Abstract

The role of non pharmacological treatment in diabetes is well known and so is the ever increasing menace of diabetes.

Exercise not only reduces hyperglycemia, but reduces insulin resistance by reducing obesity. Therapeutic diet also is helpful in management of diabetes.

Lifestyle modification alone can prevent development of diabetes in impaired glucose tolerance patients. It can also be the sole therapeutic tool in early diabetes.

However adherence to the lifestyle modification measures is very poor among patients. Moreover, as the disease progresses, lifestyle modification alone can no longer be used as the sole mode of treatment. It has to be supplemented by drugs or insulin or both.

Key words

Lifestyle modification (LSM), Body mass index (BMI), Obesity, Exercise, Medical nutrition therapy
Introduction

The number of type2 diabetics is increasing at an alarming rate world wide\(^1\). The incidence is also increasing in Indian sub-continent\(^2\), especially so in South-Indian population\(^3\). Maximum prevalence of Diabetes in India has been reported from South-Indians\(^4\). It is projected that by 2025 an estimated 270 million individuals will be affected by diabetes world wide. An alarming situation probably due to sedentary lifestyle and resultant obesity\(^5\). Obese individuals (those with BMI >30 Kg/m\(^2\)) were found to have highest risk for diabetes mellitus. (age adjusted odds ratio=3.66)\(^6\)

Over weight individuals (BMI= 23-30Kg/m\(^2\)) also have higher incidence of diabetes(age adjusted odds ratio =1.59)\(^7\)

Many effective drugs have been developed for diabetes over the years. How ever the importance of lifestyle modification as primary treatment is still prudent. The pharmacological options for treatment of obesity is not very promising.\(^6\) Hence non-pharmacological treatment is of utmost importance in management of type 2 diabetes mellitus.\(^8\) In the present review we tried to address the issue of non-pharmacological treatment options in the present scenario.

Lifestyle modification

The major environmental factors that increase cardiovascular risk in type 2 diabetes are sedentary lifestyle and over nutrition leading to obesity.\(^9\) Interventions that improve or reverse these factors have been demonstrated to have beneficial effects on controlling hyperglycemia in established type 2 diabetes.\(^10\) There is controversy regarding the best suited diet and exercise in diabetes. But published data teach us that weight loss effectively lowers glycemia.\(^11,12\) Diabetes is virtually erased by mean sustained weight loss of more than 20Kg.

Exercise

Physical activity reduces the risk of developing type 2 diabetes by 30-50% and risk reductions are observed with as little as 30 minutes of moderate exercise per day.\(^13\) Regular exercise improves glycemic control in all forms of diabetes. Insulin resistance is major cause of hypoglycemia in type 2 diabetes and physical exercise is the best way to reduce insulin resistance.\(^14\) Physical activity improves insulin sensitivity in many ways. Fat accumulation in the liver is the main cause of insulin resistance in obesity. Exercise can reduce the free fatty acid load to liver and thereby reduce hepatic insulin resistance.\(^15\) Reversal of hepatic insulin resistance is proportional to the reduction in central obesity as a result of exercise. Weight loss achieved by regular exercise was better correlated with reduction in insulin resistance compared to weight loss achieved by caloric restriction.\(^16\) Exercise also reduces hepatic glucose output.\(^17\)

Lifestyle modifications including regular exercise combined with diet modifications can clearly prevent type 2 diabetes in individuals with impaired glucose
tolerance.\textsuperscript{13,14,15} Exercise recommended is moderate exercise for 30 minutes a day,\textsuperscript{18} or moderate physical activity like brisk walking at least 150 minutes per week.\textsuperscript{19}

Exercise training improves the quality of glycemic control as demonstrated by 0.66\% reduction in HbA1c in one particular study.\textsuperscript{20} Improvements are most marked in mild diabetics especially in those with insulin resistance.\textsuperscript{21} Exercise increases skeletal muscle glucose uptake and utilization by increasing the expression of the glucose transporter 4 (GLUT4).\textsuperscript{22} Exercise also increases the insulin sensitivity of skeletal muscle.\textsuperscript{23} Exercising just four hours a week increased insulin mediated glucose uptake by 30\%.\textsuperscript{24}

Regular exercise confers benefits beyond glycemic control. It is also associated with reduced morbidity and mortality.\textsuperscript{25, 26} Seven hours or more of exercise per week reduced cardiovascular event risk by 48\%, when compared with those exercised less than seven hours per week. A dose response relationship is seen between exercise and event reduction.\textsuperscript{27} Exercise also reduces atherogenic lipids and homocysteine levels.\textsuperscript{28} Physical activity also reduces obesity and hypertension. Benefits of exercises is greater when used early in the progression from insulin resistance to impaired glucose tolerance and then diabetes.\textsuperscript{21}

