

Effect of physical activity, exercise and diet in the control of type 2 diabetes mellitus

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Abstract

Diabetes Mellitus (DM) is a multifactorial metabolic disease associated with several conditions, including physical inactivity, genetic predisposition, poor nutrition, and obesity. Studies have shown that diet and exercise play an important role in the delay of development and control of type 2 diabetes. **Aim:** To assess the effect of diet, physical activity and exercise on the control of diabetes type 2 diabetes mellitus. **Method:** n=60 type 2 diabetic patients of either sex of age group between 35-50 years were enrolled from the Diabetic Clinic of GMCH, Aurangabad, Maharashtra. Lipid profile and HbA_{1c} was done to assess the glycemic control and the complications related to diabetes. History regarding the dietary habits, physical activity and exercise was taken and was correlated with HbA_{1c} and lipid profile. **Result:** The results of our study showed poor glycemic control and lipid derangement in patients who did not follow proper dietary habits and who had less physical activity/exercise schedules. **Conclusion:** Diet, lifestyle modification and exercise helps to control the progression of diabetes and its complications.

Keywords: Diet, Exercise, Type 2 Diabetes Mellitus (DM).

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INTRODUCTION

Diabetes mellitus is a heterogeneous group of metabolic disorders characterized by hyperglycemia with disturbances of carbohydrate, fat and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of tissues to insulin^{1,2}. It is a chronic illness that requires continuing medical care and ongoing patient self-management education and support to prevent acute complications and to reduce the risk of long-term complications³. The prevalence of T2D is especially high in overweight and obese individuals⁴. For example, obese individuals are 42.1 times more likely to develop T2D after a 5-year follow-up compared to normal weight individuals⁵. The major sources of the morbidity of

diabetes are the chronic complications that arise from prolonged hyperglycemia, including retinopathy, neuropathy, nephropathy and cardiovascular diseases. Management of diabetes mellitus concentrates on maintaining blood sugar levels as close to normal ("euglycemia") as possible without presenting undue patient dangers. This can usually be with close dietary management, exercise and use of appropriate medications. In the past 20 years, a growing interest on the effect of exercise and diet in the reduction of prevalence and incidence of T2D has been observed in the scientific literature. Increased physical activity and dietary management implemented by health-care professionals is fundamental to initial treatment of type 2 diabetes mellitus and is recommended by international consensus^{6,7}. Meta-analyses of exercise and diet studies have concluded that concentrations of glycated haemoglobin A_{1c} (HbA_{1c}) can be lowered by aerobic and resistance exercise and by dietary intervention by 0.6–0.8%^{8–10} and 0.5%, respectively^{11,12}.

AIMS AND OBJECTIVE

The aim of the study was to assess the effect of diet, physical activity and exercise on the control of type 2 diabetes mellitus.

MATERIALS AND METHODS

Study Design: It was a Cross-Sectional Comparative Study.

Inclusion Criteria: n= 60 Type 2 diabetes mellitus patients of either sex between the age of 35-50 years were enrolled from the Diabetic Clinic of Govt Medical College, Aurangabad, Maharashtra.

Group 1- n=30 Type 2 diabetic patients were on diet restriction as prescribed by physician and were doing exercise i.e. walking for one hour regularly.

Group 2- n=30 Type 2 diabetic patients were neither on diet restriction nor doing any exercise.

Exclusion Criteria: Smokers, alcoholics, and subjects with hepatic, renal, endocrine disorders, and those on lipid lowering agents were excluded from the study. Informed written consent was obtained from every participant and the study was approved by the institutional ethical committee.

Methods

HbA_{1c} and Lipid Profile: Venous blood samples were taken after an overnight fast for HbA_{1c} and lipid profile to assess the glycemic control and the complications related to diabetes. HbA_{1c} was done by High Pressure Liquid Chromatography and lipid profile by colorimetric method. The cut off values for dyslipidemia were according to National Cholesterol Education Program Adult Treatment Panel III criteria.¹³ History regarding the dietary habits, physical activity and exercise was taken and was correlated with HbA_{1c} and lipid profile.

Body height (Ht): Body height (Ht) in centimeters was measured by having the subjects stand with their heels, buttocks, and heads against a wall. A flat object was placed on top of the subjects' head, and their height was marked on a tape measure affixed to the wall.

Body weight: Body weight was measured in kilograms (kg) with a standard portable scale. Body weight and body height were measured with light clothes and bare feet.

Body mass index (BMI): BMI was calculated as body weight in kilogram divided by the square of body height in meters. Cut off values for BMI was 23 kg/m². The

reference values for cut off were taken from studies done on Indian or Asian population.¹⁴

Statistical Analysis: The Data were entered into a computer and Statistical analysis was done. Values were reported as Means \pm Standard deviation using Student Unpaired t test. P value was considered significant when < 0.05 .

