

Smoking and diabetes

Introduction

This fact sheet examines the association between smoking and diabetes including smoking as a risk factor, how smoking can lead to multiple complications of diabetes and the benefits of stopping smoking among people with diabetes.

What is diabetes?

Diabetes mellitus is a metabolic condition which causes increased glucose levels in the blood. Glucose is a sugar that the body produces primarily from the digestion of carbohydrates and levels are controlled by the hormone insulin. Insulin is made and stored in the pancreas and helps glucose to enter the cells where it is used as fuel by the body.¹

Types of diabetes

There are two main types of diabetes:

Type 1 Diabetes (insulin dependent) develops when the insulin-producing cells in the pancreas have been destroyed, leaving the body unable to produce insulin. It is thought that the body's immune system destroys the cells but it's not known what causes this to happen. Type 1 diabetes usually appears in children and young adults but can occur at any age. People with this form of the condition are treated with daily insulin injections and account for about 10 per cent of diabetes cases in the UK.¹

Type 2 Diabetes (insulin resistance) develops while the body can still produce insulin, but not enough, or when the insulin produced doesn't work properly. This form of the condition usually develops gradually after the age of 40. However, it is increasingly being diagnosed in younger people, including children. Both genetic and environmental factors contribute to the development of diabetes but the development of Type 2 diabetes is more likely if some or all of the following factors are also present: physical inactivity; being overweight; family history of Type 2 diabetes; previous diabetes in pregnancy. The condition is also more common in people of Asian and African-Caribbean origin.^{1,2,3}

Prevalence and health consequences of diabetes

In the UK, 3.3 million people have been diagnosed with diabetes, equivalent to 6.2% of the population.⁴ It has been estimated that there are a further 590,000 people with diabetes who remain undiagnosed.⁵ In 2012 there were 24,900 diabetes-related deaths in England and Wales.⁶

People with diabetes are at greater risk of:

- high blood pressure
- heart disease
- stroke
- kidney disease

- nerve damage leading to limb amputation
- eye damage such as retinopathy (disorders of the retina).⁷

Smoking and the risk of developing diabetes

There is a growing body of evidence to show that smoking is a risk factor for Type 2 Diabetes.^{8,9,10,11,12} Several hypotheses have been proposed to explain this link. Smoking has been identified as a possible risk factor for insulin resistance (see below), a precursor for diabetes. Smoking has also been shown to deteriorate glucose metabolism which may lead to the onset of Type 2 diabetes.¹³ There is also some evidence which suggests that smoking increases diabetes risk through a body mass index independent mechanism.^{14,15}

Smoking has further been associated with a risk of chronic pancreatitis and pancreatic cancer, suggesting that tobacco smoke may be toxic to the pancreas.^{16,17,18}

A systematic review of 25 studies found that all but one revealed an association between active smoking and an increased risk of diabetes.¹⁹ On the basis of this review, it is estimated that 12% of all Type 2 diabetes in the United States may be attributable to smoking.²⁰ If the same proportion is applied to the UK, smoking may account for as many as 360,000 cases of diabetes.

Smoking-related risk of diabetes increases with the number of cigarettes smoked. The Cancer Prevention Study 1, a cohort study of 275 190 men and 434 637 women, found that women who smoke more than 40 cigarettes a day have a 74% increased risk of developing diabetes, with men's risk increasing by 45%.²¹

There is also evidence, including a 2013 cohort study of over 37,000 women, to suggest that exposure to secondhand smoke may be a risk factor for the development of type 2 diabetes.^{22,23,24,25,26,27}

Smoking as an aggravating factor for diabetes

People with diabetes already have an increased risk of heart disease, which is further elevated if they smoke. Diabetes acts in several ways to damage the heart. High glucose levels affect the walls of the arteries making them more likely to develop fatty deposits which in turn makes it more difficult for the blood to circulate. People with diabetes are more likely to have high blood pressure and high levels of fats such as triglycerides. They are also more likely to have lower levels of the protective HDL cholesterol.

Smoking, diabetes and pregnancy

Women who smoke during pregnancy are at increased risk of developing gestational diabetes and also increase the risk of their offspring developing diabetes later in life.²⁸ Gestational diabetes mellitus is defined as any carbohydrate intolerance that begins during pregnancy. Women who develop diabetes during pregnancy have a seven-fold increased risk of subsequently developing type 2 diabetes compared with women who have normal levels of glucose in pregnancy.²⁹

Metabolic syndrome

Metabolic syndrome is a condition in which a person has a number of different medical problems, all related to the body's metabolism, which together increase their risk of developing coronary heart disease and diabetes. These medical problems include: Type 2 diabetes, high blood pressure, high blood triglyceride levels, and low levels of HDL cholesterol (the protective type of cholesterol) in the blood.

