

Family Health History and Trending to Prediabetes- a Warning Signal to Change of Life Style: A Review

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ABSTRACT

Diabetes mellitus is one of the main threats to human health in the 21st century. Prediabetes can go years without being detected until it reaches serious consequences. Increasing prevalence of type 2 diabetes mellitus (T2DM) in children in developing countries should not be neglected at all. This future adult population, if they are given awareness to change in lifestyle and diet pattern at their adolescent age, definitely could help to control the disease group to a certain extent. Traditional diabetes education might not be sufficient to control diabetes. Early awareness on prediabetes and how much is the risk of prediabetes to diabetes and its consequences are important. The impact of family health history on the individual perception of the disease may vary between individuals and between diseases. These perceptions could be used to motivate preventive health behaviour such as promotion of screening or behaviour change (alcoholism or smoking), diet pattern and exercise modifications. Changes in life style like reduced physical activity and sedentary behaviour in relation to COVID-19 may also become increased risk to life style diseases. Training and empowering of health care providers for delivering adequate health message is important.

Key Words: Prediabetes, Genetic factor, life style, Health care

INTRODUCTION

Diabetic mellitus (DM) is defined as 'a metabolic disorder' characterized by hyper glycaemia resulting from either the deficiency in insulin secretion or in action

of insulin. There are diabetes mellitus type I (T1DM), diabetes mellitus type 2 (T2DM) and gestational diabetes mellitus (GDM). In T1DM there is absolute insulin deficiency due to the destruction of beta-cells of the pancreas by cellular mediated autoimmune disease. GDM is any degree of glucose intolerance that is recognized during pregnancy. T2DM though it is known due to insulin resistance and relative insulin deficiency also known as lifestyle disease^[1-3] DM can also arise from other diseases like genetic syndromes, surgery, malnutrition, infections or due to certain drugs such as corticosteroids^[4,5]

Prediabetes is a serious health condition where blood sugar levels are higher than normal but not high enough yet to be diagnosed as type 2 diabetes mellitus. According to American Diabetic Association, fasting blood sugar level from 100-125 mg/dl and HbA1c of 5.7-6.4% is reasonable for the diagnosis of prediabetes^[6] Approximately 88 million American adults—more than 1 in 3 have prediabetes, of those with prediabetes, more than 84% don't know they have it. Around 40% -1 in 6 Indians is prediabetes and that is just those who have been tested. 41 Million diabetes in India and that is expected to increase to 70 million by 2025^[7,8] Prediabetes put at increased risk of developing type 2 Diabetes, heart disease and stroke. Type 2 diabetes is becoming more common in children and adolescents, likely due to rise in childhood obesity. The American diabetic Association recommends prediabetes testing

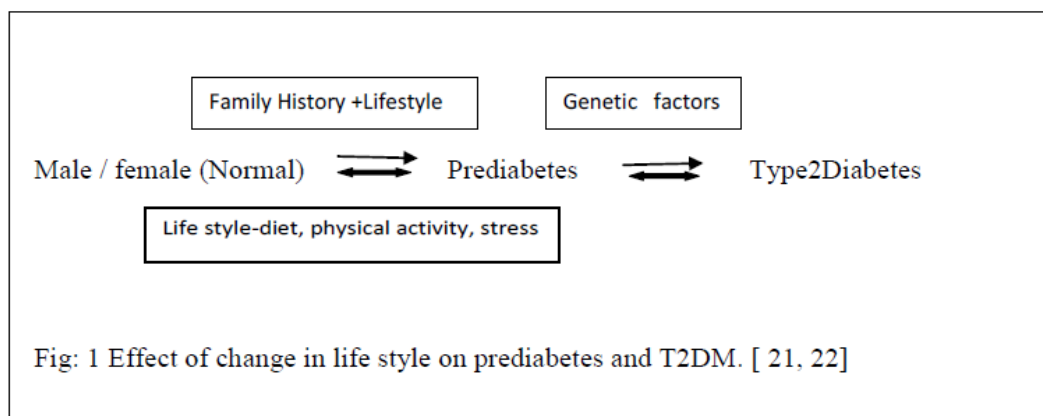
for children who are overweight or obese and who have one or more other risk factors for type2 diabetes.^[6] During the epidemiologic transition profound changes in health and disease patterns are obtaining among children and young women. ^[9] In developing countries affluence led to over nutrition, calorie excess, decreased physical activity and increased body weight. It is also reported that short term changes in physical activity and sedentary behaviour in relation to COVID-19 may become permanently entrenched, leading to increased risk of obesity, diabetes, and cardiovascular disease in children. ^[10] All of which contributed to marked increase in the prevalence of Type 2 DM. People who have prediabetes are at high risk to develop type 2 Diabetes. The good news is that there are ways to reverse this condition. Certain life style changes can lower blood sugar level and decrease the risk of developing diabetes. ^[11-14]

