The effect of medication and lifestyle factors on global burden of disease and mortality in chronic diseases in OECD countries: the case of type 2 diabetes mellitus

OECD ülkelerinde kronik hastalıklarda ilaç kullanımı ve yaşam tarzı faktörlerinin küresel hastalık yüküne ve ölümlere etkisi: tip 2 diyabet örneği

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ABSTRACT

Objective: Chronic diseases refer to long-lasting health problems that are generally difficult to treat. The most common chronic diseases include diabetes, heart disease, hypertension, chronic respiratory diseases, and cancer. These diseases are typically associated with lifestyle factors such as genetic predisposition, poor nutrition, insufficient physical activity, excessive smoking, and alcohol consumption. In addition to physical discomfort, chronic diseases also have psychological and social impacts on individuals. The treatment process usually requires long-term management and patient adherence. Therefore, regular medical check-ups, healthy lifestyle habits, and proper medication dosage are crucial. The prevalence of chronic diseases is increasing in OECD (Organisation for Economic Co-Operation and Development- Ekonomik İşbirliği ve Kalkınma Örgütü) countries, and the impact of drug use and lifestyle factors on the global burden of disease and mortality is becoming increasingly important. Type 2 diabetes is an important example in this context. This study aims to examine the impact of medication use and

ÖZET

Amaç: Kronik hastalıklar, genellikle uzun süre devam eden ve tedavi edilmesi zor olan sağlık sorunlarını ifade etmektedir. En yaygın kronik hastalıklar arasında diyabet, kalp hastalıkları, hipertansiyon, kronik solunum yolu hastalıkları ve kanser yer almaktadır. Bu hastalıklar, genel olarak genetik yatkınlık, kötü beslenme, yetersiz fiziksel aktivite, aşırı sigara ve alkol tüketimi vb. yaşam tarzı faktörleriyle ilişkilidir. Kronik hastalıklar, bireylerde fiziksel rahatsızlıkların yanı sıra, psikolojik ve sosyal etkiler de meydana getirmektedir. Tedavi süreci genellikle uzun süreli yönetim ve hasta uyumunu gerektirmektedir. Bu nedenle düzenli hekim kontrolleri, sağlıklı yaşam alışkanlıkları ve uygun dozda ilaç kullanımı önemlidir. OECD (Organisation for Economic Co-Operation and Development- Ekonomik İşbirliği ve Kalkınma Örgütü) ülkelerinde kronik hastalıkların yaygınlığı artmakta ve ilaç kullanımı ile yaşam tarzı faktörlerinin küresel hastalık yükü ve ölümler üzerindeki etkisi giderek daha önemli hale gelmektedir. Tip 2 diyabet bu bağlamda önemli bir örnektir. Bu çalışma, tip 2 diyabet yönetiminde ilaç kullanımı ve yaşam tarzı

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lifestyle factors in the management of type 2 diabetes mellitus on the global burden of disease and mortality.

Methods: The study population includes all OECD countries. Medications used in type 2 diabetes mellitus, alcohol consumption, tobacco consumption, obesity, physical inactivity were used as independent variables; type 2 diabetes-related mortality, type 2 diabetes DALYs (Disability-adjusted life years) were used as dependent variables.

Results: Regression analysis showed that lifestyle factors (lnAlc, lnTob, lnObes, lnPInact) and medication use (lnDrug) effected both lnDALY and lnDMort (p<0.05).

Conclusion: The effective use of medication and lifestyle changes in the management of type 2 diabetes is an important step in controlling the disease. Therefore, in addition to the use of medication, healthy lifestyle habits should be promoted to prevent and control chronic diseases. These measures can contribute both to improving the health of individuals and to the sustainability of health systems.

Key Words: Type 2 diabetes, global burden of disease, diabetes-related mortality, medication, healthy lifestyle

faktörlerinin küresel hastalık yükü ve ölümler üzerindeki etkisini incelemeyi amaçlamaktadır.

