



McDowell, J. (2014) *The importance of diet and exercise in preventing type 2 diabetes*. *Nursing in Practice*, 79. ISSN 1473-9445

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Deposited on: 15 September 2014

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The importance of diet and exercise in preventing type 2 diabetes

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Introduction

Diabetes is reaching epidemic proportions globally with estimates of 374 million people worldwide (WHO 2014) and impacts on the people with the condition, their families and on health service resources. While type 1 diabetes is an autoimmune disease, the causes of type 2 diabetes are more multi-factorial. In the UK there are about 2.9 million with diabetes of whom approximately 90% will have type 2. It is also estimated that there are about 850,000 people in the UK who have type 2 diabetes but have not as yet been diagnosed (NHS UK 2014). Coupled with this, there are people who have known risk factors for developing diabetes. This article aims to consider the role of diet in adults in preventing those who are at high risk of developing type 2 diabetes and to present the evidence and practical application for nurses.

Risk factors for type 2 diabetes

Type 2 diabetes is characterised by the ineffective use of insulin that results from three metabolic abnormalities.

First there is insulin resistance usually as a consequence of obesity. The insulin resistance means that circulating blood glucose cannot enter the cells to function resulting in high blood glucose levels. As the body needs glucose, it switches into increasing hepatic glucose production, further increasing the blood glucose levels. This triggers further insulin production from the beta cells which are not able to keep up with the pace of glucose production and, over years, the beta cells begin to fail. This process occurs over many years before a person is diagnosed with type 2 diabetes.

Being overweight and lack of physical activity are frequently the cause of type 2 diabetes (WHO 2014). Other factors that cause insulin resistance may result in type 2 diabetes including stress and sleep deprivation (Van Cauter 2011).

There are a variety of risk factors for developing type 2 diabetes (Box 1) some of which are modifiable or not and some of which are manageable by medication but hard to modify e.g. hypertension. While increasing age is a risk factor, it is worth noting that increasing obesity in young people puts them at high risk of developing type 2 diabetes with one case study identifying a girl aged 5years (Kevat et al 2014). Likewise, waist circumference measures are variable according to ethnic origin (Table 1). Fat deposits around the waist increase the risk of type 2 diabetes greater than fat deposits elsewhere e.g. hips.

Role of diet and exercise in developing type 2 diabetes

Obesity is a strong modifier in the risk and development of type 2 diabetes. A BMI of greater than or equal to 25 is classified as overweight and a BMI of greater than or equal to 30 is obesity. The main cause of excess weight is due to the difference between energy consumed through food and fluids and energy expended through activity and exercise (WHO 2013).

Throughout the world, there has been a considerable increase in the consumption of energy-dense foods that are usually high in fat along with a decrease in physical activity due to a variety of reasons which together has resulted in the global obesity epidemic. The build up of fat in key organs e.g. skeletal muscle and the liver, result in changes to the triggers by which insulin is released from the pancreas. These changes cause insulin resistance and result in type 2 diabetes (Tuomi et al 2014).

A large randomised trial compared three groups of people with a control group: one group received diet only, another exercise only and a third both diet and exercise (Pan et al 1997). The onset of type 2 diabetes was significantly reduced in each intervention group showing that the reduction in diet will delay or prevent the onset of type 2 diabetes. A Cochrane review found that where people were overweight but restricted their calorie intake and/or increased their physical activity to an average of 150 minutes per week, the incidence of diabetes was reduced by 37% (Orozco et al 2008). There were also benefits seen in body weight, blood pressure and waist circumference.

While a healthy eating regime is recommended, a poor diet increases the risk of type 2 diabetes. A diet that is high in sugars, high in salt, high in saturated fats, has a high carbohydrate content and low in fibre all contribute to increasing the risk factor.

How to manage people at high risk of type 2 diabetes

The first aspect is to identify the people who are at high risk of type 2 diabetes (Box 1). The mainstay of prevention of type 2 diabetes is through lifestyle changes (NICE 2011). Healthcare professionals are encouraged to consider any intervention to address type 2 diabetes risk factors as also appropriate to address other clinical aspects e.g. obesity and cardiovascular disease. NICE guidelines (2011) also state that any intervention should be considered as part of an integrated package to promote health. Any intervention needs to be culturally appropriate (NICE 2011) and a community approach to the prevention of obesity is recommended (NICE 2012).