Overview on prediabetes

Prediabetes also called Impaired Glucose Tolerance is very common, more than one million cases arising per year. T2 DM accounts to 90-95% of all diagnosed cases of diabetes and is the commonest form.50% of the people living with diabetes do not know that they are diabetic because it often lacks symptoms. Prediabetes can go years without being detected until it reaches serious consequences. ^[15] Middle income and low income countries are reporting a rapid rise in the levels of diabetic population. In India, it has become an epidemic^[16] The drastic increase in

prevalence of T2DM in the last 50yrs is strongly driven by rise of modern ‘obesogenic’ environment with associated rapid upsurge in obesity due to the combined effects of reduced physical activity and increase access to calorific foods.^[17] These serious escalating T2DM prevalence rates, while first appearing in developed western nations, are now rapidly emerging within the developing world as they increasingly adopt modern urban life styles. Prediabetes or Intermediate hyperglycaemia is at high risk rate for diabetes with an annualized conversion rate of 5-10%; with similar to proportion converting back to normoglycaemia. That means prediabetes may also convert back to normal glycaemia. In a population-based observational study of the natural of diabetes in England, 55-80% of the participants with IFG at base line had normal fasting glucose at 10 years follow-up. ^[18]

Pre diabetes is not only related to an increased risk of diabetes and its complications but there is also accumulating evidence to suggest that damage on kidney and nerves already at prediabetes stage. Identification and treatment of prediabetes individuals is therefore crucial^[19] Chances of developing type 2 DM depend on many factors, combination of risk factors like genetic and environmental factors. Some of these factors like genetic factors can't be changed, but lifestyle factors like diet and exercise and stress can be modified to decrease chances of developing type2 DM.^[20-23] [Fig: 1.]



Increased disease risk can emerge, if the individual has been exposed to an environment that is beyond their capacity to adapt, is entirely novel that poses a challenge. At its simplest level, T2DM can be envisaged as the response of the individual to a nutritional environment that gives them a metabolic load beyond their capacity to cope. While there are developmental and genetic factors that influence the adaptive metabolic capacity of an individual ultimately, it is exposure to high glycaemic foods and a very different mix of macronutrients intake, it is which is thought to be the basis of the diabetic epidemic. [20] The reported prevalence of prediabetes is higher than the prevalence of diabetic and this observation could be suggestive of a potential increase in diabetes in the coming years.[24]

Early awareness is an Advantage

The often used screening tests for diabetes are fasting plasma glucose (FPG) and, or HbA1c. FPG >110 and HbA1c >5.6% must be considered for the precautionary measures. [25] Screening tests are a good preventive method for catching the development of diabetes at an early stage. According to the American Diabetes Association, diabetes screening should be done at three year intervals beginning at age 45 especially people who are overweight or obese. If multiple risk factors like family history of diabetes, overweight, habitual physical inactivity, history of impaired fasting glucose or impaired glucose tolerance, high blood pressure, abnormal lipids like low HDL<35mg/dl, and high triglycerides >250/dl, history of gestational diabetes, polycystic ovary syndrome are present, screening should be done at an earlier age and more frequently because often there are no symptoms with prediabetes. Early screening can help to change the life style and avoid chronic hyperglycaemia and associated symptoms like long term damage of the eyes, kidneys, nerves, and heart and blood vessels. [26]

Family health history of Diabetes- Influence on life style factors

Diabetes is a serious and life-threatening disease. However self-management, training and education plays a vital role in the management of diabetes. Life style interventions is to prevent or delay the development of type2DM and its complications [26,27] by targeting obesity and physical inactivity, the most important modifiable risk factors of diabetes development. [28, 29] It was known that family history could induce the perception of disease risk.[30-33] The onset of disease in family members means that there had been inter-generational transmission of poor lifestyle behaviours such as smoking, drinking, alcohol, being overweight and being inactive that had been shared within the family before the onset of the disease.[34] Regarding the relationship type of family member, environmental factors shared differently with parents and siblings might also influence the adherence to healthy behaviours.[35,36] Behaviours typically co-occur and cluster together rather than independent. For example, those with a lower BMI may participate in physical activity or have healthy dietary habits.[21] In conjunction with genetic susceptibility particularly in certain ethnic groups type 2DM is brought on by environmental and behavioural factors such as sedentary lifestyle, overly rich nutrition and obesity are clearly important.[37]

Life style intervention on physical activity

Individuals lifestyle modification is the cornerstone of prediabetes or diabetes prevention with the evidence of 40-70% relative risk reduction.[17] Changes in the work patterns from labour to sedentary, the increase in computerization and mechanization, improved transport are just a few of the changes that have had an impact on human health. We must accept that T2DM is not just a disease, but a symptom of a much larger global problem, the effect of human health of environmental and lifestyle changes.[38] There are studies that

have demonstrated the efficacy of life style intervention^[39-41] Physical activity is likely to be most beneficial in preventing the progression of T2DM during initial stage or in prediabetes.

