VOLUME-7, ISSUE-12, DECEMBER-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Biochemistry

IMPACT OF AEROBIC EXERCISE ON HBA1C LEVELS IN TYPE 2 DIABETES MELLITUS PATIENTS

Dr. Borra, Dharmendhar	Department of Biochemistry, KVG Medical College and Hospital, Sullia
Dr. Gireesh*	Department of Medicine, K.V.G Medical College and Hospital, Sullia *Corresponding Author
Dr. Nishanth Gowda N	Physiotherapist, KIMS Bangalore.
Dr. Sandesh K S	Head, Department of PG Studies, NMC Sullia

ABSTRACT The impact of regular exercise on the levels of health promotion among patients with type 2 diabetes mellitus is highly documented. Regular exercise, especially aerobic exercise is known to have long-term impacts on the biological indicators among the identified patients. This research is a quasi-experimental trial that involves the analysis of outcome of aerobic exercise on HbA1c levels in type 2 diabetes mellitus patients. The research is carried out among patients in South Karnataka, where a total of 650 patients with type 2 diabetes mellitus aged 30-70 years are carried out with the experiment group comprising of 350 patients and the control group comprises of 300 patients. After 8 weeks of conducting the experiment, the results were taken for analysis. The results show that long-term exercise has a significant impact on Hb1A1c, where the BMI and Vo2 max was reported to be ($P<0.05$), an improvement as compared to the patients who did not undergo the exercise who had the HbA1c reduced.

KEYWORDS :

INTRODUCTION

Aerobic exercise, as any other physical exercise is associated with helpful health outcomes including the improvement in the glycemic control among patients with type 2 diabetes mellitus. Most T2DM prevention programs have recommended aerobic (cardio-respiratory) activities with strong evidence supporting this approach. Large scale prevention studies such as the Diabetes Prevention Program (DPP) [4] reported reductions in T2DM incidence of up to 58% [5] and improvements in risk factors such as weight and insulin sensitivity1.Other benefits of aerobic exercise include the improvement in the body composition and cardiovascular fitness among these patients (Ahn& Song, 2012).Furthermore it has been demonstrated that different exercise training modalities produce different effects on glycaemic control in those with type II diabetes, with combined aerobic and resistance exercise reported to be most beneficial2. Meta-analyses have demonstrated that this dose of regular exercise is effective in improving glycaemic control as measured by change in glycosylated hemoglobin (HbA1c) in diabetic cohorts3.On the contrary, the long-term exposure to aerobic activity among the patients has the ability of offsetting the deteriorations of biological indicators especially among the control groups. This experiment highly emphasizes the fact that there are different levels of benefits of aerobic training alone on the possible hemoglobin HbA1c among patients with type 2 diabetes mellitus (Umpierre et al., 2013). The study design is a randomized 8-month intervention with a control group that is carried out on one major group of aerobic training. The interventions are designed to have approximately similar time requirements (Bacchi et al., 2012). The exercise prescription was standardized to the weight of the body, where there was an estimation that 100 minutes per week of moderate intensity exercise would amount to 9-10 kcal/kg of body weight per week. The type of diabetes medication and dosage are also assessed by detailed questionnaires distributed to patients across the South Karnataka region (Choi et al., 2012). The experiment is meant to show that aerobic exercise has a significant effect on HbA1c as compared to the patients in the control groups as the former should show improvements in the BMI and VO2 max.

METHODOLOGY

In this quasi-experimental trial, 650 patients with type 2 diabetes mellitus were selected from healthcare facilities across the South Karnataka, where the inclusion criteria involved male and females aged between 30 and 70 years. The experiment group comprised of 350 patients, while the control group was represented by 300 patients (Yavari et al., 2012). The aerobic exercise program was carried out for 8 weeks, where the data on 300 patients with 150 from the experiment and 150 from the control groups were recorded for analysis. The aerobic exercise was to be carried out in terms of three sessions per week, where each lasted for 100 minutes, 40%-60% VO2 max (Umpierre et al., 2011). The indicators of hemoglobin A1C (HbA1c), the body mass index (BMI) and the VO2 max were recorded before and after every intervention. The analysis of data was carried out through a multivariate analysis of the covariance.