Yöntem: Çalışmanın evrenini tüm OECD ülkeleri oluşturmaktadır. Tip 2 diyabette kullanılan ilaçlar, alkol tüketimi, tütün tüketimi, obezite, fiziksel inaktivite bağımsız değişkenler; tip 2 diyabetle ilişkili ölüm oranı, tip 2 diyabette DALYs (Engelliliğe göre ayarlanmış yaşam yılları) bağımlı değişkenler olarak kullanılmıştır.

Bulgular: Regresyon analizi yaşam tarzı faktörlerinin (lnAlc, lnTob, lnObes, lnPInact) ve ilaç kullanımının (lnDrug) hem lnDALY hem de lnDMort'u etkilediğini göstermiştir (p<0.05).

Sonuç: Tip 2 diyabet yönetiminde ilaçların etkin kullanımı ve yaşam tarzı değişiklikleri hastalığın kontrol altına alınmasında önemli bir adımdır. Bu nedenle, ilaç kullanımına ek olarak, kronik hastalıkları önlemek ve kontrol altına almak için sağlıklı yaşam tarzı alışkanlıkları teşvik edilmelidir. Bu önlemler hem bireylerin sağlığının iyileştirilmesine hem de sağlık sistemlerinin sürdürülebilirliğine katkıda bulunabilir.

Anahtar Kelimeler: Tip 2 diyabet, küresel hastalık yükü, diyabete bağlı ölümler, ilaç tedavisi, sağlıklı yaşam tarzı

INTRODUCTION

Chronic diseases, also known as non-communicable diseases, are defined by the WHO (World Health Organisation) as the result of a combination of genetic, physiological, environmental and lifestyle (behavioural) factors that tend to be long-term (1). Chronic diseases are long-term conditions that can usually be controlled but not cured. People living with chronic diseases often have to cope with daily symptoms that affect their quality of life, and experience acute health problems and complications that can shorten their life expectancy (2).

In 1990, more than 28 million (57 per cent) of all deaths worldwide were due to chronic diseases (3), whereas today more than 40 million (74 per cent) of all deaths worldwide are due to chronic diseases (1). Furthermore, the number of disability-adjusted life years (DALYs) from chronic diseases increased by 36.6 percent between 1990 and 2016(4).

Type 2 diabetes mellitus is one of the leading chronic diseases, along with cardiovascular disease, cancer and respiratory disease, which account for a significant proportion of deaths and disease burden across the world (1). This chronic disease is particularly associated with a high burden of

disability, causing cardiovascular disease, blindness, kidney failure and lower limb amputation. Type 2 diabetes occurs when the body is unable to control excessive levels of glucose in the blood. In 2021, 6.9% of the adult population in the Organisation for Economic Co-operation and Development (OECD) countries will be living with type 2 diabetes. In addition, it is estimated that 48 million adults have undiagnosed type 2 diabete (5).

A review of the literature shows that the incidence of cancer, cardiovascular disease, chronic respiratory disease and diabetes share similar modifiable (lifestyle) risk factors such as alcohol consumption, body mass index (BMI), smoking, unhealthy diet and physical inactivity (6). An important way to control chronic diseases such as type 2 diabetes is to focus on reducing the risk factors associated with these diseases. Low-cost solutions to reduce common lifestyle risk factors are available to governments and other stakeholders. Monitoring progress and trends in non-communicable diseases and their risks is important to guide policies and priorities (1).

Medication is another way to prevent the devastating effects of type 2 diabetes. In particular, the use of medications that lower blood glucose and blood pressure facilitates the treatment of the disease (7).

In this context, this study aims to examine the impact of medication use and lifestyle factors on the global burden of disease and mortality in the management of type 2 diabetes. Understanding this issue is important for both health professionals and societies, as reducing and controlling the impact of type 2 diabetes is important for the sustainability of health systems.