RESULT

The mean \pm standard deviation of HbA_{1c} in group 1 of diabetic patients was 7.17 \pm 0.92 and in group 2 of diabetic patients was 7.94 \pm 1 .81. It was found to be statistically significant. The mean \pm standard deviation of BMI in group 1 of diabetic patients was 24.14 \pm 2.61 (Kg/m²) and in group 2 of diabetic patients was 28.43 \pm 3.75 (Kg/m²). It was found to be statistically significant. The mean \pm standard deviation of total cholesterol in group 1 of diabetic patients was 175 \pm 16.56 (mg %) and in group 2 of diabetic patients was 236 \pm 29.91 (mg %). It was found to be statistically significant. The mean \pm standard deviation of triglycerides in group 1 of diabetic patients was 248.66 \pm 66.07 (mg %) and in group 2 of diabetic patients was 292.70 \pm 70.75 (mg %). It was found to be statistically non significant. The mean \pm standard deviation of HDL in group 1 of diabetic patients was 39.33 \pm 2.82 (mg %) and in group 2 of diabetic patients was 39.12 \pm 6.91 (mg %). It was found to be statistically non significant. The mean \pm standard deviation of LDL in group 1 of diabetic patients was 84 \pm 11.20 (mg %) and in group 2 of diabetic patients was 137 \pm 20.67 (mg %). It was found to be statistically significant. The mean \pm standard deviation of VLDL in group 1 of diabetic patients was 27.33 \pm 3.63 (mg %) and in group 2 of diabetic patients was 60 \pm 29.37 (mg %). It was found to be statistically significant. The significant and higher values in group 2 shows that deranged lipid profile values with poor control of glucose with significant BMI in diabetics are associated more with physical inactivity and lack of diet restriction that needs to be implemented earlier in diabetic patients in order to avoid complications.

Table 1: HbA_{1c} and Lipid Profile Values

PARAMETERS	GROUP-1 (Diet Restriction And Doing Exercise Regularly) MEAN \pm SD	GROUP-2(Neither on Diet Restriction Nor Doing Any Exercise) MEAN \pm SD	P VALUE
HbA _{1c} (mg%)	7.17 \pm 0.92	7.94 \pm 1 .81	P=0.04S
BMI(Kg/m ²)	24.14 \pm 2.61	28.43 \pm 3.75	P=0.00129S
Total Cholestrol(mg%)	175 \pm 16.56	236 \pm 29.91	P=0.001S
Triglycerides(mg%)	248.66 \pm 66.07	292.70 \pm 70.75	P=0.298NS
HDL (mg%)	39.33 \pm 2.82	39.12 \pm 6.91	P=0.961NS
LDL (mg%)	84 \pm 11.20	137 \pm 20.67	P=0.00025S
VLDL (mg%)	27.33 \pm 3.63	60 \pm 29.37	P=0.002S

Reference Values BMI \geq 25 kg/m² NS- Non Significant, S- Significant

DISCUSSION

The present study showed the mean values of HbA1C, BMI, TCHO, TG, LDL, VLDL in group 1 diabetic patients who were doing exercise regularly and were on diet restriction as (7.17 ±0.92, 24.14±2.61, 175±16.56, 248.66±66.07, 84±11.20, 27.33±3.63) respectively. Group 2 diabetic patients who were neither on diet restriction nor doing any exercise showed the mean values of HbA1C, BMI, TCHO, TG, LDL, VLDL as (7.94 ±1.81, 28.43±3.75, 236±29.91, 292.70±70.75, 137±20.67, 60±29.37) and were statistically significant. Our findings showed that majority of type 2 diabetic patients who were doing physical activity and on diet restriction were having good control of blood sugar and less dyslipidemia as compared to those diabetic patients who were not doing any exercise nor on any diet restriction. Studies have been done in an attempt to discover whether changes to diet and physical activity are better than changes to diet alone in patients with type 2 diabetes. One study showed an improvement in HbA1c concentrations.¹⁵ Two studies showed better weight loss and glucose control when a walking programme was added to a diet intervention.^{16,17} Three studies showed no improvements in HbA1c concentrations, weight, blood pressure, or insulin resistance with interventions involving exercise compared with those involving diet alone.^{18,19,20} All these studies, however, lacked power, were of short durations, and used no objective measurements of physical activity. Self-reporting of physical activity is inaccurate and, therefore, any effects of exercise additional to those of diet intervention are difficult to assess. Physical activity and diet regulations are important factors to control diabetes. University of Michigan Health System show that men and women who walked for 30 minutes five days a week, decreased their fat and total calorie intake, and reduced their body weight by 7% over a period of three years were able to cut their risk of developing type 2 diabetes by 58%.²¹ Similar results were seen in studies of weight loss, exercise, and dietary change, conducted in Finland and Chinese.^{22,23,24} Participation in regular physical activity improves blood sugar control and can prevent or delay onset of type 2 diabetes.^{25,26,27,28,29,30} Prospective cohort and cross-sectional observational studies that assessed physical activity with questionnaires showed that higher physical activity levels are associated with reduced risk for type 2 diabetes, regardless of method of activity assessment, ranges of activity categories, and statistical methods.^{31,32,33} Both moderate walking and vigorous activity have been associated with a decreased risk, and greater volumes of physical activity may provide the most prevention.³²

CONCLUSION

Intentional weight loss seems to have a positive effect for diabetes outcomes in the long term, particularly if it is maintained. This long-term commitment seems to be more successful if multifaceted interventions are used that combine diet, physical activity and behaviour therapy. More rigorous studies with long-term follow-up are needed to evaluate the impact of different macronutrients and exercise modality on glycemic control and weight loss in diabetic patients. This would help in providing better management for diabetic patients. However, despite the lack of details, lifestyle modifications definitely improve short- and long-term glycemic control and need to be promoted in clinical settings.

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