Most commonly, patients suffering from metabolic syndrome will be overweight, particularly around the waist, and have resistance to insulin. Recent evidence suggests a strong association between cigarette smoking, insulin resistance and metabolic syndrome.^{30,31,32}

Smoking, diabetes and premature death

Compared to non-smokers with diabetes, people with diabetes who smoke have an increased risk of premature death. A meta-analysis³³ found that diabetic patients who were smokers were at an increased relative risk for mortality of 1.48 compared to non-smokers. Smokers were also at a further increased risk of cardiovascular mortality, and a number of cardiovascular events including coronary heart disease, stroke and myocardial infarction.

There is evidence that these risks increase with increased cigarettes smoked per day. A large prospective study of US nurses found that among those with diabetes the relative risks of mortality were 1.31 for past smokers, 1.43 for current smokers of 1-14 cigarettes per day, 1.64 for smokers of 15-34 cigarettes per day, and 2.19 for current smokers of 35 or more cigarettes per day.³⁴

The effect of smoking on complications of diabetes

Smoking is associated with multiple complications of diabetes; the risk of complications associated with tobacco use and diabetes in combination has been stated to be approximately 14 times higher than the risk of either smoking or diabetes alone.³⁵

Increased risks of kidney disease (nephropathy) have been shown in Type 1 diabetes patients who smoke.³⁶ There is also evidence that both active and passive smoking increases the risks of chronic kidney disease in Type 2 diabetes patients.³⁷

Smoking has been found to increase the risk of albuminuria (the presence of protein in the urine, which indicate signs of kidney disease) in both Type 1 and Type 2 diabetes.^{38,39} A small study of 33 people with Type 2 diabetes with kidney disease found that smokers' kidney function declined more rapidly than that of non-smokers, despite drug treatment, suggesting that smoking cessation could slow the progression of kidney disease in people with diabetes who use ACE inhibitors.⁴⁰

The relationship between cigarette smoking and retinopathy (disorders of the retina) is less well defined than that of other microvascular complications of diabetes.⁴¹ However, some studies have found an association between smoking and diabetic retinopathy.^{36,42}

Smoking is also a documented risk factor for both the development and progression of various types of neuropathy (damage to the peripheral nervous system). A retrospective case control study of Type 1 and Type 2 diabetic patients found that current or ex-smokers were significantly more likely to have neuropathy than individuals who never smoked (64.8% vs. 42.8%).⁴³ A prospective study found that cigarette smoking was associated with a 2-fold increase in risk.⁴⁴ More recently, a systematic review and meta-analysis found that smoking increased the risk of diabetic peripheral neuropathy by 42%.⁴⁵

Benefits of stopping smoking

Stopping smoking reduces the risk of cardiovascular disease, lung disease, cancer and stroke.⁴⁶ (See also ASH fact sheet: Stopping smoking - the benefits and aids to quitting.) As diabetes also increases the risk for heart disease and stroke, smokers with diabetes are strongly advised to quit.⁴⁷ However it appears that many smokers with diabetes are not receiving this advice.

As part of a regular survey of its members, Diabetes UK found that 64.1% of smokers had not received support or advice to quit.⁴⁸ Research available suggests that smokers with diabetes may be less successful in quitting than smokers without diabetes.⁴⁹ A recent meta-analysis of the effectiveness of both high and low intensity smoking cessation interventions for people with diabetes concluded that more research is needed to explore the most effective way of helping people with diabetes to stop smoking.⁵⁰

One possible explanation for the lower quitting rates among people with diabetes is the fact that stopping smoking is associated with weight gain and this is likely to be of concern in people who have diabetes and are already overweight. One US study found that concerns about weight gain among smokers with Type 1 diabetes were particularly prevalent among women, obese smokers, and those in poor metabolic control.⁵¹ Fear of weight gain was cited by 49% of smokers.

A British prospective study of 7,735 men aged 40-59 years found that the benefit of giving up smoking was only apparent after 5 years of smoking cessation and risk reverted to that of never-smokers only after 20 years. Men who gave up smoking during the first 5 years of follow-up showed significant weight gain and subsequently higher risk of diabetes than continuing smokers. However, the authors concluded that in the long term, the benefits of giving up smoking outweigh the adverse effects of early weight gain.⁵² The US Cancer Prevention Study also provided evidence that stopping smoking for 10 years in men and five years in women could reduce the risk of diabetes to that of nonsmokers.²¹

Stopping smoking also reduces the risk of premature death. The US Nurses' Study found that women with Type 2 diabetes who had stopped smoking for 10 or more years had a mortality relative risk of 1.11 compared with diabetic women who were never smokers.³⁴

In the light of evidence demonstrating that smoking is an independent risk factor for diabetes and that it is also an aggravating factor for diabetes complications, smoking cessation advice should be a routine component of diabetic care. Concerns about weight gain should be addressed by health care providers whilst emphasising the fact that the health benefits of smoking cessation far outweigh post cessation weight gain, even in people who are focused on weight management.⁵³

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