Review Article

The Impact of Smoking on Individuals with Diabetes Type 2

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Abstract

Smoking is one of the biggest threats to public health and has a negative impact on the health of smokers as well as non-smokers. The purpose of this article was to investigate the impact of smoking on individuals with diabetes type 2 Smokers who have diabetes mellitus were observed to suffer from various other conditions such as increased triglycerides, reduced HDL, central obesity and increased visceral fat deposition. Smoking also causes insulin resistance, increased insulin levels. Smoking accelerates diabetic complications such as cardiovascular diseases (angina pectoris, heart attacks, strokes, aneurysms), tendency for thrombosis, hypertension, diabetic nephropathy, diabetic retinopathy. Prevention of tobacco use and smoking cessation is recommended and should be recommended to all smokers suffering from diabetes mellitus. The cessation procedure starts off with an initial recording of the smoking habit (history of the habit and possible attempts made towards quitting smoking). The cessation procedure is determined based on the person's individual characteristics. Healthcare providers should encourage individuals with diabetes mellitus to quit smoking. Encouraging all smokers to quit may also help in reducing the number of diabetes mellitus cases overall.

Key words: smoking, diabetes mellitus, smoking cessation, tobacco, health

Introduction

Smoking is one of the biggest threats to public health, which causes more than 8 million deaths every year worldwide. More than 7 million of these deaths are caused by direct tobacco consumption. About 1.2 million deaths are caused due to non-smoking exposure in the form of passive smoking. Thus, it is proven that smoking has a negative impact on the health of smokers as well as non-smokers (WHO 2020).

Diabetes Mellitus (DM), commonly known as diabetes, is a disease that is classified as a pandemic, by the WHO. Currently, there are about 463 million adults affected by diabetes all around the world, which is expected to reach about 700 million by the year 2045 (IFD Diabetes Atlas 2019). DM is characterized by chronic hyperglycaemia, which causes irreversible damage to blood vessels and consequently leads to macrovascular and microvascular complications (Kazakos, 2016). Smoking is one of the most important modifiable risk factors that causes DM (Campagna et al. 2019).

A literature review was conducted using the electronic database, PubMed. The following key words were used individually and in combination, to search the database: "smoking", "tobacco", "diabetes type2", "smoking cessation". Articles in languages other than English were excluded from the search.

The purpose of this article was to investigate the impact of smoking on individuals with diabetes type 2.

Smoking and Health

Every cigarette consists of approximately 7,000 dangerous chemical substances, out of which 250 are toxic and 70 are carcinogens. Tobacco consists of nicotine, tar and carbon monoxide.

Nicotine is an addictive substance. It is a drug that stimulates the release of large amounts of various substances, which exist normally in the human body. Such a release can be extremely

toxic to the human body. As these substances flow directly to the central nervous system and the heart, they can cause an increase in the heart rate and blood pressure. Nicotine also has numerous positive effects, such as contributing to the improvement of concentration and mood and the reduction of anger and body weight. When cigarette smoke is inhaled, a high amount of nicotine reaches the brain quickly, within about 10 seconds.

Tar is a carcinogenic substance that is deposited in the lungs, gets sent to the respiratory system and is gradually absorbed by the body. Tar is a mixture of many different chemical substances including formaldehyde, arsenic, cyanide and benzene.

Carbon monoxide binds to haemoglobin more easily than oxygen, thus reducing the levels of oxygen carried by it to the tissues. This affects the oxygenation of various organs, which is especially dangerous for people who suffer from chronic lung or heart diseases (Skoutas 2008).

Smoking causes multiple adverse health effects. It causes various types of cancer such as that of lungs, mouth, larynx, oesophagus, cervix, bladder, and pancreas. It also causes other diseases such as chronic obstructive pulmonary disease (COPD), coronary heart disease, stroke, peripheral vascular disease, and reproductive complications (In men: impotence, erectile dysfunction, poor sperm quality and testicular cancer. In women: reduced fertility, premature menopause, and contraindication to taking contraceptives as smoking increases the risk of thromboembolic events). Smoking also causes premature aging (such as wrinkles and grey hair) and increases the risk of developing Diabetes Mellitus type II (IARC, 2007, CDC 2000).

WHO has classified smoking as an addictive habit. Substance dependence is a psychological and physical condition, characterized by the urgent need to receive the substance on a continuous or periodic basis, in order for the user to experience the effects of the action of the substance or to avoid the discomfort caused by its deprivation. It is possible for a person to develop addiction for more than one substance. A psychotropic substance can cause psychological dependence, physical dependence or both.

