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RESEARCH ARTICLE

EXERCISE AND DIET- THEIR ROLE ON LIPID PROFILE IN TYPE -2 DIABETIC PATIENTS

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ABSTRACT

Introduction- these lifestyle interventions namely diet and exercise can have a role to play in slowing down the progress of diabetes in T2DM. **Material & Method:** This was a intervention, pre and post study. Diabetic patients in the age group of 30-60 years, including both sexes and taking treatment since 5 to 10 years . **Result-** The finding in Group B is significant which implies that diet affects HbA1C. The finding in Group B also showed that diet can affect HDL values significantly. And the finding of Group A was significant which shows that exercise affects LDL values. **Conclusion-**Diet and exercise can act as a supplementary therapy in the management of type2 diabetes mellitus.

INTRODUCTION

In 2013, according to International Diabetes Federation, an estimated 381 million people had diabetes (Wild et al., 2004). Several studies on migrant Indians across the globe have shown that Asian Indians have an increased risk for developing type 2 diabetes and related metabolic abnormalities compared to other ethnic groups (McKeigue, 1991; Mohan, 1986; Abate, 2001). Although the exact reasons are still not clear, certain unique clinical and biochemical characteristics of this ethnic group collectively called as the "Asian Indian phenotype" is considered to be one of the major factors contributing to the increased predilection towards diabetes (Joshi, 2003; Deepa et al., 2006). Exercise appears to improve glycated haemoglobin at six and twelve months in people with type 2 diabetes (Nield et al., 2007). Regular physical activity and exercise are important components in the prevention of diabetes. In addition to lowering blood glucose, exercise improves insulin action, contributes to weight loss. The association between increased levels of physical activity and a reduced occurrence of diabetes' long-term complications suggests that regular physical activity has a protective role. This association has been shown in the Diabetes Prevention Program in which physical activity in the form of walking for 30 minutes/day on most days of the week was encouraged (Jean Mayer, 2003).

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One promising trend is the "lifestyle exercise" approach used in the Diabetes Prevention Program, in which exercise is broken down into multiple short bouts of activity (eg, 10 minutes of brisk walking) (Shern-Brewer et al., 1998). Evidence-based medicine (EBM) has come to be regarded as essential in all fields of medical sciences and practical medicine. Among the epidemiological studies of physical exercise, recent mega-trials such as the Diabetes Prevention Program (DPP) in the U.S. have shown that lifestyle intervention programs involving diet and/or exercise reduce the progression of impaired glucose tolerance (IGT) to type-2 diabetes. In studies examining the endocrinological and metabolic effects of exercise, it has been demonstrated that physical exercise promotes the utilization of blood glucose and free fatty acids in muscles and lowers blood glucose levels in well-controlled diabetic patients. As a prescription for exercise, aerobic exercise of mild to moderate intensity, including walking and jogging, 10–30 minutes a day, 3–5 days a week, is recommended. An active lifestyle is essential in the management of diabetes, which is one of typical lifestyle related diseases (Yuzo, 2003). Interventions aimed at increasing exercise combined with diet have been shown to decrease the incidence of type 2 diabetes mellitus in high-risk groups (people with impaired glucose tolerance or the metabolic syndrome (Orozco, 2008). However, there are no high-quality data on the efficacy of dietary intervention for the prevention of type 2 diabetes (Nield, 2008). The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low high-density lipoprotein (HDL) concentration and increased concentration of small dense low-

density lipoprotein (LDL) particles. Insulin resistance leads to increased flux of free fatty acids and hence the lipid changes (Mooradian Arshag, 2009) Reports from the National Health and Nutrition Examination Survey (NHANES) 1999–2000 indicate that 51% of adults aged 20–59 years with diabetes have hypercholesterolemia (Ford, 2003; Imperatore, 2004). Our hypothesis is that these lifestyle interventions namely diet and exercise can have a role to play in slowing down the progress of diabetes in T2DM.

Objectives of the study was: To find out the out the fasting blood sugar (FBS) and post prandial blood sugar (PPBS) in the two groups.

