



RESEARCH ARTICLE

DIETRY AND PHYSICAL ACTIVITY COUNSELLING IN THE PREVENTION OF TYPE 2 DIABETES

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ARTICLE INFO

Article History:

Received 11th September, 2017

Received in revised form

19th October, 2017

Accepted 16th November, 2017

Published online 25th December, 2017

Key words:

Type 2 diabetes,
Physical inactivity,
Obesity.

ABSTRACT

Type 2 diabetes, formerly known as non-insulin-dependent diabetes (NIDDM), constitutes a major portion (90-95%) of all cases of diabetes worldwide. The objective of this study was to evaluate and provide evidence on current published literature about diet and lifestyle in the prevention of type 2 diabetes and thereby making disease-specific recommendations. There is a convincing evidence for a decreased risk of type 2 diabetes in adults who are physically active and maintain their normal body mass index (BMI). Also an increased risk for developing type 2 diabetes is associated with overweight, obesity and physical inactivity. On the basis of available evidence regarding diet and lifestyle in the prevention of type 2 diabetes, it is recommended that a normal weight status in the lower BMI range (BMI 21–23) and regular physical activity be maintained throughout adulthood; abdominal obesity be prevented; and low intake of saturated fats be encouraged.

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Citation: Syed Anayat Hussain and Saba Bashir, 2017. "Dietry and physical activity counselling in the prevention of type 2 Diabetes", *International Journal of Current Research*, 9, (12), 62075-62078.

INTRODUCTION

Diabetes is a metabolic disease characterized by hyperglycemia (high blood sugar) resulting from defects in insulin secretion (Type 1 Diabetes), insulin action (Type 2 Diabetes) or both. It is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels. The worldwide prevalence of diabetes is increasing at an alarming rate and is projected to increase by 48 % by the year 2030 (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003). In spite of the significant advances that have been made in the knowledge and management options for treating diabetes, it has become a pandemic disease (Flood & Constance, 2002). Type 2 Diabetes constitutes a major proportion (90-95%) of population diagnosed with diabetes, while 5- 10 % consist of Type 1 diabetes (National Institute of Health, 2005). Type 2 Diabetes, which is most common, was figured at 150 million individuals in 2000 and this number was estimated to get double fold by 2025 (King, Aubert & Herman, 1998). It is the fourth leading cause of deaths in most of developed countries. In rural areas, its occurrence is little less because of prevalence of traditional life style (Amos, McCarty & Zimmet, 1997). In communities where there have occurred drastic changes in food habits from indigenous to a typical Western diet, large incidences of type 2 diabetes have been

observed, for example, Aborigines in Australia, Pima Indians in Arizona (Bennett, 1999). The changes in the disease rates are attributed largely to the dietary as well as other life style factor more noticeably physical inactivity.

Prevalence of type 2 diabetes

In many parts of world especially the newly developing and industrialized countries, a dramatic increase has been observed in the incidences of type 2 Diabetes (King and Rewers, 1993). In coming future, the most affected will be India and China (Table 1). The 366 million figures that were estimated to reach by 2030 reached much earlier in 2011. This shows the extent of pandemics of the diseases we are facing. Now by 2030, it has been estimated that it may reach to 552 million.

Diabetes in India

India has become the diabetes capital of the world (King *et al.*, 1998). The increase in number of diagnosed individuals mostly occurs in rapid urbanization areas and affects mostly the young age group as compared to the elders. In India, the complications of the disease are occurring earlier and progressing at dramatic rate. Further, it is to mention that, there is more number of individuals who have diabetes but are not diagnosed than those of known ones.

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Table 1: Countries with Highest Number of Estimated Cases of Diabetes (in millions) for 2000 and 2030.²

Ranking	2000		2030	
	Country	People with diabetes	Country	People with diabetes
1	India	31.7	India	79.4
2	China	20.8	China	42.3
3	U.S.	17.7	U.S.	30.3
4	Indonesia	8.4	Indonesia	21.3
5	Japan	6.8	Japan	13.9
6	Pakistan	5.2	Pakistan	11.3
7	Russian Federation	4.6	Russian Federation	11.1
8	Brazil	4.6	Brazil	8.9
9	Italy	4.3	Italy	7.8
10	Bangladesh	3.2	Bangladesh	6.7
World Total (millions)		177		366

Adapted from Wild S et al. *Diabetes Care*, 2004.