The protective mechanism of physical activity appears to have a synergistic effect with insulin. During a single prolonged session of physical activity, contracting skeletal muscle enhances glucose uptake in to the cells. This effect increases blood flow in the muscle and enhances glucose transport in to muscle cells^[41] A single bout of prolonged aerobic exercise (30-60min.of approx.60-70% of maximal oxygen consumption) can significantly lower plasma glucose levels, owing to normal contraction induced stimulation of GluT-4 glucose transporter translocation and glucose transport activity in insulin-resistant skeletal muscle^[42] The regular physical activity reduces the risk of insulin resistance, metabolic syndrome and T2DM. Insulin sensitivity improves when individuals comply with exercise and or physical activity^[43]Physical activity has also been found to reduce intraabdominal fat which is a known risk factor for insulin resistance.^[47] In certain studies physical activity has been inversely associated with intra-abdominal fat distribution can reduce body fat stores.^[44] Life style and environmental factors are reported to be the main cause of extreme increase in the incidence of T2DM. Increased physical activity is effective in preventing T2DM, and protective benefit is especially pronounced in persons at the high risk for the disease.^[45,46]Increasing physical activity is associated with a significant reduction in risk for diabetes whereas sedentary life style indicated prolonged TV watching is directly related to risk in both men and women^[48,49] Sedentary life style pattern in children and adolescents i. e, playing digital games, using computer and especially watching television have been associated with obesity^[50] Advanced technology leading people to action at the tip of the finger also reducing physical activity a lot. Epidemiological

studies suggests that regular physical activity prevents T2DM, cardiovascular disease, and premature mortality in large part.^[51, 52]

Childhood overweight and obesity is a major public health issue. A better understanding of factors like screen-based sedentary behaviour is critical for preventing and reducing obesity among youth population^[51,21,52-55]Effects of exercise and leisure time physical activity extend from prevention to treatment of the various components of the metabolic syndrome as well as to mood and quality of life. Any effort should be done to favour adherence to protocols of physical activity in the community.^[49, 57]

Life style intervention on dietary habits

Dietary habit of an ordinary person depends on family history, tradition, culture and economic status. Dietary pattern interacted with genetic variation in relation to diabetic risk.^[58] It is highly interesting to know that life style interventions including dietary pattern can have hopeful approach towards T2DM management and prevention.^[59] There are reports that subjects with family history of diabetes develop diabetes earlier compared to subjects without family history.^[60]The composition of food is one of the best known dietary pattern for its beneficial effect on human health, that may act beneficially against the development of type2DM including reduced oxidative stress and insulin resistance. Among all food items associated with incidence of T2DM in observational studies, unambiguous evidence has emerged over the last few decades on the possible role of wholegrain consumption in preventing this disease as well as many other widely chronic non-communicable diseases.^[61]

Whole grains are represented by cereals (wheat, rice ,maize, rye, oat, millet, barley, sorghum, teff, and triticale) pseudo-cereals (amaranth, buck-wheat and quinoa) and wild rice which with great variability of macronutrients / micronutrients and content of bioactive compounds.^[62] The awareness

and intake of food with low glycaemic index (GI) and inclusion of grains, legumes, fruits and vegetables which are (sulphur- containing compounds) and several types of dietary fibres and avoidance of much saturated fat will provide better health and prevent malnutrition^[63-65] In conjunction with genetic susceptibility particularly in certain ethnic groups T2DM is brought on by environmental, and behavioural factors such as life sedentary style, overly rich nutrition and obesity are clearly important. ^[34] The attempts of elimination of many of the communicable diseases, non-communicable diseases (NCD) such as diabetes and cardiovascular disease (CVD) have now become the main public health challenge for the 21st century. Because their impact on personal and national health and the premature morbidity and mortality associated with NCD^[21, 37-39]

The early dietary intervention of preventing prediabetes to diabetes is healthy, easy, economic also to person, society, and to the Nation. More and more emphasis is put on the importance of the diversity of food and in particular fruits and vegetables in a new and effective approach to diabetes which is remarkably simple^[66, 67]As rice is the staple food of India, most people consume mixed meals as the main energy source and it enhances a medium glycaemic response. It is seen that majority are facing difficulties in obeying diet advice of the physician due to the nature of the job and heavy work load, leading to take fast food, that are easily available. The fast food is a major driver of diseases it is rich in fat and calorie. High intake of red meat, sweets

and fried foods attribute to the increased risk of insulin resistance and T2DM. Improvement in the elevated HbA1C which is one leading risk factor for developing microvascular and macrovascular complications can be achieved through diet management^[68] With rapid modernization, the easily available high fat diets, increased physical inactivity and sedentary occupational habits have resulted in the increased prevalence of T2DM. The increasing Studies have shown that compliance have been good when dietary advice come from family physicians or their treating doctors.^[69]