Tobacco withdrawal syndrome is classified under the code F17.2 in the International Classification of Diseases (ICD-10). One of the criteria for diagnosing ICD-10 for substance abuse, is that the person continues substance use despite knowing that persistent or recurring physical or psychological problems are likely to be created or exacerbated by the substance itself (ICD 2020).

Smoking and Diabetes Mellitus

The frequency of smoking is about the same in individuals with DM and those without DM. This is evidenced by the results of large-scale research. The results of the Behavioral Risk Factor Surveillance System revealed that DM affected smokers at 26%, ex-smokers at 25.9% and people who had never smoked at 48.1% (Ford et al. 1991).

The results of the National Health Interview Survey found that the prevalence of smoking was 27.4% in people with diabetes and 25.9% in individuals without diabetes. The prevalence of smoking was found to decrease as the duration of diabetes increased (Ford et al. 1994).

Smoking is an independent risk factor for DM type 2. The dose-dependent relationship between the two is recorded in large-scale studies related to smoking and the risk of developing DM type 2.

In the research study,Nurses' Health Study, 114,247 women were followed for 8 years and type 2 DM was found to have occurred in 2,333 women. When these women were checked for multiple risk factors, the relative risk for DM type 2 among women who smoked $\geq$ 25 cigarettes per 24 hours, when compared to those who never smoked was 1.42 (95% CI, 18-1.72). Similar results were obtained from a similar research that was conducted on a population of 41,810 men who were followed for 6 years. The corresponding relative risk for those smoking $\geq$ 25 cigarettes per day when compared to non-smokers for DM type 2 was 1.94 (95% CI 1.25-3.03) (Rimm et al. 1995)

Age of smoking onset and the number of cigarettes smoked per day are the major risk factors for developing DM type 2. This is evidenced by the Cancer Prevention Study (1959-1972), which studied a population of 275,190 men and 434,637 women. The risk of developing DM type 2 was found to be 5% in men and zero in women, when cigarette consumption was less than 20 cigarettes per 24 hours. When the number of cigarettes was

increased to 20-40 cigarettes per 24 hours, this risk increased to 19% in men and 21% in women. When the number of cigarettes smoked per 24 hours exceeded 40, the risk of developing DM type 2 reached 45% for men and 74% for women. Thus, smoking was proved to be directly responsible for causing DM type 2. (Will et al. 2001)

Smokers who have DM were observed to suffer from various other conditions such as increased triglycerides, reduced HDL, central obesity and increased visceral fat deposition. Smoking also causes insulin resistance, increased insulin levels and eventually, DM. Additionally, it was found that there is a positive correlation between the number of cigarettes smoked per 24 hours and glycosylated Hb (HbA1C) levels. As the daily tobacco consumption increases, metabolic control deteriorates. When this happens, increased insulin is required to achieve the required metabolic control (Hu et al. 2018; Campagna et al. 2019).

Smoking during pregnancy affects foetal development and baby's birth weight. It also increases the possibility of overweight and obesity in children later on in life. Women who smoke during their pregnancy face an increased risk of developing gestational diabetes during pregnancy and also DM later on in their lives.

Smoking accelerates the following diabetic complications:

a)   Cardiovascular diseases (angina pectoris, heart attacks, strokes, aneurysms), which are two to three times more common in male smokers with DM than non-diabetics and non-smokers, and 3 to 5 times more common in female smokers with DM.
b)   Tendency for thrombosis
c)   Hypertension
d)   Diabetic nephropathy
e)   Diabetic retinopathy

Smoking reduces HDL cholesterol and increases atherosclerosis, which narrows down arteries, such as the carotid arteries that irrigate the brain and the arteries that irrigate the lower extremities. Male smokers with DM are also much more likely to have erection and sexual dysfunction when compared to their non-smoking diabetic peers (Chang 2012; Campagna et al. 2019)

In addition, diabetic smokers also face the risk of developing other complications that non-diabetic smokers face. These include chronic obstructive pulmonary disease, lung cancer, mouth cancer, larynx cancer, pancreatic cancer and premature cell aging and attrition.