MATERIAL and METHOD

The aim of this study is to examine the impact of medication use and lifestyle factors on the global burden of disease and mortality in the management of type 2 diabetes.

The variables used in the study were selected from the literature (1,5,7). Information on the relevant variables is presented in Table 1.

Table 1. Variables

Variables		Abbrev.	Expl.	Data From[1]
Independents	Drugs used in Type 2 Diabetes	lnDrug	Daily dosage per 1000 population (mg)	OECD
	Alcohol consumption	lnAlc	15 age and above population alcohol consumption (Liter)	OECD
	Tobacco consumption	lnTob	Tobacco consumption 15 age and above population who daily smokers (%)	WHO
	Obesity	lnObes	Obese population (%)	WB
	Physical inactivity	lnPInact	Insufficient physical activity population (Crude %)	WHO
Dependents	Type 2 diabetes-related mortality	lnDMort	Mortality rate per 100 000 (Rate)	OECD
	Type 2 diabetes disability-adjusted life years (DALYs)	lnDALY	Disability-adjusted life years per 100 000 population (Rate)	IHME

[1] OECD=Organisation for Economic Co-Operation and Development;
WHO= World Health Organization; WB= World Bank; IHME= Institute for Health Metrics and Evaluation

The population of the study consists of all OECD countries. The data covers the years 2010-2015. It is planned to reach the whole population by not selecting a sample. However, Colombia, Costa Rica, Finland, Ireland, Japan, Mexico, Japan, Mexico, Poland, Switzerland and the United States of America, which had missing data on variables and years, were not included in the study. Data were obtained from Organisation for Economic Co-operation and Development (OECD), World Health Organization (WHO), World Bank (WB) and The Institute For Health Metrics And Evaluation (IHME) databases.

Before analysing the data, a logarithmic transformation was applied to the data. This ensured the normality of the data. The Augmented Dickey Fuller (ADF) unit root test was then used to test whether the time series data were stationary. As all variables were found to be stationary at the 95% confidence level (t=-7.425; p<0.05), the analysis continued without removing the variable. Finally, the Hausman test was performed to select the effect model and the random effect model was selected (X^2=46.589; p>0.05). The data were analysed in two steps. First, the effect of the independent variables

(lnDrug, lnAlc, lnTob, lnObes, lnPInact) on the global burden of disease (lnDALY) for type 2 diabetes was analysed. In the second step, the effect of the same independent variables on deaths due to type 2 diabetes (lnMort) was analysed. Based on the results obtained, the effects of the independent variables on deaths and burden of disease were evaluated separately. EViews 9.0 software was used to analyse the data.

RESULTS

Descriptive statistics of the variables used in the study are presented in Table 2. Accordingly, the mean values of the variables ranged between 0.03±0.01 and 82.09±4.42.

The correlations between the variables are presented in Table 3. According to Table 3, the lowest correlation was found between lnDrug and lnObes with 0.02, while the highest correlation was found between lnMort and lnDALY with 0.71. Considering the coefficients, it is determined that there is no multicollinearity problem between the variables.

Table 2. Descriptive Statistics

	LnAlc	lnTob	lnObes	lnPInact	lnDrug	lnDALY	lnMort
Mean	9.49	28.03	57.16	82.09	61.52	0.03	21.15
Std. Dev.	2.79	6.83	6.19	4.42	14.65	0.01	10.62
Obs.	174	174	174	174	174	174	174

Table 3. Correlations Coefficients and Probablities

	lnAlc	lnTob	lnObes	lnPInact	lnDrug	lnDALY	lnMort
lnAlc	1.00						
lnTob	0.17*	1.00					
lnObes	0.22*	0.07	1.00				
lnPInact	0.13	0.03	0.09*	1.00			
lnDrug	0.18*	0.08	0.02	-0.11	1.00		
lnDALY	0.30*	0.04*	0.07*	0.17*	-0.22*	1.00	
lnMort	0.43*	0.10*	0.02*	0.23*	-0.22*	0.71*	1.00

*p<0.05

Table 4 presents the results of the first stage regression analysis. According to Table 4, the model was found to be significant (p<0.05). lnDrug, lnAlc, lnTob, lnObes and lnPInact variables were all found to significantly affect lnDALY. The explanatory rate of the variables in the model was 22%.