SAMPLING METHOD

The sampling method was randomized to help incorporate other factors that may determine the changes in biological conditions such as the hemoglobin A1C (HbA1c), the body mass index (BMI) and the VO2 max (Karstoft et al., 2013). A total of 650 patients from South Karnataka region were selected to participate in this research with 350 belonging to the experimental group, while 300 participants belonged to the control group (O'Hagan et al., 2013). The sample was considered valid as it would represent the findings from the whole population.

PARAMETERS TESTED

The participants in both the experimental and the control groups were required to continue with their previous medications and diets (Kwon et al., 2011). On the other hand, the participants in the control group were required to maintain their present lifestyle from the onset to the end of the experiment. Before and after the said intervention, patients were subjected to the measures of parameters such as the HbA1c and VO2max by the applications of the HbA1c analyzer (Schwingshack et al., 2014). The estimations of the VO2 max were timed following 100 hour period of aerobatics exercises incorporating the gender, the age, and the body weight in pounds at the end of the training session. The rate of heart beat was monitored using the PolarFT60 machine obtained from China.

EXERCISE PROGRAMS

The exercise regimen was set in such a way that there was a 2 week run-phase that was carried out in two phases per week, where each would last for 15-30 minutes (Yavari, et al., 2012). The activities of the sessions included warm-up movements, and carrying out the

aerobic exercises at moderation. The first sessions involved setting the time requirements to enable patients to be familiar with the exercise machines (Kennedy et al., 2013). There was a consequent progression of the exercises in durations from 50% to 90% of maximum heart rates.

STATISTICAL ANALYSIS

The descriptive statistical analysis was used in obtaining the central and variation measures. On the other hand, the Kolmogrov-Smirnov test was carried out in the course of normalization of data (Kennedy et al., 2013). Paired t-tests were used in comparing the variables in each group before and after the aerobic exercise.

RESULTS

The results showed that the mean age of the subjects was 58 years, while the mean ages for the experimental and control groups were 57.3 and 57.4 years respectively. The table below demonstrates the descriptive statistics of HbA1c, the body composition and the VO2 max for the intervention measure that was proposed among the patients in the experimental and the control groups. In the table, there are statistical significant variations in the three variables that were tested.

Table 1: Descriptive statistics

Parameter	Group	Mean	SD	N
Post-BMI	Experiment	27.5	4.5	150
	Control	31.4	5.13	150
	Total	30	5.22	300
Post HBA1c	Experiment	6.52	0.63	150
	Control	7.92	1.14	150
	Total	7.3	1	300
Post VO2 Max	Experiment	32.11	7.61	150
	Control	20	14.5	150
	Total	25.8	13	300

The other analysis was the pairwise comparisons between the levels of BMI and HbA1c in the experimental group, which was lower than the control group. The results also showed that the level of VO2 max in the experimental group was higher than that of the control group.

Table 2: pairwise Comparisons

Dependent variable	(I) group	(J) group	Mean difference (I–J)	SE	P value
Post-BMI	Experiment	Control	−3.81*	0.922	0.000
	Control	Experiment	3.81*	0.922	0.000
Post-HbA1c	Experiment	Control	−1.06*	0.319	0.003
	Control	Experiment	1.063*	0.319	0.003
Post-VO_2max	Experiment	Control	12.97*	1.28	0.000
	Control	Experiment	−12.97*	1.28	0.000

The changes in the BMI and HbA1c during the 8 weeks of carrying out the program on the patients with type 2 diabetes mellitus were as shown in the graph below:

