



ORIGINAL RESEARCH PAPER

Medicine

EFFECT OF DAILY EXERCISE ON HBA1C REVERSAL.

KEY WORDS: Diabetes, Pre-diabetes, HbA1c level and Exercise.

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ABSTRACT

Diabetes mellitus is a metabolic disease in which due to abnormal insulin secretion, or due to insulin action there is an abnormal hyperglycaemic index. There is a strong relationship between physical inactivity and type 2 diabetes mellitus. HbA1c test is a gold standard to detect the pre-diabetes and diabetes. The regular exercise or physical activity decreases the risk of diabetes and other diseases. This prospective study was conducted in a tertiary health care centre, over a period of 1 year and included a total of 50 patients diagnosed with diabetes mellitus attending the Department of Medicine. It was observed that majority of the patients were in the age group of 41-50 (36%) and majority of the patients were females (64%). Most of the study participants were house wife (34%) and most of the study participants were from middle class (54%), 62% patients performed aerobic exercise and there was significant decrease in HbA1c level. The present study concluded that the regular physical activity is helpful in improving the physiological parameters in patients with diabetes mellitus.

INTRODUCTION

Diabetes mellitus is a metabolic disease in which due to abnormal insulin secretion, or due to insulin action there is an abnormal hyperglycaemic index.¹ According to International Diabetes Federation, 643 million people would suffer from Diabetes Mellitus (DM) by 2030 and 783 million people would suffer from Diabetes Mellitus (DM) by 2030.² There is a strong relationship between physical inactivity and type 2 diabetes mellitus. The physically inactive and overweight patients are at 40% risk of developing diabetes mellitus and obese patients are at 300% risk of developing diabetes mellitus.^{3,4}

Glycated or glycosylated hemoglobin test (HbA1c test) is a gold standard to detect the pre-diabetes and diabetes. The level of HbA1c in RBCs indicates the level of plasma glucose. The literature suggest that the physiological changes affects the HbA1c levels.⁵

After the confirmation of the diabetes, firstly an exercise regimen is given to the patient as a first management strategy along with the medicines and other lifestyle changes. The regular exercise or physical activity decreases the risk of diabetes and other diseases. The studies reported that HbA1c level is a predictor of diabetes and regular exercise reduces the level of HbA1c level.⁶

A meta analysis conducted by Boule N.G. et al. (2003), observed that 50% to 75% of maximal aerobic capacity improved the HbA1c level in patients with type 2 diabetes mellitus.⁷

The regular exercise lowers the blood glucose level, boost the body's sensitivity to insulin and counter the insulin resistance. Most of the studies observed that regular exercise lowers the HbA1c level by 0.7%. Thus, this study aimed to evaluate the effect of daily exercise on HbA1c reversal.

MATERIAL AND METHODS

This prospective study was conducted in a tertiary health care centre, Jammu & Kashmir, over a period of 1 year (April 2021 to March 2022) after obtaining approval from the institute ethical committee.

A total of 50 patients diagnosed with diabetes mellitus attending the Department of Medicine, of a tertiary health care centre, Jammu & Kashmir were involved after obtaining the informed consent from all the patients.

Data was collected with the help of a record sheet which contains the test values of HbA1, exercise regimen and other details of all the patients.

Inclusion Criteria

- Patients who were willing to participate in the study were included.
- > 18 years of age.
- Patients diagnosed with the diabetes.
- HbA1c level between 7% to 10%.

Exclusion Criteria

- The patients with other co-morbid illnesses (type 1 DM, cardiovascular diseases, etc.) were excluded.
- Patients on insulin.
- Patient not following the regular exercise regimen.

A detailed history and physical examination was done. The demographic variables age, gender, socio-economic status and occupation of the patient were recorded. All the patients were followed by HbA1c testing throughout the study. Data was tabulated, organized, analyzed and interpreted in both descriptive and inferential statistics i.e. frequency and percentage distribution, by using statistical package for social science software (SPSS), version 17.0. Categorical variables were expressed as number and percentage.