Table 5 presents the results of the second stage regression analysis. According to Table 4, the model was found to be significant (p<0.05). lnDrug, lnAlc, logTob, lnObes and lnPInact variables were all found to significantly affect lnMort. The explanatory rate of the variables in the model was 27%.

When Table 4 is analysed, it is seen that lnDrug has the least contribution to lnDALY and lnObes has the most contribution. When Table 5 is analysed, the least contribution to lnMort is made by lnDrug and the most contribution is made by lnAlc. From this point of view, it can be said that drug use may be less effective compared to other risk factors.

According to the results of Breusch-Pagan-Godfrey test and LM test, it is determined that there is no horizontal cross-section dependence between countries according to both regression models. In this sense, it can be said that the data of the countries that are not included in the study due to missing data will not have any effect on the significance of the models.

Table 4. Regression Analysis Results (First Stage)

Variables	Coefficients	Std. Error	VIF	Prob.
lnAlc	0.015	0.002	2.121	0.001
lnTob	0.021	8.105	1.192	0.032
lnObes	0.312	9.063	1.987	0.007
lnPInact	0.003	0.001	2.012	0.010
lnDrug	-0.001	3.792	3.102	0.001
c	0.013	0.123	2.452	0.023

R^2=0.220; F=10.807; p<0.001; Durbin-Watson=2.250; Breusch-Pagan-Godfrey:0,211;
Breusch-Godfrey Serial Correlation LM test: 0,061; Spesification Test of Hsiao:1,5E148(1,5.10^{-148})

Table 5. Regression Analysis Results (Second Stage)

Variables	Coefficients	Std. Error	VIF	Prob.
lnAlc	0.250	0.263	1.542	0.001
lnTob	0.326	0.103	1.654	0.002
lnObes	1.714	0.115	2.100	0.031
lnPInact	0.434	0.158	2.521	0.006
lnDrug	-0.097	0.048	3.412	0.044
c	12.878	15.314	1.985	0.040

R^2=0.271; F=13.901; p<0.001; Durbin-Watson=2.246; Breusch-Pagan-Godfrey:0,300;
Breusch-Godfrey Serial Correlation LM test: 0,101; Spesification Test of Hsiao:2,2E234(2,2.10^{-234}).

DISCUSSION

This study analysed the impact of medication use and lifestyle factors on the global burden of disease and mortality in the management of type 2 diabetes. As a result of the analysis, it was found that lifestyle factors (lnAlc, lnTob, lnObes, lnPInact) and medication use (lnDrug) both influence lnDALY. It was found that the burden of type 2 diabetes increased as alcohol consumption, smoking, obesity and physical inactivity increased, and that the burden of type 2 diabetes decreased as drug use increased.

Lifestyle or behavioural risk factors play an important role in the development and progression of several health problems, including type 2 diabetes. Type 2 diabetes is a chronic metabolic disorder characterised by high blood glucose levels and can lead to a number of complications that can increase the burden of disease and cause mortality from the disease.

A review of the literature found studies with similar results. In a study by Knott et al (8), it was found that excessive alcohol consumption can lead to both type 2 diabetes and diabetes-related complications. Alcohol can affect blood glucose levels and contribute to poor glycaemic control. Another study by Wannamethee et al (9) found an indirect link between alcohol consumption and the development of type 2 diabetes. In another study by Carlsson et al (10), excessive alcohol consumption was found to cause the development of type 2 diabetes. A study by Baliunas et al (11) also found that excessive alcohol consumption increased type 2 diabetes. Excessive alcohol consumption may increase the development of type 2 diabetes by affecting blood glucose levels and causing poor glycaemic control (12).