It has been confirmed that diet with low glycaemic index value improve the prevention of coronary artery disease in diseased as well as healthy subjects. Selecting low glycaemic index foods has also demonstrated benefits for healthy persons in terms of post-prandial glucose and lipid metabolism^[70] A low glycaemic index diet can improve the overall health and help to prevent certain illness. There is an increasing evidence that foods with low glycaemic index can reduce the risk of developing T2DM and cardiovascular diseases, which is a major cause of mortality in diabetes. Low Glycaemic index diets reduce total and LDL cholesterol, reduce serum triglycerides and increase HDL cholesterol^[71, 72] Glycaemic index is the term coined by Alexander Williams MD and is used to classify foods that contain carbohydrates with their potential for raising blood sugar and how quickly they raise blood sugar.^[73] (Table 1)

Table 1. Commonly used food items and their GI

High GI (70-100)	Moderate GI (56-69)	Low GI (≤ 55)
Polished Rice or wheat and its products (bread pasta)	Unpolished Rice or wheat and its products (bread, pasta) Oat, bran flakes	Wheat whole kernels Barley, Millets
Ripped banana Pineapple,	Banana unripe Orange, Apple, papaya, Mango,	Soya-beans and beans and peas
Corn chips, Popcorn	High fibre rye, Crisp bread	Plums, Apricots, Peaches, Orange Tomato, Row carrot, Dates, Grapes, Grapefruit.
Candies, Soft drinks		Cashew, Peanuts
Foods contain low or no carbohydrates can be included as part of the low GI diet to improve the nutritional value and to keep required Glucose load(GL) such as sea foods, animal products, fats and oils, herbs and spices .[74-76]		

The rate at which foods raise blood sugar levels depend on three factors, the type of carbohydrate they contain, their nutrient composition and the quantity is taken. Even if low GI foods, the portion size matters because calorie still matter. Glucose Load (GL) is also important, it is a measure of how a carbohydrate diet affects blood sugar levels taking both the type of GI and quantity (per servings) into account.^[74,75] Traditional societies consumed largely unprocessed plant diet that were high in fibre and included whole grains, legumes and nuts as staples these diets were low in GI and low GL. The shift away from traditional diets to western highly processed diets has paralleled a drastic rise in the prevalence of diabetes, obesity and CVD.^[75] Habitual diet is the major modifiable risk factor and identification of simple, cost effective strategies for prevention and management is a matter of urgency. The choice of low GI foods offers a similar or higher level of prevention of chronic lifestyle-related diseases.^[75,76] High simple sugar intake during gestation may contribute to an excessive gestational weight gain(GWG) as well as to develop other pregnancy complications such as GDM, preeclampsia and preterm birth.^[77] Modest reductions in sugar intake have a large effect in reducing obesity and T2DM risk factors in high-risk paediatric populations.^[78] Therefore large, well-designed intervention-controlled trials with biological biomarkers to ensure dietary adherences are necessary to evaluate the effectiveness of life style interventions in order to provide effective nutritional advice.^[79]

CONCLUSION

Diabetes is likely to remain a huge threat to public health in the year to come. We must accept that T2DM is not just a disease but a symptom of a much larger global problem, the effect of human health on environmental and life style changes. The early intervention of preventing prediabetes to diabetes is healthy, easy, economic, also to persons, society, and to

the nation. Other than genetic factors, environmental and dietary pattern are variable. A better understanding of factors like screen-based sedentary behaviour is critical for preventing and reducing obesity among youth population The food selection and dietary behaviour can be influenced by strong diabetic diet recommendations. These should be started in the young age itself especially for family with history of diabetes. Obesity has been strongly linked with food intake, not only related to the volume of food but also in terms of composition and quality of diet. High intake of fat and carbohydrate rich foods attributed to the increased risk. More and more emphasis need to be put on the importance of diversity of food including wholegrain cereals, fruits and vegetables in a new and effective approach to diabetes, which is remarkably simple. An emphasis on diet needs to be given by family physicians and their treating doctors.

Prevention requires a public health approach accompanied by major structural changes in the society. Major shifts in public health policies are necessary to create an environment for the whole community or nation in which individual behaviour initiative can succeed. This may require the promotion of agriculture, more and easy availability of fruits and vegetables to common people than depending on staple diet like rice which is with high GI .There is also in need of provisions of safe healthy condition for the elderly and younger sectors of the community. Community and work place must be access to facilitate sufficient exercise.

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