- To compare the HbA_1C among the two groups.
- To analyze the lipid profile values in the two groups.

MATERIALS AND METHODS

The guidelines of the National Diabetes Data Group and the third set of the Adult Treatment Panel of the National Cholesterol Education Program (NCEP ATP III) was used to recruit patients with type 2 diabetes and dyslipidemia(16,17). Diabetic patients who were smokers, alcoholics, pregnant, on long-term steroids and those with known retinopathy, nephropathy, coronary artery disease and cerebrovascular diseases were excluded from the study.

Study Design- This was a intervention, pre and post study.

Study setting- Department of Physiology, Jawaharlal Nehru Medical College, Wardha.

Period of Study – 1 ½ years.

Study participants – All diabetic patients in the age group of 30-60 years, including both sexes and taking treatment since 5 to 10 years .

Intervention: By random selection 40 diabetic patients were allocated to the intervention group. The study group had 2 groups namely (A) Exercise (B) Diet. Each group had 20 diabetic patients. A group comprised of 20 diabetic patients. Their regimen was brisk walking for 30 minutes daily at dawn or dusk for 5 days a week for 6 months. For the B group, daily food time table was the self-selected low-GI diets in the regular diet of the patients supplemented with additional proteins(18). A project dietician supported facilitators and gave dietary counselling.

Outcome measures: Primary follow up measures were fasting and postmeal blood sugar and lipid profile estimations. The secondary follow up measure was HbA_1C. HbA_1C was estimated using morning blood samples by immunoturbidity method. The fasting blood samples shall be analyzed for triglycerides (TG), total cholesterol (TC) and high-density lipoprotein–cholesterol (HDL–C). Total cholesterol shall be estimated by Enzyme end point method. HDL cholesterol shall be assessed by enzyme direct method. Triglyceride by GPO-PAP method. LDL cholesterol and VLDL shall not separately estimated but calculated. LDL shall be calculated using the formula: LDL cholesterol = Total cholesterol – [HDL cholesterol + TG/5). The lipid profile study shall also be done with lipid profile Kit as per suitability.

There was a dropout of 3 cases, reason attributed to non adherence to the program.

Observation: Table 1 shows age wise distribution of patients in two groups. Group A had patients in the age range of 36-40 years and Group b in the range of 40-60 yars. Total of 17 patients were in each group. Table 2 depicts the gender wise distribution of patients in three groups. Group A had 10 males & 7 females, whereas Group b had 11 males and 6 females. Table 3 shows that maximum patients were in the middle income group. Student's paired t test was applied to study the comparative findings. Table 4 shows the comparison of fasting blood sugar level in two groups pre and post operatively. Group A had a mean difference of 2.11± 23.45 between pre and post test and this b value was not significant. Similarly group B had a mean difference of 10.94 ± 46.23 between pre and post test which was also not significant. Table 5 compares PBS levels in two groups pre and post operatively. Group A had a mean difference of 2.17 ± 72.88 and group B of 20.70 ±82.13.. The findings of both groups between pre and post test values was not significant.

Table 6 shows comparison of HbA1C level in two groups pre and post operatively. Here Group a showed a mean difference of 0.76 ± 1.49 and Group B of 0.86± 1.48 between pre and post test values. The finding in Group B is significant which implies that diet affects HbA1C. Table 7 -11 shows the comparison of TC, TG, HDL, LDL and VLDL level in two groups pre and post operatively. Mean score of all values between pretest and post test are discussed as follows.

TC was 4.52 ± 11.89 in Group A and 8.64 ± 36.7 in Group B. Both the findings were insignificant. TG in Group A was 13.05 ± 37.64 , and in Group B was 17.11 ± 56.69. Both the values are not significant. HDL in Group a was 1.64± 4.55 and in Group B was 2.3± 5 4.34. Here finding of Group B is significant . This shows diet can affect HDL values which is a significant finding. LDL in Group A was 10.76 ± 14.35 and in Group B was 9.64± 34.70. The finding of Group A was significant which shows that exercise affects LDL values. VLDL in group a was 2.35 ± 8.37 and in Group B was 2.41 ± 20.18. Both the findings were not significant.