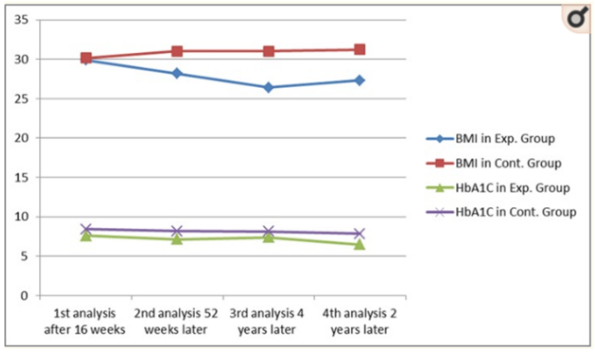
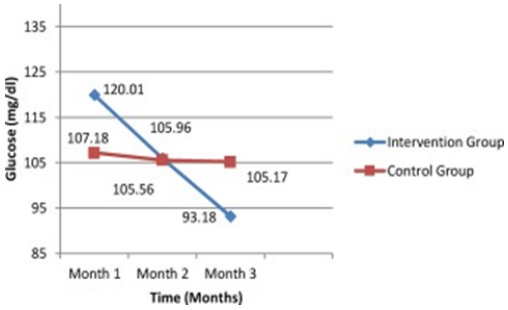


Figure 3: Graph for the changes in BMI and HbA1c

The graph below can also showed the relationship between the glucose sugar levels for the intervention group and the control group.

Figure 4: Changes in Glucose levels following aerobic exercise



DISCUSSION

The current study showed that there was a significant decrease (1.4%) in the levels of HbA1c among the experimental group following 8 weeks of aerobic exercise. There was also a constant decrease in the pattern of the variable that was observed in the experimental group following the same periods of examination. Among the control groups, the 8-weeks' timeline alterations were also found to follow a distinct pattern (Grøntved et al., 2012). Despite the decreasing pattern of the levels of HbA1c in the control group, there were variations in the indices, where those in the experimental group depicted higher values compared to the control. The significance of aerobic exercise on the HbA1c levels was also marked by monitoring the BMI alterations among the groups (Schwingshackl et al., 2014). It is imperative that the body mass index may define the levels of glucose in blood.

This implies that having long-term periods of exposure to aerobic exercise can increasingly improve the levels of HbA1c among patients with type 2 diabetes mellitus. In addition, the results were significant at showing that the long-term regular exercise or aerobics can result in the increase in the levels of VO2 max among the patients diagnosed with type 2 diabetes mellitus. The result findings concur with literature analysis of different researchers that have shown that the values in HbA1c following aerobic training program may be improved especially if it is followed up with the medication regiment.

CONCLUSION

The research has been essential as it has shown that long-term regular aerobics and physical training are helpful as they improve the glycemic control, the body composition and the cardiovascular fitness among patients diagnosed with type 2 diabetes mellitus. The biological principle behind the experiment is that physical activity has the ability of offsetting the deteriorations of the biological indicators that are found in the control groups for this analysis. Further research is required in the course of determination of the responsive health outcomes of the long-term programs on the patients. This research is also build on the premise that there is an increase in the incidences of life-style related chronic physical and psychological problems because of the decrease in the levels of healthy behaviors including nutrition and physical activity.

REFERENCES

1. Ahn, S., & Song, R. (2012). Effects of tai chi exercise on glucose control, neuropathy scores, balance, and quality of life in patients with type 2 diabetes and neuropathy. The Journal of Alternative and Complementary Medicine, 18(12), 1172-1178
2. Bacchi, E., Negri, C., Zanolin, M. E., Milanese, C., Faccioli, N., Trombetta, M., ...&Bonora, E. (2012). Metabolic effects of aerobic training and resistance training in type 2 diabetic subjects: a randomized controlled trial (the RAED2 study). Diabetes care, DC_111655.
3. Balducci, S., Zanuso, S., Cardelli, P., Salvi, L., Bazuro, A., Pugliese, L., ...&Pugliese, G. (2012). Effect of high-versus low-intensity supervised aerobic and resistance training on modifiable cardiovascular risk factors in type 2 diabetes; the Italian Diabetes and Exercise Study (IDES). PloS one, 7(11), e49297.
4. Choi, K. M., Han, K. A., Ahn, H. J., Hwang, S. Y., Hong, H. C., Choi, H. Y., ... & Min, K. W. (2012). Effects of exercise on sRAGE levels and cardiometabolic risk factors in patients with type 2 diabetes: a randomized controlled trial. The Journal of Clinical Endocrinology & Metabolism, 97(10), 3751-3758.
5. Grøntved, A., Rimm, E. B., Willett, W. C., Andersen, L. B., & Hu, F. B. (2012). A prospective study of weight training and risk of type 2 diabetes mellitus in men. Archives of internal medicine, 172(17), 1306-1312.
6. Hayashino, Y., Jackson, J. L., Fukumori, N., Nakamura, F., &Fukuhara, S. (2012). Effects of supervised exercise on lipid profiles and blood pressure control in people with type 2