Smoking is a behavioural risk factor associated with a high risk of type 2 diabetes. Nicotine and other chemicals in tobacco smoke can impair insulin function and lead to diabetes by increasing insulin resistance (13). A study by Willi et al (14) found that type 2 diabetes and its complications, such as cardiovascular disease, worsen with increasing

smoking. Another study by Maddatu et al (15) found a significant association between smoking and increased type 2 diabetes. Another study by Yeh et al (16) found a significant association between smoking and type 2 diabetes. A study by Chang (17) revealed that smoking increases the risk of developing type 2 diabetes and aggravates micro- and macrovascular complications of diabetes. In another study by the InterAct Consortium et al (18), past and current smoking was associated with a higher risk of type 2 diabetes in men and women compared to never smokers. Smoking has been shown to contribute to insulin resistance. Smoking is known to cause inflammation in the body. Chronic inflammation can affect the body's ability to use insulin properly. Smoking can have several metabolic effects that can lead to an increased risk of type 2 diabetes. For example, smoking is associated with adverse changes in lipid profiles (high triglycerides and low HDL cholesterol), which are also risk factors for diabetes (19-20).

Obesity is a well-recognised risk factor for the development of type 2 diabetes and has a significant impact on the Disability Adjusted Life Years (DALYs) associated with this chronic disease. Obesity, particularly central or abdominal obesity, is closely associated with insulin resistance. Excess adipose tissue, especially visceral fat, can lead to the release of inflammatory substances that interfere with the body's ability to use insulin effectively. As a result, the pancreas may need to produce more insulin to regulate blood glucose levels. Persistently high insulin levels can eventually lead to insulin resistance, the hallmark of type 2 diabetes (21). A study by Lemieux (22) found that obesity is associated with adverse changes in lipid profiles, including high levels of triglycerides and high-density lipoprotein (HDL) cholesterol. These lipid abnormalities are commonly seen in people with insulin resistance and have been shown to increase the risk of cardiovascular complications associated with type 2 diabetes. Another study by Mokdad et al (23) found that the increase in the prevalence of obesity was

positively associated with the development of type 2 diabetes. A study by Eckel et al (24) found that being overweight increases the risk of developing type 2 diabetes, although it is not enough on its own. Type 2 diabetes often leads to various complications such as diabetic retinopathy, neuropathy, nephropathy and cardiovascular disease. Obesity increases the severity and progression of these complications. Individuals with obesity and diabetes tend to experience greater disability and poorer quality of life, leading them to live with disability for longer years (25).

Physical inactivity or insufficient physical activity can lead to obesity and insulin resistance, which can lead to the development of type 2 diabetes. A study by Booth et al (26) found that there is a direct link between physical inactivity and an increased risk of diabetes and its complications. Another study by Duclos et al (27) found that regular physical activity is one of the most effective ways to protect against type 2 diabetes. Another study by Gill and Cooper (28) found that high levels of physical activity were associated with a 20-30% reduction in the risk of diabetes. Research suggests that diabetes prevention can be achieved through a range of moderate to vigorous intensity activities, and regular light intensity activity may also be sufficient. A study by Kanaley et al (29) found that different types of physical activity that improve health and glycaemic control in people with type 2 diabetes, including flexibility and balance exercises, have a direct impact on reducing the burden of disease. Moderate-intensity physical activity, such as walking and gardening, appears to be the most common form of activity among adults and can be easily adopted to reduce the risk of type 2 diabetes. Controlling blood glucose levels: Regular physical activity helps muscles use more glucose, which can lower blood glucose levels. This can reduce the risk of type 2 diabetes. Adequate physical activity improves insulin sensitivity, weight control, cardiovascular health, stress and insulin resistance. At the same time, exercise leads to cardiovascular and muscular adaptation (increase in skeletal muscle oxidative capacity, capillarisation and muscle blood flow). This slows the development of type 2 diabetes (30-32).