DISCUSSION

In our study the main significant findings were

Group B and HbA1C.- The finding in Group B is significant which implies that diet affects HbA1C: Masaki Asano et al Using a single-blind randomized controlled trial, the modern diet (MD) was compared with the 1975-type JD, which is based on the MD but includes five characteristics of the 1975 JD in an enhanced form. Overweight people were randomly assigned to an MD group (n = 30) and a JD group (n = 30). The participants consumed test diets that were provided three times a day for 28 days. Body composition measurements and blood biochemical examinations were performed before and after the test diet intake, and the proportions of change were compared. Those in the JD group had significantly decreased BMI, fat mass, and levels of low-density lipoprotein cholesterol, glycated hemoglobin, and C-reactive protein (P = 0.002, 0.015, 0.014, 0.012, and 0.039, respectively) and significantly increased high-density lipoprotein cholesterol levels compared with those in the MD group (P = 0.020), (19).

Observation

Table 1. Age wise distribution of patients in two groups

Age Group(yrs)	Group A	Group B	χ2-value
31-40 yrs	1(5.88%)	1(5.88%)	8.66
41-50 yrs	7(41.18%)	2(11.76%)	p=0.07,NS
51-60 yrs	9(52.94%)	14(82.35%)	
Total	17(100%)	17(100%)	
Mean±SD	51.64±7.13	54.76±6.33	
Range	36-40 yrs	40-60 yrs	

Table 2. Gender wise distribution of patients in three groups

Gender	Group A	Group B	χ2-value
Male	10(58.82%)	11(64.71%)	1.23
Female	7(41.18%)	6(35.29%)	p=0.53,NS
Total	17(100%)	17(100%)	

Table 3. Distribution of patients in three groups according to socio-economic status

SES	Group A	Group B	χ2-value
Low	3(17.65%)	3(17.65%)	0.29
Middle	14(82.35%)	14(82.35%)	p=0.86,NS
High	0(0%)	0(0%)	
Total	17(100%)	17(100%)	

Table 4. Comparison of fasting blood sugar level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	129.58	17	45.18	10.95	2.11±23.45	0.37
	Post t/t	131.70	17	42.71	10.36		p=0.71,NS
Group B	Pre t/t	126.64	17	45.44	11.02	10.94±46.23	0.97
	Post t/t	115.70	17	27.44	6.65		p=0.34,NS

Table 5. Comparison of PBS level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	222.47	17	87.75	21.28	2.17±72.88	0.12
	Post t/t	220.29	17	67.92	16.47		p=0.90,NS
Group B	Pre t/t	242.00	17	80.83	19.60	20.70±82.13	1.03
	Post t/t	221.29	17	61.29	14.86		p=0.31,NS

Table 6: Comparison of HbA1C level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	8.79	17	1.74	0.42	0.76±1.49	2.11
	Post t/t	8.03	17	2.10	0.51		p=0.051,NS
Group B	Pre t/t	8.50	17	1.65	0.40	0.86±1.48	2.41
	Post t/t	7.63	17	1.55	0.37		p=0.048,S

Table 7: Comparison of TC level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	197.47	17	61.37	14.88	4.52±11.89	1.57
	Post t/t	202.00	17	58.43	14.17		p=0.13,NS
Group B	Pre t/t	178.05	17	43.44	10.53	8.64±36.70	0.97
	Post t/t	186.70	17	39.49	9.58		p=0.34,NS

Table 8: Comparison of TG level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	186.23	17	76.88	18.64	13.05±37.64	1.43
	Post t/t	173.17	17	76.89	18.65		p=0.17,NS
Group B	Pre t/t	176.11	17	181.97	44.13	17.11±56.69	1.24
	Post t/t	193.23	17	184.04	44.63		p=0.23,NS

Table 9. Comparison of HDL level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	33.82	17	7.02	1.70	1.64±4.55	1.49
	Post t/t	32.17	17	6.73	1.63		p=0.14,NS
Group B	Pre t/t	33.17	17	6.27	1.52	2.35±4.34	2.23
	Post t/t	35.52	17	6.22	1.51		p=0.040,S

