MEAN ARTERIAL BLOOD PRESSURE</b>					
Low intensity aerobic training	Initial	98.07	2.42	93.50	<b>102.00</b>
	Final	97.33	2.33	93.50	<b>100.00</b>
	Adjusted Mean	97.36			
Medium intensity aerobic training	Initial	97.33	2.60	93.50	<b>101.00</b>
	Final	93.10	5.68	85.00	<b>99.00</b>
	Adjusted Mean	93.36			
High intensity aerobic training	Initial	99.03	2.80	94.00	<b>105.00</b>
	Final	95.50	3.95	84.00	<b>100.00</b>
	Adjusted Mean	95.21			
Control Group	Initial	98.13	4.39	90.50	<b>104.50</b>
	Final	99.83	4.80	93.50	<b>107.50</b>
	Adjusted Mean	<b>99.84</b>			

**Table 2: ANCOVA Results on Resting Pulse Rate and Mean Arterial Blood Pressure comparing LIAE, MIAE, HIAE and CG**

	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
<b>RESTING PULSE RATE</b>					
Pre Test Mean	Between	1.13	3	0.38	0.01
	Within	2340.80	56	41.80	
Post Test Mean	Between	194.33	3	64.78	2.73
	Within	1330.40	56	23.76	
Adjusted Post Test Mean	Between	185.20	3	61.73	3.68*
	Within	923.46	55	16.79	
<b>MEAN ARTERIAL BLOOD PRESSURE</b>					
Pre Test Mean	Between	21.81	3	7.27	0.73
	Within	555.23	56	9.91	
Post Test Mean	Between	365.28	3	121.76	6.38*
	Within	1068.77	56	19.09	
Adjusted Post Test Mean	Between	349.77	3	116.59	6.34*
	Within	1010.74	55	18.38	

Required  $F_{(0.05, (df3,75))} = 2.77$ ; \* Significant at 0.05 level of confidence

**Table 3: Multiple paired means comparisons among LIAE, MIAE, HIAE and CG on Resting Pulse Rate and Mean Arterial Blood Pressure**

Low intensity aerobic training Group	Medium intensity aerobic training Group	High intensity aerobic training Group	Control Group	MEAN DIFF	C.I
<b>RESTING PULSE RATE</b>					
72.46	69.67			2.79	4.31
72.46		72.18		0.29	4.31
72.46			74.62	2.16	4.31
	69.67	72.18		2.51	4.31
	69.67		74.62	4.96*	4.31
		72.18	74.62	2.45	4.31
<b>MEAN ARTERIAL BLOOD PRESSURE</b>					
97.36	93.36			4.00	4.51
97.36		95.21		2.15	4.51
97.36			99.84	2.48	4.51
	93.36	95.21		1.85	4.51
	93.36		99.84	6.47*	4.51
		95.21	99.84	4.62*	4.51

\* Significant at 0.05 level

## DISCUSSION

Gaziano *et al.*, 2007 found that the problem of physical inactivity, which is considered as a factor to increase diabetics among diabetic patients can be addressed effectively by suggesting different sets of physical activities. And among the different physical activities suggested, aerobic exercises are considered to be more effective. This paper made an attempt how far different intensities of aerobic exercises, namely, low, medium and high can influence selected physiological variables resting pulse rate and mean arterial blood pressure of diabetic patients. The results of the study proved that medium intensity aerobic exercises is significantly better than control group in altering resting pulse rate. The differences due to low and high intensity aerobic exercises in altering resting pulse rate were not found to be significant. As for mean arterial blood pressure, medium and high intensity aerobic exercises significantly altered compared to control group. The effect of low intensity aerobic exercise was not significant.

## CONCLUSION

It was concluded that aerobic exercises of medium intensities may be recommended for diabetic patients in managing diabetics.

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