The impact of medication use on Disability Adjusted Life Years (DALYs) due to type 2 diabetes is an important issue. Medications play an important role in the management and control of this chronic disease. There are several classes of drugs that are commonly used to treat type 2 diabetes. These medicines work through different mechanisms to help regulate blood glucose levels, increase insulin sensitivity and reduce the risk of complications. Drug selection and effectiveness can vary from person to person, depending on factors such as disease severity, comorbidities and individual response (33). A study by Chehade and Mooradian (34) found that the use of medication together with behavioural risk factors slowed the development of type 2 diabetes more quickly. In a study conducted by Tehrani et al (35), the use of glucose-lowering medications was found to be effective in the management of type 2 diabetes. Another study by Krentz et al (36) concluded that the use of antidiabetic drugs, which are used to reduce insulin resistance and lower blood glucose levels, indirectly reduces the development of type 2 diabetes. Medications prescribed for type 2 diabetes are primarily aimed at improving glycaemic control. Proper glycaemic control is effective in reducing the risk of diabetes-related complications such as cardiovascular disease, neuropathy, retinopathy and nephropathy (37). Medications can play an important role in preventing or delaying the onset of diabetes-related complications, especially if started early and used consistently (38). Well-managed diabetes can increase life expectancy by reducing the risk of premature death associated with uncontrolled diabetes and its complications. Some medications have been shown to have a beneficial effect on overall survival (25). This contributes to the reduction in years of life lost.

This study also found that lifestyle factors (lnAlc, lnTob, lnObes, lnPInact) and medication use (lnDrug) significantly influence type 2 diabetes mortality

(lnMort). It was found that as alcohol consumption, smoking, obesity and physical inactivity increase, type 2 diabetes mortality increases, and as drug use increases, type 2 diabetes mortality decreases.

Although some evidence suggests that moderate alcohol consumption may have potential cardiovascular benefits, including reducing the risk of heart disease and stroke (39-41), this does not apply to people with type 2 diabetes who are at high risk of complications (42). A study by Diem et al (43) found that excessive alcohol consumption makes people more susceptible to death from many diseases, including type 2 diabetes. Other studies by Koppes et al (44) and Blomster et al (45) also found that excessive alcohol consumption causes more deaths from type 2 diabetes compared to those who drink no alcohol and those who drink small amounts. Alcohol can affect blood glucose levels. In some cases, especially if consumed on an empty stomach, it can cause hypoglycaemia (low blood sugar) in people with diabetes. Hypoglycaemia can be life-threatening and, in severe cases, fatal (46). To avoid this risk, it is important to manage alcohol consumption appropriately. In addition, chronic alcohol use can lead to liver damage, including fatty liver disease and alcoholic liver disease. People with type 2 diabetes already have an increased risk of non-alcoholic fatty liver disease. The combination of diabetes and excessive alcohol consumption can worsen liver complications and lead to an increased risk of death (47).

People with type 2 diabetes have a higher risk of premature death than people without diabetes. A study by Gregg et al (48) found that smoking significantly increased this risk. Another study found that diabetic smokers were more likely to die from cardiovascular disease, infections and other smoking-related conditions than non-smokers (49). Another study by Fagard and Nilsson (50) found that smoking is an important risk factor for chronic diseases and increases mortality in patients with type 2 diabetes. A study by Qin et al (51) found that smoking causes deaths from both diabetes and cardiovascular disease.

The impact of tobacco use on type 2 diabetes-related mortality is a critical public health issue. Smoking and the use of tobacco products are associated with several adverse health effects, including an increased risk of type 2 diabetes and its complications (49).