Table 10. Comparison of LDL level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	125.64	17	52.37	12.70	10.76±14.35	3.09
	Post t/t	136.41	17	46.31	11.23		p=0.007,S
Group B	Pre t/t	111.00	17	42.98	10.42	9.64±34.70	1.14
	Post t/t	120.64	17	31.75	7.70		p=0.26,NS

Table 11. Comparison of VLDL level in two groups pre and post operatively Student's paired t test

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group A	Pre t/t	38.00	17	15.11	3.66	2.35±8.37	1.15
	Post t/t	35.64	17	16.59	4.02		p=0.26,NS
Group B	Pre t/t	33.17	17	26.27	6.37	2.41±20.18	0.49 p=0.62,NS

Jennie brand-miller et al performed a metaanalysis of randomized controlled trials to determine whether low-GI diets, compared with conventional or high-G Idiets, improved over all glycemic control in individuals with diabetes, as assessed by reduced HbA1c or fructosamine levels. Research design and methods involved Literature searches identified 14 studies, comprising 356 subjects, that met strict inclusion criteria. All were randomized crossover or parallel experimental design of 12 days' to 12 months' duration (mean 10 weeks) with modification of at least two meals per day. Only 10 studies documented differences in postprandial glycemia on the two types of diet. Their result showed Low-GI diets reduced HbA1c by 0.43% points (CI 0.72–0.13) over and above that produced by high-GI diets.(20).

Group B and HDL. The finding in Group B is significant which shows that diet can affect HDL values: Leila Azadbakht et al studied the the effects of a Dietary Approaches to Stop Hypertension (DASH) eating plan on metabolic risks in patients with the metabolic syndrome. This study was a randomized controlled outpatient trial conducted on 116 patients with the metabolic syndrome. Three diets were prescribed for 6 months: a control diet, a weight-reducing diet emphasizing healthy food choices, and the DASH diet with reduced calories and increased consumption of fruit, vegetables, low-fat dairy, and whole grains and lower in saturated fat, total fat, and cholesterol and restricted to 2,400 mg Na. The main outcome measures were the components of the metabolic syndrome. Result of the study was relative to the control diet, the DASH diet resulted in higher HDL cholesterol (7 and 10 mg/dl), lower triglycerides (−18 and −14 mg/dl), systolic blood pressure (SBP) (−12 and −11 mmHg), diastolic blood pressure (−6 and −7 mmHg), weight (−16 and −14 kg), fasting blood glucose (FBG) (−15 and −8 mg/dl), and weight (−16 and −15 kg), among men and women, respectively (all $P < 0.001$). They concluded that the DASH diet can likely reduce most of the metabolic risks in both men and women(21).

Group A and LDL.- The finding of Group A was significant which shows that exercise affects LDL values: Masayo Kawano, et al investigated the correlation between lifestyle improvements, in particular increased cardio-respiratory fitness and changes in the blood lipid profile. The participants were 217 residents of Fuji and Yamato Towns, Saga City, with mildly abnormal blood pressure, serum lipids or blood glucose detected at health check-ups in 2003. Participants were randomly allocated to an Intervention (108 subjects) or Control group (109 subjects), matched for age and various conditions. The Intervention group was given exercise advice and prescription and dietary instructions. Cardio-respiratory fitness was evaluated using the work rate at double product breaking point. Changes of lipid parameters were compared before and after intervention, and examined the relationship with cardio-respiratory fitness. They concluded that Improvement was seen in atherosclerotic risk factors through lifestyle modification. In particular, improved cardiorespiratory fitness was associated with qualitative and quantitative changes in LDLs. (Masayo Kawano, 2009). Limitations of the study include the small number of subjects and their relatively short duration.

Conclusion

Our study shows that regular, low glycemic index diets can have a favourable impact on glycemic control findings as seen through HbA1C. Also this type of diet can affect HDL levels significantly. However exercise was seen to favouraly affect only LDL values, in our study. Hence, we conclude that diet and exercise can act as a supplementary therapy in the management of type2 diabetes mellitus.

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