After identifying people at high risk, undertake a thorough assessment of their risk factors, involving the individual in all aspects of this. Together identify the key aspects of care that the person wishes

to address first. Assuming that the person is overweight, there are general guiding principles for weight management that are detailed in Box 2. Engaging support for the individual, especially from their family, can encourage them to make small, target focused changes in their diet that are sustainable. SIGN (2010) state that professionals should ensure patients know the benefits of even modest weight loss and assessing people's motivation to change is one component of this along with weight management programmes. It is recommended that there is a reduction of 600 kcal/day to promote an energy deficit (SIGN 2010).

It may also be that the person is willing to increase their physical activity. Research has shown that obese people who are also physically fit have a better clinical outcome than thin people who are not fit, including people with pre type 2 diabetes (Lavie et al 2014, McAuley et al 2014, Church et al 2005). Hence encouraging and promoting physical activity is a key element of care. Not only does this bring health benefits relating to blood pressure and blood glucose levels, physical activity can increase a person's sense of well being and lifts their mood. Adults should engage in at least 30 minutes of moderate exercise, preferably daily (Laaksonen et al 2005). Recent studies have shown that modest changes to lifestyle, introducing healthy eating, reducing weight and increasing exercise all reduce the risk of type 2 diabetes (Tuomilehto et al 2001, Knowler et al 2002).

Healthcare professionals need various skills to support people in their self management especially when the people are not necessarily ill at this stage. Skills in supporting people in behaviour change are essential (NICE 2007) and also in motivational interviewing. Healthcare professionals should explore the reasons why someone does or does not want to make changes in their lifestyle and encourage the person to make small, incremental changes towards their goal.

Research into the prevention of type 2 diabetes

There is ongoing research into almost all the main causes of type 2 diabetes. However there is also research being undertaken into diet and exercise.

There is a large multi-centred 5 year trial being conducted investigating an intensive weight management plan for people with type 2 diabetes. Study participants will either undertake normal care or else be selected to follow a low-calorie liquid diet followed by long term weight control (Diabetes UK 2013). While this study is for people who have type 2 diabetes, the outcomes will inform dietary recommendations for all.

Bariatric surgery is one option for people who are morbidly obese and after other options have been explored and other criteria are met (SIGN 2010). There is ongoing research into the efficacy of bariatric surgery on insulin resistance, obesity and those at risk of, or who have, type 2 diabetes.

Sleep deprivation also causes insulin resistance and there are a variety of sleep studies being undertaken to determine the pathophysiology and the impact of different sleep patterns.

A sedentary lifestyle is a predisposing factor for type 2 diabetes and the benefits of exercise in preventing this is already known. Further studies are investigating the comparative benefits of different types of exercise and whether the intensity of the exercise have different effects.

Conclusion

The incidence and prevalence of type 2 diabetes is increasing globally. Through a reduction in calorie intake on a daily basis, adhering to the principles of a healthy diet and undertaking 30 minutes of moderate activity on a daily basis, the epidemic of type 2 diabetes may be reduced.

While several risk factors cannot be modified due to inherited factors, the modification of other risk factors is within individual's control. Healthcare professionals need skills in motivational interviewing and behaviour change to encourage people to make changes to their lifestyle to reduce the onset of type 2 diabetes.

References

Church TS, LaMonte MJ, Barlow CE, Blair SN (2005) Cardiorespiratory fitness and body mass index as predictors of cardiovascular disease mortality among men with diabetes. *Archives of Internal Medicine* 165: 2114-2220

Diabetes UK (2013) Research spotlight – low calorie liquid diet.
www.diabetes.org.uk/Research/Research-round-up/Research

Kevat D, Wilson D, Sinha A (2014) A 5-year-old girl with type 2 diabetes. *The Lancet* 383:1268

Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Waler EA, Nathan DM (2002) Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine* 346:393-403

Laaksonen DE, Lindström J, Lakka TA, Eriksson JG, Niskanen L, Wikström K, Aunola S, Keinänen-Kiukaanniemi S, Laakso M, Valle TT, Ilanne-Parikka P, Louheranta A, Hämäläinen H, Rastas M, Salminen V, Cepaitis Z, Hakumaki M, Kaikkonen H, Härkönen P, Sundvall J, Tuomilehto J, Uusitupa M, for the Finnish Diabetes Prevention Study Group (2005) Physical activity in the prevention of type 2 diabetes: The Finnish Diabetes Prevention Study. *Diabetes* 54: 158-165