Obesity has a significant impact on mortality from type 2 diabetes. Obesity is an independent risk factor for mortality in people with type 2 diabetes. The combination of obesity and diabetes significantly increases the risk of premature death. A study by Hu et al (52) found that obese people with diabetes had a higher risk of all-cause death and death from cardiovascular events than non-obese people with diabetes. Obesity increases the already increased risk of death associated with diabetes (53). Another study by Frydrych et al (54) found that individuals with obesity and type 2 diabetes are physiologically frail and have a higher risk of death from infection and sepsis. In a study conducted by Zoppini et al (55) obesity was found to cause a significant increase in deaths due to type 2 diabetes, particularly in individuals under the age of 65. Obesity is strongly associated with an increased risk of complications in people with type 2 diabetes. These complications, including cardiovascular disease, neuropathy, retinopathy and nephropathy, contribute significantly to mortality in people with diabetes. Obesity exacerbates insulin resistance, leading to impaired glycaemic control, which increases the risk of these complications (22). Cardiovascular disease is a leading cause of death in people with diabetes, and obesity is an important determinant of cardiovascular risk.

The impact of physical inactivity on deaths from type 2 diabetes is another important aspect of public health and diabetes management. There is an association between physical inactivity and high mortality from type 2 diabetes. A study by Gregg et al (48) found that a sedentary lifestyle is associated with an increased risk of death from all causes and death from cardiovascular events. Physical inactivity increases the already high risk of death associated with diabetes. In another study by Wei et al (56),

the risk of death was found to be 1.7 times higher in adults who reported being physically inactive than in those who reported being physically active. A study by Bakrania et al (57) found that regular physical activity is an effective way to protect against cardiovascular disease, thereby reducing the risk of death from type 2 diabetes. A study by Fogelholm (58) found that good levels of physical activity reduced deaths from type 2 diabetes and cardiovascular disease. Physical activity plays an important role in improving insulin sensitivity. Regular physical activity helps the body use insulin more effectively. Insufficient physical activity worsens insulin resistance and leads to poor blood glucose control. High blood glucose levels are associated with an increased risk of diabetes-related complications and death (59). Regular physical activity is also important for weight management. Obesity is a major risk factor for type 2 diabetes and its complications. Physical inactivity can lead to weight gain or interfere with weight loss efforts. Obesity is associated with a higher risk of death, particularly from cardiovascular disease, in people with diabetes (60). Physical activity helps to prevent or delay diabetes-related complications such as retinopathy, neuropathy and nephropathy. These complications can have a significant impact on mortality. Inadequate physical activity can increase the risk of complications and reduce life expectancy (59).

The use of diabetes medications in the treatment and management of type 2 diabetes can have a significant impact on mortality. Well-managed diabetes can increase life expectancy by reducing the risk of premature death associated with uncontrolled diabetes and its complications. A study by Zheng et al (25) showed that some antidiabetic drugs have a beneficial effect on overall survival. This contributes to the reduction in years of life lost. Another study by Tzoulaki et al (61) found that a group of drugs used to treat type 2 diabetes significantly reduced deaths from the disease. Another study by Brown et al (62) found that the use of insulin and glucose-lowering drugs reduced deaths from type 2 diabetes.

A study by Rahelić et al (63) found that the use of an antidiabetic drug also reduced deaths from type 2 diabetes. Antidiabetic drugs are prescribed to improve blood sugar control in people with type 2 diabetes. Proper glycaemic control is essential to reduce the risk of diabetes-related complications such as cardiovascular disease, neuropathy, retinopathy and nephropathy (37). Effective glycaemic control through antidiabetic drug therapy can help delay or prevent these complications, reducing years lived with disability and risk of death.

Drug use and obesity both effect DALYs and mortality from type 2 diabetes, but obesity has a stronger impact. Medications (drug use) can help manage blood glucose and reduce complications like cardiovascular disease and neuropathy, thus lowering DALYs and mortality. However, inadequate use of these medications can worsen health outcomes by leaving blood glucose uncontrolled. Obesity, on the other hand, plays a major role in worsening diabetes by increasing insulin resistance, leading to higher blood sugar and a greater risk of severe complications. Excess body fat also promotes inflammation and metabolic stress, which compound health issues in diabetes, thereby driving up both DALYs and mortality. Managing obesity through lifestyle changes and interventions is therefore essential for improving outcomes in type 2 diabetes.