Observations and results

In the present study, 50 patients diagnosed with diabetes mellitus and attending the Outpatient Department of Medicine were involved.

Table 1.
Age distribution

Age range	No. of cases	Percentage
≤20	0	0

21-30	8	16
31-40	12	24
41-50	18	36
51-60	5	10
>60	7	14

Table 1 depicted that the majority of the patients were in the age group of 41-50 (36%).

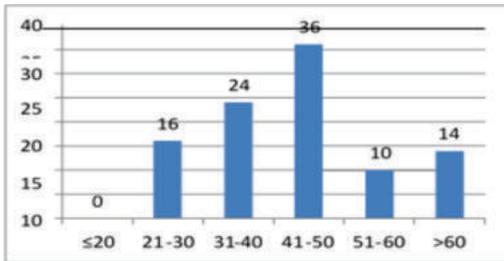


Figure 1. Age distribution

Table 2 Gender distribution

Gender	No. of cases	Percentage
Male	18	36
Female	32	64

The majority of the patients were females (64%) followed by 36% males as depicted in table 2.

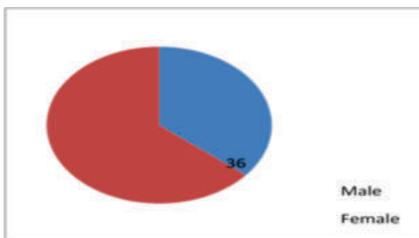


Figure 2. Gender distribution

Table 3 Occupation

Occupation	Number	Percentage
Government job	11	22
House wife	17	34
Labourer	5	10
Businessman	8	16
Student	0	0
Miscellaneous worker	9	18

In the present study the majority of the study participants were house wife (34%), followed by Government job employee (22%), labourer (10%), miscellaneous workers (18%) and businessman (16%) as depicted in table 3.

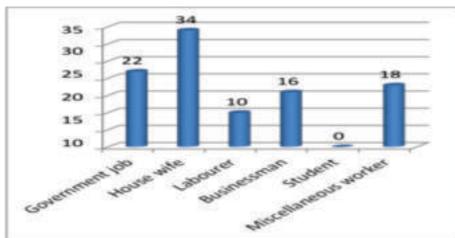


Figure 3. Occupation

Table 4 Socio-economic status

Socio- economic status	Number	Percentage
Low	11	22
Middle	27	54
High	12	24

Table 4 depicted the socio-economic status. Majority of the study participants were from middle class (54%), followed by low class (22%) and high class (24%).

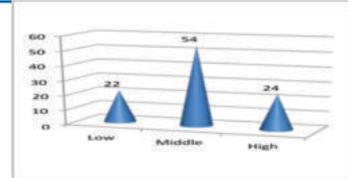


Figure 4. Socio-economic status

Table 5 Types of exercises performed by the patients

Exercise	Number	Percentage
Aerobic	31	62
Resistance	19	38

Table 5 showed that majority (62%) of the patients performed the aerobic exercise and 38% patients performed resistance exercise.

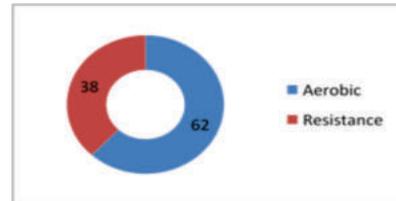


Figure 5. Types of exercises performed by the patients

Table 6 Before Exercise BMI score

BMI category	Number	Percentage
18.5-24.9 kg/m ²	5	10
25.0-29.9 kg/m ²	23	46
30.0-34.9 kg/m ²	17	34
35.0-39.9 kg/m ²	4	8
>40 kg/m ²	1	2

Table 6 depicted the BMI score before exercise. Majority of the patients had BMI 25.0-29.9 kg/m² (46%), followed by 30.0-34.9 kg/m² (34%), 18.5-24.9 kg/m² (10%), 35.0-39.9 kg/m² (8%) and >40 kg/m² (2%).