Diabetes Prevention Program (DPP) was a prospective multicenter randomized clinical trial examining the diabetes incidence in overweight and obese adults managed with intensive lifestyle intervention or metformin or placebo. Maximum reduction in diabetes incidence was seen in the group with lifestyle modification including intensive physical activity (58\%). Metformin group also showed a fair amount of reduction in the incidence of diabetes (31\%) compared to the placebo group, in 2.8 years of follow up.\textsuperscript{29} Decreased diabetes incidence was related to reduction in BMI and central obesity.\textsuperscript{30} Cumulative incidence of diabetes was lowest in the intensive lifestyle modification group even after ten years.\textsuperscript{31}

It may concluded that the analyzed results are in concordance with American Diabetes Association guidelines\textsuperscript{32} which emphasizes the need for regular exercise in type 2 diabetes prevention.

**Medical nutrition therapy**

Medical nutrition therapy is another key component in preventing or delaying type 2 diabetes in individuals with impaired glucose. Primary prevention of diabetes is possible with lifestyle modifications of which medical nutrition therapy is an integral part.\textsuperscript{33} Nutritional measures are important not only in preventing diabetes but in treating it and preventing its complications.

The total calorie intake can be divided as 45-65\% carbohydrates, 10-30\% proteins and less than 30\% fats, in which saturated fat should be less than 7\% and cholesterol less than 300mg/day.\textsuperscript{34} Total caloric intake should be appropriate for the body weight goals for individual patients. Other nutrient levels should be according
to the metabolic status of the patient. Evidence based recommendations for
generalization of macro-nutrient support is lacking.
For obese type2 diabetics weight loosing diets with low carbohydrates and / or fats and restricted calories give good short term results.\textsuperscript{34} In standard weight loosing diet calories are reduced by 500-1000 Cals compared to weight maintaining diet. About 10\% weight loss can be achieved by such measures and during this intensive phase of treatment they require monitoring of lipid profiles, renal function and protein intake. Hypoglycemic drug dosage also should be reduced to avoid hypoglycemia. After six months adherence to lifestyle interventions will maintain weight.

European association for the study of diabetes have given nutritional recommendations which may be used for individualized diet advices for six months intensive medical nutritional therapy. Such regimens have shown to reduce HbA1c by 0.4\%, body weight by 1.3Kg BMI by 0.5Kg/m\textsuperscript{2} and waist circumference by 1.3cm, compared to controls.\textsuperscript{35}

Recommendations of dietary modifications should address both energy restriction and quality of food especially fat intake.

**Role of smoking cessation**

The effects of stopping smoking in diabetes are substantial. The incidence of micro and macro vascular complications was significantly increased in smokers compared to non-smokers.\textsuperscript{36} This has also been emphasized by American Diabetes association. Health care providers should advice all diabetics not to initiate tobacco and emphasize stopping smoking in smokers as utmost priority for diabetic smokers.\textsuperscript{37}

**The facts**

Sedentary lifestyle is more common in urbanized societies. The median activity score among both black and white girls were low at baseline (27 and 30 METs) and declined further by 10 years (0 and 11 METs) as reported by Kimm.S et al. in one study.\textsuperscript{38} Caloric intake in diabetic patients were clearly in compared to the recommendations.\textsuperscript{39} In a recent study we looked at the caloric intake and distribution of carbohydrate and fat in South Indian population by a survey. We used a three day recall method for the survey. The caloric intake was clearly in excess of recommendations at 2740+/\_750 Cals (recommended 2320+/\_510 Cals). In addition we observed that the carbohydrate levels were much above the recommendations at 72+/\_.6\%. Fat intake was 13+/\_.4\% and protein intake was 11+/\_.4\% (unpublished data).

**Limitations of non-pharmacological treatment**

Diet and exercise are extremely useful early in the management of type 2 diabetes at stages of impaired glucose tolerance and early diabetes. But as disease progresses pharmacological interventions along with lifestyle modifications may be
required to maintain normoglycemia and prevention of complications. In UKPDS only less than 20% of newly detected type 2 diabetes patients achieved glycemic goals at three months and less than 10% were able to were able to achieve long term control by dietary measures alone. Saddest fact to note is that we are still standing at this juncture, if not gone backward. High rate of weight regain is the biggest limitation that reduces the role of lifestyle modification as an effective long term tool for glycemic control.

Conclusions

1. Majority of type 2 diabetics are obese and initial treatment should be with lifestyle modification
2. Reduced caloric intake and increased physical activity are integral parts of non-pharmacological management
3. Multi faceted approach should be adopted when lifestyle modification alone fails
4. lifestyle goals are poorly achieved in most of the diabetic patients

References

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