CZERSKA, Magdalena Agata, WÓJCIK, Zofia Martyna, KAMIŃSKA-OMASTA, Katarzyna, OMASTA, Bartosz, KRUPA, Olga, PIETRUKANIEC, Paulina Dorota, ROMAŃCZUK, Kuba Borys, FURTAK, Kinga, STOLARCZYK, Szymon Przemysław and RYBAK, Daria. Effective Treatment Strategies for Adults with Type 2 Diabetes. Quality in Sport. 2025;38:58246. eISSN 2450-3118.
https://doi.org/10.12775/QS.2025.38.58246
https://apcz.umk.pl/QS/article/view/58246

The journal has been 20 points in the Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.
Has a Journal's Unique Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.
Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 26.01.2025. Revised: 12.02.2025. Accepted: 14.02.2025 Published: 14.02.2025.

Effective Treatment Strategies for Adults with Type 2 Diabetes

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Abstract
Introduction
Type 2 diabetes is a chronic metabolic disorder marked by insulin resistance and insufficient insulin production. It affects millions globally, with 537 million adults diagnosed in 2021, a prevalence that has doubled from 7% in 1990 to 14% in 2022. This rise imposes a significant burden on individuals, healthcare systems, and economies.

Aim of the Study
This study aims to provide an overview of therapeutic management for type 2 diabetes, focusing on pharmacological treatments and their integration with lifestyle changes, such as diet and exercise, to improve outcomes and reduce complications.

Materials and Methods
The study reviews literature and clinical guidelines on managing type 2 diabetes, emphasizing pharmacological treatments like insulin, oral hypoglycemic agents, and newer therapies. It also examines the role of diet and physical activity in controlling blood glucose and preventing complications. Data sources include peer-reviewed articles and health organization publications from the past ten years, targeting adults aged 18 and older.

Summary
Type 2 diabetes remains a global health challenge with rising prevalence. Effective management requires a combined approach of pharmacological therapies and lifestyle modifications, underscoring the importance of early intervention to reduce complications and improve outcomes.

Keywords: Diabetes type 2, adults, Insulin resistance, Pharmacological treatments, Lifestyle modifications ,Diabetes management, Physical activity. Global health challenge, Diabetes prevalence

Introduction

Type 2 diabetes has become one of the most important health problems worldwide, affecting millions of people and affecting healthcare systems in many countries. In recent decades, there has been a dramatic increase in the number of cases, which is largely due to lifestyle changes such as poor diet, lack of physical activity and the growing number of people with obesity.

Type 2 diabetes not only affects individual health, but also generates huge social and economic costs, burdening healthcare systems and reducing work productivity.

Global data indicate that the number of people with type 2 diabetes is increasing at an alarming rate, especially in developing countries, where economic changes and urbanization contribute to unhealthy eating habits.

In 2021, it was estimated that there were about 537 million people living with diabetes worldwide, and this number is expected to continue to grow. In the face of this health crisis, it is crucial to take action on prevention, education and access to appropriate medical care to effectively manage and limit the effects of this disease.
The main objective of this article is to understand the appropriate course of treatment for type 2 diabetes in adults at different stages of the disease and at different times of diagnosis.

Epidemiology
The epidemiology of type 2 diabetes among adults worldwide, according to the World Health Organization (WHO), indicates a growing health problem that affects millions of people. Here are some key facts:
The number of people with type 2 diabetes has increased significantly in recent decades. In 2021, an estimated 537 million adults (aged 20–79 years) worldwide were estimated to have diabetes, and this number is expected to increase to 783 million by 2045. [1]
Type 2 diabetes occurs in various regions of the world, with the highest rates in high-income countries, as well as in some low- and middle-income countries, where lifestyle changes are contributing to the increase in cases.
Obesity is one of the major risk factors for type 2 diabetes. Changes in diet, physical inactivity, and urbanization contribute to rising obesity rates.
The risk of developing type 2 diabetes increases with age, especially in people over 45 years of age. A family history of diabetes also increases the risk of developing the disease. [2]
Type 2 diabetes can lead to many complications, such as cardiovascular disease, kidney failure, neuropathy, and vision problems.
Treatment of diabetes and its complications is associated with high costs for healthcare systems. WHO and other health organizations conduct programs aimed at educating the public about a healthy lifestyle, including a healthy diet and physical activity. Early diagnosis of diabetes and lifestyle interventions can significantly reduce its incidence and complications.
Type 2 diabetes is a serious health challenge in the world, which requires appropriate actions at both the individual and system levels. Lifestyle changes, education, and early detection of the disease are key to combating this disease. [3]