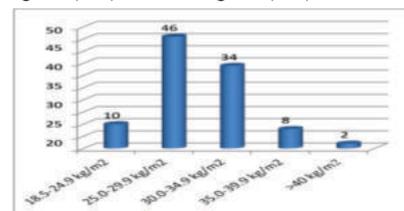


Figure 6. BMI score before exercise

Table 7 After Exercise BMI score

BMI category	Number	Percentage
18.5-24.9 kg/m ²	18	36
25.0-29.9 kg/m ²	22	44
30.0-34.9 kg/m ²	8	16
35.0-39.9 kg/m ²	2	4
>40 kg/m ²	0	0

Table 7 depicted the BMI score after exercise. Majority of the patients had BMI 25.0-29.9 kg/m² (44%), followed by 18.5-24.9 kg/m² (36%), 30.0-34.9 kg/m² (16%), (10%) and 35.0-39.9 kg/m² (4%). There was significant improvement in the BMI score after implementation of exercises.

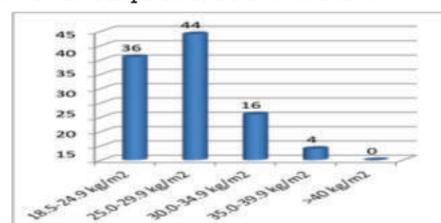


Figure 7. BMI score after exercise

Table 8 Before exercise HbA1c level

HbA1c level	Number	Percentage
4	0	0
5	0	0
6	0	0
7	8	16
8	13	26
9	19	38
10	10	20

Table 8 depict the level of HbA1c before the exercise in majority of the patients was 9 score (38% patients), followed by 8 score (26% patients), 7 score (16% patients) and 10 score (20% patients).

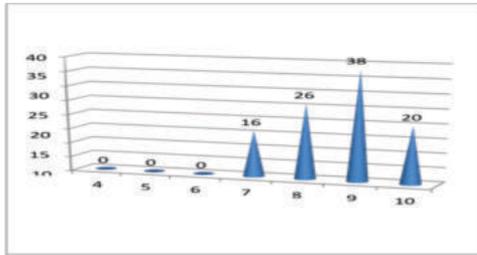


Figure 8. Before exercise HbA1c level

Table 9 After exercise HbA1c level

HbA1c level	Number	Percentage
4	0	0
5	7	14
6	12	24
7	23	46
8	4	8
9	3	6
10	1	2

Table 9 depict the level of HbA1c after the exercise in majority of the patients was 7 score (46% patients), followed by 6 score (24% patients), 5 score (14% patients), 8 score (8% patients), 9 score (6% patients) and 10 score (2% patients). There was significant reduction in post exercise HbA1c level.

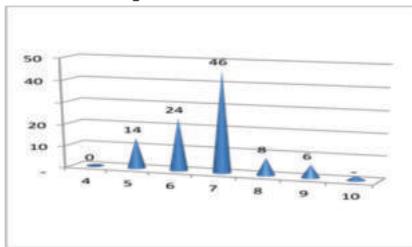


Figure 9. After exercise HbA1c level

DISCUSSION

In this study 50 patients diagnosed with diabetes mellitus attending the Outpatient Department of Medicine, of a tertiary care centre, Jammu & Kashmir were included. A detailed history and physical examination was done. Data was analyzed and discussed with previous literature.

In the present study majority of the patients were in the age group of 41-50 (36%) and majority of the patients were females (64%). Most of the study participants were house wife (34%) and most of the study participants were from middle class (54%). In similar study conducted by Najafipour F, et al. (2017), observed that the mean age of the study participants in experimental and control group was 57.6±8.7 and 57.9±8.2, respectively.⁸

In another study conducted by Lade CGD, et al. (2013), reported that the mean age of the study participants was 57 ± 12 years.⁹ Similarly Chou YH, et al. (2022), observed that mean age of the study participants was 46.44 years and majority of

the study participants were females (71.17%).¹⁰ It was observed that most of the study participants (62%) performed aerobic exercise. Similarly Chou YH, et al. (2022), reported that majority of the participants performed aerobic exercise.¹⁰