diabetes mellitus: a meta-analysis of randomized controlled trials. Diabetes research and clinical practice, 98(3), 349-360.
7. Kadoglou, N. P., Fotiadis, G., Athanasiadou, Z., Vitta, I., Lampropoulos, S., &Vrabas, I. S. (2012). The effects of resistance training on ApoB/ApoA-I ratio, Lp (a) and inflammatory markers in patients with type 2 diabetes. Endocrine, 42(3), 561-569.
8. Karstoft, K., Winding, K., Knudsen, S. H., Nielsen, J. S., Thomsen, C., Pedersen, B. K., & Solomon, T. P. (2013). The effects of free-living interval-walking training on glycemic control, body composition, and physical fitness in type 2 diabetic patients: a randomized, controlled trial. Diabetes care, 36(2), 228-236.
9. Kennedy, A., Nirantharakumar, K., Chimen, M., Pang, T. T., Hemming, K., Andrews, R. C., &Narendran, P. (2013). Does exercise improve glycaemic control in type 1 diabetes? A systematic review and meta-analysis. PloS one, 8(3), e58861.
10. Kwon, H. R., Min, K. W., Ahn, H. J., Seok, H. G., Lee, J. H., Park, G. S., & Han, K. A. (2011). Effects of aerobic exercise vs. resistance training on endothelial function in women with type 2 diabetes mellitus. Diabetes & metabolism journal, 35(4), 364-373.
11. Larose, J., Sigal, R. J., Khandwala, F., Prud'homme, D., Boulé, N. G., & Kenny, G. P. (2011). Associations between physical fitness and HbA1c in type 2 diabetes mellitus. Diabetologia, 54(1), 93-102.
12. O'Hagan, C., De Vito, G., &Boreham, C. A. (2013). Exercise prescription in the treatment of type 2 diabetes mellitus. Sports Medicine, 43(1), 39-49.Teixeira-Lemos, E., Nunes, S., Teixeira, F., & Reis, F. (2011). Regular physical exercise training assists in preventing type 2 diabetes development: focus on its antioxidant and anti-inflammatory properties. Cardiovascular diabetology, 10(1), 12.
13. Schwingshackl, L., Missbach, B., Dias, S., König, J., & Hoffmann, G. (2014). Impact of different training modalities on glycaemic control and blood lipids in patients with type 2 diabetes: a systematic review and network meta-analysis.
14. Umpierre, D., Ribeiro, P. A., Kramer, C. K., Leitão, C. B., Zucatti, A. T., Azevedo, M. J., ... &Schaan, B. D. (2011). Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis. Jama, 305(17), 1790-1799.
15. Yavari, A., Najafipoor, F., Aliasgarzadeh, A., Niafar, M., &Mobasseri, M. (2012).Effect of aerobic exercise, resistance training or combined training on glycaemic control and cardiovascular risk factors in patients with type 2 diabetes. Biology of Sport, 29(2), 135.
16. Elroy J Aguiar, Philip J Morgan, Clare E Collins, Ronald C Plotnikoff, and Robin Callister (2014). Efficacy of interventions that include diet, aerobic and resistance training components for type 2 diabetes prevention: a systematic review with meta-analysis. International Journal of Behavioral Nutrition and Physical Activity 2014, 11:2
17. Aimee Grace, Erick Chan, Francesco Giallauria, Petra L. Grahamand Neil A. Smart (2017). Clinical outcomes and glycaemicresponses to different aerobic exercise training intensities in type II diabetes: a systematic review and meta-analysis.CardiovascDiabetol (2017) 16:37
18. Kimberley L. Way, Daniel A. Hackett, Michael K. Baker, Nathan A. Johnson (2016).The Effect of Regular Exercise on Insulin Sensitivity in Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. Diabetes Metab J 2016;40:253-271