Cessation of Smoking

Prevention of tobacco use and smoking cessation is recommended and should be recommended to all smokers suffering from DM. Health professionals should advise and discourage people with DM from starting smoking, especially those who are under 21 years of age. This is important because, the onset of smoking and alcohol consumption happens majorly during adolescence. 70% of active smokers are reported to have started smoking before they turned 18. Particularly, a majority of diabetic adolescents start smoking shortly after being diagnosed with DM. Some girls start smoking during adolescence in order to regulate their body weight. Therefore, it is very important to discourage diabetic adolescents from taking up smoking.

When a healthcare provider urges a person to quit smoking, he/she worries about various factors such as appetite control, weight gain and depression or anxiety that they may experience due to smoking cessation.

Considering all the above, it can be understood that the approach and treatment of each diabetic smoker should be individualized based on their particular characteristics, such as cause, age, lifestyle, metabolic regulation, and complications.

When an individual with diabetes decides to quit smoking, the cessation procedure starts off with an initial recording of the smoking habit. This includes recording the history of the habit and possible attempts made towards quitting smoking. Then, the smoker's willingness to make an effort to quit smoking at that particular time is assessed. Finally, the cessation procedure is determined based on the person's individual characteristics. Obstacles to cessation are explored, suspensions in taking measures are considered, and dangers of cessation are explained to the smoker (Skoutas 2008).

Detection of Nicotine Dependence Using the Frageström Scale is the next step.The Fagerström Test for Nicotine Dependence is a standard instrument used for assessing the intensity of physical addiction to nicotine. The test was designed to provide an ordinal measure of

nicotine dependence related to cigarette smoking. It contains six questions that evaluate the quantity of cigarettes smoked, the compulsion to smoke, and the dependence on the substance.

In scoring the Fagerström Test for Nicotine Dependence, yes/no questions are scored from 0 to 1 and multiple-choice questions are scored from 0 to 3. The scores for all the answers are summed up to yield a total score of 0-10. The higher the total Fagerström score, the more intense is the patient's physical dependence on nicotine. (Heatherton et al. 1991)

An individual who wants to quit smoking is advised to focus on the benefits of quitting rather than on the harms of smoking. Family members play a significant role in helping smokers to quit smoking. Therefore, they are given a thorough explanation of the benefits of smoking cessation and the positive effects of the same on the quality of life and metabolic regulation of the patient. Thereafter, regular check-ups are scheduled, starting one week after the day of smoking cessation and then reprogramed depending on the efforts put in by the patient and the corresponding results. E-cigarettes are sometimes recommended for patients going through smoking cessation. Although e-cigarette is argued to help in quitting smoking, it has not been proven to be the most appropriate solution to quit smoking. Also, the safety and effectiveness of e-cigarettes are still under discussion and controversy,

Healthcare providers should encourage smoking cessation patients to improve their physical activity. Exercise helps to reduce the intensity of the withdrawal syndrome and helps in maintaining body weight, which in combination with proper nutrition, can help increase self-confidence and reduce depression and stress. Physical exercise can be started with 30 minutes of moderate physical activity and be continued with relatively intense exercise for three days per week by patients with DM type 2 and daily by patients with DM type 1.

Smoking cessation can be done in special smoking cessation clinics that exist in several public hospitals. Patients follow nicotine replacement therapy using stickers, chewing gum and chewable pills or inhalers, which help in the treatment of withdrawal symptoms. Smoking cessation affects the metabolic profile, improves insulin sensitivity, and causes hypertension, fat metabolism, impaired glucose tolerance and central obesity. Individuals with DM who quit smoking have better control of their blood sugar levels (Campagna et al. 2019). Within 8 weeks of stopping smoking, they can record a reduction in insulin resistance. Quitting smoking, shows clear benefits in terms of reduction or slowing of the risk for cardiovascular morbidity and mortality in people with diabetes as it does for the general population (Jha et al.2013; Pirie et al. 2013)

Literature stresses the evidence that smoking cessation decreases the risk of diabetes, perhaps by reducing systemic inflammation, which is a well-established risk factor for incident diabetes. On the other hand, smoking cessation can cause substantial weight gain, which could again increase the risk of diabetes (Yeh et al. 2010).

Conclusion

Healthcare providers have a duty to alert individuals with diabetes about the burden of risks caused by smoking. The message must be strong and personalized. Smoking and diabetes have both a dangerous liaison and confusing relationship. Further research is required to collect more evidence to clarify this relationship. Until then, healthcare providers should encourage individuals with DM to quit smoking. Encouraging all smokers to quit may also help in reducing the number of DM cases overall.

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