Table 2. Populations in India

No of adults with diabetes (million)	
2011	2030
50.7	87.0
61.3	101.2

Shah *et al.*, 2010. DRCP
Whiting *et al* 2011. DRCP

Why to have a concern about the Diabetes

Some of the facts, which make it a real concern, are that, every 3 seconds a person is diagnosed with diabetes, every 7 seconds a person dies from diabetes or related complications. Diabetes is the major cause of non-traumatic lower limb amputations, largest cause of blindness. One in every three persons undergoing dialysis is affected with diabetes.

Complications

i) Stroke: A stroke happens when the blood supply to part of the brain is suddenly interrupted. Then brain tissue is damaged. In diabetic patients, the chances of having a stroke are twice higher than in people who do not have diabetes (Kannel, *et al*, 1990).

ii) Cardiovascular Disease: Damage to the heart and blood vessels is collectively known as cardiovascular disease and people with diabetes have a higher chance of developing it. 8/10 individuals with diabetes die from CV events (Gray & Yudkin, 1997).

iii) Diabetic Neuropathy: Diabetic neuropathy is a type of nerve damage that can occur due to diabetes. Diabetic neuropathy most often damages the nerves in legs and feet. It is the leading cause of non-traumatic lower extremity amputations (King, 1996).

iv) Diabetic Nephropathy: Nephropathy means kidney disease or damage. Diabetic nephropathy is damage to kidneys caused by diabetes. It is the Leading cause of end-stage renal disease (Hypertens, 1993).

v) Diabetic Retinopathy: Diabetic retinopathy affects eyes. It is caused by damage to the blood vessels of the light-sensitive tissue at the back of the eye (retina). It is the Leading cause of blindness in adults (UK Prospective Diabetes Study Group, 1990).

Modifiable risk factors

The section deals with the risk factors related to dietary and life style factors. These factors play a significant role in the increased or decreased risk for the development of type 2 diabetes. These factors are modifiable i.e. can be modified in order to prevent the onset of the disease.

i) Obesity: Dieticians have developed a formula to calculate a number, called BMI (Body Mass Index) which is a measure of body fat based on height and weight that applies to adult men and women, $BMI = \text{Weight}/\text{height}^2$. The following numbers are good indicators of whether are not you are overweight. Underweight = BMI of 19.8 or less, Normal Weight = BMI of 26.0, Overweight = BMI of 26.0-29.0, Obese = BMI over 29.0. The obesity has made a drastic increase from past few years because of interaction between genetic and environmental factors (Kuczmarski, Flegal, Campbell & Johnson, 1994). The factors include metabolic characteristics, physical inactivity, and habitual energy intake in relation to expenditure and macronutrient composition of the diet. The likelihood and severity of type 2 diabetes are closely linked with body mass index (BMI). There is a seven times greater risk of diabetes in obese people compared to those of healthy weight, with a threefold increase in risk for overweight people (Abdullah, Peeters & Courten, 2010). It has been observed that the rapid increase in the prevalence of type 2 diabetes from past few years among many populations is certainly related to increasing obesity. Further, data from the Nurses' Health Study has shown lower risk of diabetes occurs in the individuals who have BMI index nearing to 21, with the increase in this level, prevalence of obesity also increases (Colditz, *et al*, 1990).

ii) Physical inactivity: Because of increased prevalence of diabetes in the population, effective strategies and management is the need of hour. Physical activity along with diet and medication play a key role in the management of both type 1 and type 2 diabetes (Sigal, Kenny, Wasserman, & Castaneda-Sceppa, 2004). Further, many other complications related with diabetes like cardiovascular diseases and cancer can be prevented through active participation in physical activities. Despite of having known benefits of physical activities in relation with the prevention of diabetes, a large number of diabetic populations are physically inactive. According to the report of (Plotnikoff, 2006), only about 36.3 and 28.1% adults in the population with type 1 and type 2 diabetes respectively are meeting the recommended physical activity guidelines i.e., 150 minutes/week of moderate physical exercises. Therefore, there is a great need of developing the programmes, which will help in promoting the physical activity among the diabetic patients of both the types. Recommendations with regard to physical activity as a preventative measure for developing type 2 diabetes are still difficult to quantify. However, evidence that is more recent suggests that vigorous exercise is required to improve insulin sensitivity (McAuley, 2002)

iii) Fat: quantity and quality: Both the quantity and quality of fats in the diet play a significant role in the modification of insulin sensitivity and glucose tolerance. A high intake of fats especially Trans fatty acids (TFAs), created through the transformation of polyunsaturated fatty acids which are abundant in western diets may promote insulin resistance and deterioration of glucose tolerance in our body. Several mechanism responsible for this deleterious effect of fats include, decreased binding of insulin to its receptors, reduced glucose transport, decreased glycogen synthesis and

accumulation of stored triglycerides in skeletal muscles (Grundleger & Thenen, 1982).

repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results and risk status.