In our study there was a significant improvement in BMI scores after exercise and the HbA1c level was also improved. In similar study conducted by Yang Z, et al. (2014), observed that the exercise interventions had a good effect on reduction of HbA1c level and there was significant difference between pre exercise and post exercise BMI score.¹¹ Similarly Reddy R, et al. (2019) and Chou YH, et al. (2022), showed that there was significant reduction in mean glucose level after exercises.^{12,10}

CONCLUSION

The present study concluded that the regular physical activity is helpful in improving the physiological parameters in patients with diabetes mellitus and in decreasing the HbA1c levels.

REFERENCES

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2009 Jan;32 Suppl 1(Suppl 1):S62- 7. doi: 10.2337/dc09-S062.
2. Diabetes facts & figures. 2021. Available at: <https://idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html>.
3. Adams KF, Schatzkin A, Harris TB, Kipnis V, Mouw T, Ballard-Barbash R, Hollenbeck A, Leitzmann MF. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *N Engl J Med*. 2006; 355:763-778.
4. Flegal KM, Graubard BI, Williamson DF, Gail MH. Cause-specific excess deaths associated with underweight, overweight, and obesity. *JAMA*. 2007;298:2028-2037. Annette Masuch
5. Nele Friedrich, Johannes Roth, Matthias Nauck, Ulrich Alfons Müller, Astrid Petersmann. Preventing misdiagnosis of diabetes in the elderly: age-dependent HbA1c reference intervals derived from two population-based study cohorts. *BMC Endocr Disord*. 2019; 19, 20. John P. Kirwan
6. Jessica Sacks, Stephan Nieuwoudt. The essential role of exercise in the management of type 2 diabetes. *Cleve Clin J Med*. 2017;84(7 Suppl 1):S15-S21.
7. N. G. Boule, G. P. Kenny, E. Haddad, G. A. Wells, R. J. Sigal. Meta-analysis of the effect of structured exercise training on cardiorespiratory fitness in Type 2 diabetes mellitus. *Diabetologia*. 2003; 46: 1071-1081.
8. Farzad Najafipour, Majid Mobasseri, Abbas Yavari, Haidar Nadrian, Akbar Aliasgarzadeh, Naimeh Mashinchi Abbasi, et al. Effect of regular exercise training on changes in HbA1c, BMI and VO2 max among patients with type 2 diabetes mellitus: an 8-year trial. *BMJ Open Diabetes Research & Care*. 2017; 5:e000414. Carlos Gabriel de Lade,
9. Joao Carlos Bouzas Marins, Luciana Moreira Lima, Cristiane Junqueira de Carvalho, Robson Bonoto Teixeira, Maicon Rodrigues Albuquerque et al. Effects of different exercise programs and minimal detectable changes in hemoglobin A1c in patients with type 2 diabetes. *Diabetol Metab Syndr*. 2016; 8, 13. Ying-Hsiang Chou
10. Yung-Yin Cheng, Oswald Ndi Nfor, Pei-Hsin Chen, Che-Hong Chen, Hsin-Lin Chen, et al. Effects of aerobic and resistance exercise on glycosylated hemoglobin (HbA1c) concentrations in non-diabetic Taiwanese individuals based on the waist-hip ratio. *PLoS One*. 2022; 17(5): e0267387.
11. Zuyao Yang Catherine A Scott, Chen Mao, Jinling Tang, Andrew J Farmer. Resistance exercise versus aerobic exercise for type 2 diabetes: a systematic review and meta-analysis. *Sports Med*. 2014; 44(4): 487-99. Ravi Reddy, Aman da Wittenberg, Jessica R Castle, Joseph El Youssef, Kerri Winters-Stone, Melanie Gillingham, et al. Effect of Aerobic and Resistance Exercise on Glycemic Control in Adults With Type 1 Diabetes. *Can J Diabetes*. 2019; 43(6): 406-414.e1.