Diagnosing Type 2 Diabetes
Type 2 diabetes (T2D) is a chronic metabolic disease characterized by insulin resistance and relative insulin deficiency. Diagnosing T2D is crucial for early interventions that can prevent complications and improve the quality of life of patients.
According to the American Diabetes Association (ADA) and the European Diabetes Expert Group, the diagnosis of T2D is based on several key criteria:
Fasting glucose (FPG): Glucose level ≥ 126 mg/dL (7.0 mmol/L) after at least 8 hours of fasting. Postprandial glucose (OGTT): Glucose level ≥ 200 mg/dL (11.1 mmol/L) after 2 hours of a 75 g glucose load. HbA1c: Glycosylated hemoglobin level ≥ 6.5% (48 mmol/mol).
In the event of characteristic symptoms (such as polydipsia, polyuria, sudden weight loss) and glucose level ≥ 200 mg/dl (11.1 mmol/l) at any time. [4]
Laboratory tests including blood tests to determine glucose and HbA1c levels. Screening is recommended in risk groups such as people with obesity, hypertension, dyslipidemia and a family history of diabetes. Screening is recommended in adults over 45 years of age and in younger people with additional risk factors. Regular monitoring of glucose and HbA1c levels to assess the effectiveness of treatment and the risk of complications. [5]
Early diagnosis of type 2 diabetes is crucial for effective disease management and prevention of complications. Educational campaigns on a healthy lifestyle and regular screening should

be conducted in risk groups. Collaboration with primary care physicians and endocrinologists is essential for early detection and treatment of this disease. [6], [7]

Risk factors for type 2 diabetes in adults

Risk factors for type 2 diabetes in adults include a range of lifestyle, genetic and health issues. One key factor is obesity, particularly the accumulation of fat around the belly. People who lead a sedentary lifestyle are also at increased risk of developing the condition, as a lack of regular physical activity affects metabolism and can lead to insulin resistance.[8]

Age is another important factor; the risk of type 2 diabetes increases after the age of 45. Genetics also plays a significant role – if you have a family history of diabetes, other family members are more likely to develop the disease. Unhealthy eating habits, such as eating a lot of processed foods, sugars and saturated fats, contribute to the development of insulin resistance.[9]

In addition, people with high blood pressure or high cholesterol levels are also at increased risk of developing type 2 diabetes. Certain health conditions, such as polycystic ovary syndrome in women, can also increase the risk. It is also worth paying attention to stress and sleep problems, which can affect the body's hormonal and metabolic balance. [10]

Understanding these risk factors can help identify people who may need early intervention and support in preventing type 2 diabetes.

Complications of Type 2 Diabetes in Adults

Type 2 diabetes is a chronic metabolic disease that can lead to a number of complications that affect various body systems. As the disease progresses, too high blood glucose levels can damage blood vessels and nerves, leading to serious health problems. [11]

One of the most common complications of type 2 diabetes is neuropathy, or nerve damage. Symptoms include numbness, burning, and pain in the limbs. These changes can lead to loss of sensation, which increases the risk of injury and infection. [12]

Another serious complication is diabetic retinopathy, which affects the eyes. Changes in the blood vessels in the retina can lead to vision loss and, in extreme cases, blindness. Regular eye examinations are key to preventing these problems. [13]

Type 2 diabetes can also affect the cardiovascular system, increasing the risk of heart disease, stroke, and high blood pressure. People with diabetes are more likely to develop atherosclerosis, which narrows the blood vessels. [14]

Another aspect is complications related to the kidneys, known as diabetic nephropathy. Damage to the kidneys can lead to chronic kidney failure, which requires dialysis or a kidney transplant. Regular tests of kidney function are important for early detection and treatment of these changes. [15]

Diabetes also affects the skin, leading to problems such as infections, fungal infections, and ulcers. In people with diabetes, wound healing is much more difficult, which increases the risk of complications. [16]

Management of type 2 diabetes involves regular monitoring of glucose levels, eating a healthy diet, exercising, and taking medications. Regular health checks are also crucial to be able to respond quickly to any complications. Early intervention and appropriate therapy can significantly improve the quality of life of people with diabetes and prevent serious health consequences. [17]

Methods of treatment for type 2 diabetes in adults

Treatment of type 2 diabetes in adults is based on a multifaceted approach that includes lifestyle changes, pharmacotherapy and regular monitoring of health status. A key element of therapy is diet modification, which should be balanced, rich in fiber and low in simple

carbohydrates and saturated fats. Regular physical activity, recommended for at least 150 minutes per week, helps to improve insulin sensitivity and control body weight. [18]
If adequate glycemic control cannot be achieved through lifestyle changes alone, pharmacotherapy is introduced. The most commonly used drugs are metformin, which increases tissue sensitivity to insulin and reduces glucose production in the liver, and drugs from the SGLT2 and GLP-1 inhibitor groups, which help reduce body weight and cardiovascular risk. Insulin can also be used in some cases. [19]
Regular monitoring of blood glucose levels is important for assessing the effectiveness of treatment and adjusting therapy. In addition to glycemic control, it is also important to monitor other health parameters, such as blood pressure, lipid profile, and kidney function. Patient education plays a key role in the treatment of type 2 diabetes, as it allows for a better understanding of the disease and making informed decisions about health. Collaboration with a medical team, including a dietitian and a diabetes educator, is essential to achieve optimal therapeutic results. [20]