Guidelines to regulate glycemic levels in relation to physical activity

Table 2. General guidelines of ADA/ACSM in regulating the glycemic response to physical activity

<p>1. Metabolic control before physical activity.</p> <ul style="list-style-type: none"> • Avoid physical activity if fasting glucose levels are >250 mg/dl and ketosis (abnormal fats) is present, and use caution if glucose levels are >300 mg/dl and no ketosis is present. • Take additional carbohydrate if glucose levels are <100 mg/dl. <p>2. Tracing blood glucose before and after physical activity.</p> <ul style="list-style-type: none"> • Identify when changes in insulin or food intake are necessary. • Learn the glycemic response to different physical activity conditions. <p>3. Food intake</p> <ul style="list-style-type: none"> • Consume added carbohydrate as needed to avoid hypoglycemia. • Carbohydrate-based foods should be readily available during and after physical activity.

iv) **Carbohydrates: quantity and quality:** One area of confusion for diabetics and their diets is carbohydrates. So, should it be taken or eat avoided. Carbohydrates have a direct influence on blood sugar levels and so diets followed by people with diabetes tend to focus either on the quantity of carbohydrate intake or on the speed at which carbohydrates are absorbed by the body. Many controversies surround the optimal ratio of carbohydrate-to-fat in the diet with respect to the prevention of chronic diseases, including type 2 diabetes. A marked difference has been observed in different countries regarding this ratio. However, a positive association has been shown between the dietary fat intake and over-weight. This fact supports the notion of decreased fat intake but increased carbohydrate intake as a preventive measure for chronic diseases including type 2 diabetes (Marshall, Hamman & Baxter, 1991). Other studies (Salmeron, *et al*, 1997 & Meyer, *et al*, 2000) did not find any significant association between total carbohydrate consumption and diabetes risk. It is known whenever a high carbohydrate intake takes place, an increased requirement for insulin secretion is felt in order to maintain glucose homeostasis. This process produces higher post-prandial (following a meal) insulin levels. It is possible that repeated stimulation of a high insulin secretion by a high carbohydrate diet could speed up an age-related decline in insulin secretion and lead to an earlier onset of type 2 diabetes (Grundy, 1999). The quality as well as the quantity of carbohydrates taken may however play a significant role in speeding up of this response. The most recent American dietary guidelines recommend intake of a variety of grain products (including whole grains) equating to six or more servings a day, however, no specific carbohydrate guideline, which is aimed at the prevention of type 2 diabetes is available. Therefore, a wide range of carbohydrate intakes may be acceptable in terms of achieving a low risk of type 2 diabetes with type and source of carbohydrate being more important than quantity.

Criteria for undergoing tests for pre-diabetes and diabetes in asymptomatic adults: All the adults whose are over-weight (BMI 25 kg/m²) and have additional risk factors discussed below should undergo testing for diabetes. The risk factors include: physical inactivity, first-degree relation with diabetic patient, member of high-risk ethnic group, women who delivers a baby weighing 9 lb, hypertension (140/90 mmHg), having HDL cholesterol level 35 mg/dl and/or a triglyceride level 250 mg/dl, women with polycystic ovarian syndrome, other clinical conditions associated with insulin resistance (e.g., severe obesity), history of CVD. In the absence of the above criteria, testing for pre-diabetes and diabetes should begin at age 45 years. If results are normal, testing should be

Conclusion

The increased prevalence of type 2 disease from last few years has put a great cost on economic, social, and personal factors among the people. In addition, there is great evidence regarding the prevention of type 2 diabetes through the implementation of life style measure like weight control and exercises. In order to achieve maximum benefits from these life style interventional measures (weight control & exercises), there must be change in government policies besides other community-based programmes (Temple and Nestle 2001). The policy should include imparting nutrition education in schools, banning the advertisement of unhealthy products. Besides, stress should be laid on schools and other public health authorities to emphasize the role of weight control and increased physical activities in the prevention of type 2 diabetes. The priority should be given to promotion and evaluation of 'healthy' lifestyle Programmes, Healthy lifestyle programmes/interventions should focus on a life course perspective and not on a specific age group or developmental stage, Legislative action will be necessary to promote a healthier lifestyle for all populations.

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