Lavie CJ, McAuley PA, Church TS, Milani RV, Blair SN (2014) Obesity and cardiovascular diseases – implications regarding fitness, fatness, and severity in the obesity paradox. *Journal of American College of cardiology* January 30 DOI: 10.1056/NEJMc1401876

McAuley PA, Artero EG, Sui X, Lavie CJ, Almeida MJ, Blair SN (2014) Fitness, fatness, and survival in adults with prediabetes. *Diabetes Care* 37:529-536

NHS UK (2014) NHS Choices: Diabetes type 2 <http://www.nhs.uk/Conditions/Diabetes-type2/Pages/Introduction.aspx>

NICE (2007) Behaviour change: the principles for effective interventions (PH6)
<http://www.nice.org.uk/nicemedia/live/11868/37987/37987.pdf>

NICE (2011) Preventing type 2 diabetes – population and community interventions (PH35). NICE, England

NICE (2012) Obesity: working with local communities (PH 42)
<http://www.nice.org.uk/nicemedia/live/13974/61622/61622.pdf>

Orozco LJ, Buchleitner AM, Gimenez-Perez G, Roqué i Figuls M, Richter B, Mauricio D. (2008) Exercise or exercise and diet for preventing type 2 diabetes mellitus. Cochrane Database of Systematic Reviews, Issue 3. Art. No.: CD003054. DOI: 10.1002/14651858.CD003054.pub3.

Pan XR, Li GW, Hu YH, Wang JX, Yang WY, An ZX, Hu ZX, Lin J, Xiao JZ, Cao HB, Liu PA, Jiang XG, Jiang YY, Wang JP, Zheng H, Zhang H, Bennett PH, Howard BV (1997) Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: The Da Qing IGT and Diabetes study. Diabetes Care 20:4:537-544

SIGN (2010) SIGN 115: Management of Obesity. <http://www.sign.ac.uk/pdf/qrg115.pdf>

Tuomi T, Santoro N, Caprio S, Cai M, Weng M, Groop L (2014) The many faces of diabetes: a disease with increasing heterogeneity. The Lancet 383:1084-1094

Tuomilehto J, Lindstrum J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, Keinänen-Kiukaanniemi S, Laakso M, Louheranta A, Rastas M, Salminen V, Uusitupa M (2001) Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. New England Journal of Medicine 344:1343-1350

Van Cauter E (2011) Sleep disturbances and insulin resistance. Diabetic Medicine 28:12:1455-1426

WHO (2013) Obesity and overweight <http://www.who.int/mediacentre/factsheets/fs311/en/>

WHO (2014) Diabetes fact sheet <http://www.who.int/mediacentre/factsheets/fs312/en/>

Box 1: Risk factors for developing type 2 diabetes

Non-modifiable

Increasing age

A family history of type 2 diabetes

People from the black and ethnic minority communities

Hypertension or hyperlipidaemia

Gestational diabetes

Any woman with a baby delivered over 4kg

Modifiable

Overweight with a BMI in excess of 25

Waist circumference

Obese women with polycystic ovary syndrome

Lack of activity

Impaired fasting glycaemia

Impaired glucose tolerance

Box 2: Guiding principles for weight management

Base meals on starchy foods using wholegrain as much as possible e.g. potatoes, pasta, bread, rice

Eat fibre-rich foods e.g. fruit, vegetables, brown rice and pasta, oats, beans, peas, lentils, seeds, grain

Replace high fat and high calorie foods with at least five portions of fruit and vegetables daily

Eat a low-fat diet

Reduce fat or calorie intake daily

Source: NICE (2011) Preventing type 2 diabetes – population and community interventions (PH35).
NICE, England

Table 1 Waist measurement guidelines: measurements above these indicate increased risk of diabetes

Ethnic Group	Men	Women
White	94 cm or 37 inches	80 cm or 31.5 inches
Black	94 cm or 37 inches	80 cm or 31.5 inches
Asian	90 cm or 35 inches	80 cm or 31.5 inches