This study is limited to OECD countries only. The results should be evaluated according to the independent and dependent variables used in this study. It may be possible to reach different results with different variables. Many other factors that may affect mortality such as age, sex, treatment, time of diagnosis, etc. were not included in the evaluation. This study was conducted based on data covering the years 2010-2015. Taking these limitations into account in new future studies may increase the scope of the studies and the generalizability of the results.

In conclusion; lifestyle factors and medication use have a significant impact on diabetes-related DALYs and deaths. Obesity, physical inactivity, tobacco use,

alcohol consumption and non-use of antidiabetic medications can lead to the development and progression of diabetes and its complications. Addressing these risk factors through public health measures and individual lifestyle changes, as well as the use of proven medications, is essential to reduce the burden of DALYs and deaths from diabetes and to improve the overall health of the population.

In addition, type 2 diabetes is a heterogeneous disease with multiple underlying pathophysiological processes. Treatment should be individualised according to the degree of hyperglycaemia, hyperinsulinaemia or insulin deficiency. In addition, several factors such as efficacy, safety, affordability and ease of administration should be considered when prescribing a particular therapeutic agent.

Implications for healthcare managers

Healthcare managers play a crucial role in managing type 2 diabetes and reducing the disability adjusted life years (DALYs) and mortality associated with the disease. Some suggestions for healthcare managers are listed below:

• Establish and support multidisciplinary care teams that include endocrinologists, primary care physicians, dietitians, nurses and pharmacists to provide comprehensive care for people with type 2 diabetes.

• Implement patient education programmes that focus on the importance of lifestyle factors, including diet, exercise and stress management. Encourage self-monitoring of blood glucose levels and compliance with medication.

• Develop and promote lifestyle modification programmes that provide guidance on diet, physical activity and weight management. These programmes should be tailored to individual patient needs and preferences.

• Work with community organisations to promote physical activity. Support initiatives that make it easier for individuals to exercise regularly, such as walking groups or fitness classes.

• Provide dietary advice that emphasises balanced, nutritious meals. Increase consumption of fruits, vegetables and whole grains, while encouraging patients to reduce their intake of sugary and processed foods.

• Ensure that healthcare providers have access to the most up-to-date information on antidiabetic medications and their effectiveness in the management of type 2 diabetes. Promote evidence-based prescribing and monitor patient response to medication.

• Implement a system for regular monitoring of patient progress. This includes monitoring blood glucose levels, weight, blood pressure and other relevant health markers. Adjust treatment plans as needed based on monitoring results.

• Explore the use of telemedicine and remote monitoring tools to provide ongoing care and support to patients, especially those who face barriers to face-to-face visits.

• Recognise the impact of mental health on diabetes management. Integrate mental health services and provide resources for patients dealing with stress, anxiety and depression.

• Promote regular health checks and screenings to identify people at risk of developing type 2 diabetes. Implement preventive measures for high-risk populations.

• Continuously monitor and evaluate the quality of diabetes care. Implement quality improvement initiatives to improve patient outcomes and reduce complications.

• Emphasise a patient-centred approach by involving patients in their own care plans and treatment decisions. Understand cultural, social and economic factors that may affect patients' ability to manage their condition effectively.

• Use data analysis tools to monitor outcomes, identify trends and make data-driven decisions to improve care and reduce DALYs and mortality.

• Work with government agencies, public health organisations and community partners to create a supportive environment for diabetes management, including access to healthy food and safe spaces for physical activity.

ETHICS COMMITTEE APPROVAL

* This study does not require Ethics Committee Approval.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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