Diet and Effective Dietary Strategies Used in Type 2 Diabetes
Type 2 diabetes is a chronic metabolic disease characterized by insulin resistance and insufficient insulin production by the pancreas. Proper diet and dietary strategies play a key role in managing this disease, and their goal is to control blood glucose levels, reduce the risk of complications, and improve the patient's overall health. [9]
The basis of the diet in type 2 diabetes is choosing the right foods that affect the stabilization of blood sugar levels. People with diabetes should avoid products with a high glycemic index, which cause a rapid increase in glucose levels. It is worth reaching for complex carbohydrates, such as whole grains, vegetables, seeds, and nuts, which introduce glucose into the body gradually. It is also important to consume adequate amounts of fiber, which helps regulate sugar levels and supports the proper functioning of the digestive system. [21]
You should also pay attention to the amount and quality of fats in your diet. Unsaturated fats are preferred, and are found in olive oil, avocados, fish, and nuts. Limiting saturated fats, which are found in animal products, and trans fats, which are found in processed foods, is key to maintaining healthy cholesterol levels and reducing the risk of cardiovascular disease, which is a common complication of diabetes. [22]
Regularity in meals is another important element of dietary strategies. People with diabetes should eat meals at regular times, which helps stabilize blood glucose levels. It is also important to ensure that meals are balanced and contain the right proportions of carbohydrates, proteins, and fats. Consider introducing healthy snacks to help prevent sudden drops in blood sugar.
Portion control is also important. People with diabetes should be aware of the size of their meals to avoid excessive calorie intake. Keeping a food diary can be helpful in monitoring food intake and identifying any problems with glucose control. [23]
It is important to have regular medical check-ups and work with a dietician who will help you adjust your diet to your individual needs. A proper approach to nutrition and physical activity, combined with regular health monitoring, can significantly improve the quality of life of people with type 2 diabetes and help prevent complications. In this way, it is possible not only to effectively manage the disease, but also to lead an active and healthy life. [24]

Pharmacological strategies in adults with type 2 diabetes
Type 2 diabetes is a chronic metabolic disease characterized by insulin resistance and insufficient insulin production by the pancreas. Treatment of type 2 diabetes in adults focuses on controlling blood glucose levels and preventing complications related to the disease. Different pharmacological strategies are used in the treatment of type 2 diabetes, which can be

implemented alone or in combination with lifestyle modifications such as diet and physical activity.
The primary goal of pharmacotherapy is to achieve and maintain optimal blood glucose levels, which is crucial to minimize the risk of complications. Different classes of drugs that act on different mechanisms in the body are used in the treatment of type 2 diabetes. [25]
The first line of treatment is oral medications, such as metformin. Metformin works mainly by reducing glucose production in the liver and increasing cell sensitivity to insulin. It is the preferred drug due to its efficacy, safety profile, and beneficial effect on body weight. If metformin does not provide adequate glycemic control, other oral medications can be used. [26]
Another popular class of medications is the sulfonylureas, which stimulate the pancreas to secrete more insulin. Examples of sulfonylureas include glipizide and glibenclamide. Although effective, they are associated with a risk of hypoglycemia and weight gain. [27]
SGLT2 inhibitors are another class of medications used to treat type 2 diabetes. They work by inhibiting glucose absorption in the kidneys, which leads to its excretion in the urine. These medications, such as empagliflozin and dapagliflozin, have additional benefits, including cardiovascular benefits and a reduced risk of chronic kidney disease.
GLP-1 agonists are another class of medications that work by stimulating insulin secretion in response to meals and slowing stomach emptying. Examples include liraglutide and semaglutide. These medications not only improve glycemic control but also aid in weight loss, which is important for many patients with type 2 diabetes.[28]
For patients with more advanced type 2 diabetes who do not achieve adequate glycemic control with oral medications, insulin therapy may be necessary. Insulin can be used in a variety of regimens, depending on the patient's needs. Basal insulin, given once daily, can help control fasting glucose levels, while prandial insulin is used to control postprandial glucose spikes.[29]
An important aspect of drug therapy is individualization of treatment. The selection of appropriate medications should take into account not only blood glucose levels but also other factors, such as the presence of comorbidities, risk of complications, and patient preferences.
Managing type 2 diabetes requires not only drug therapy but also an active approach to a healthy lifestyle. Patients should be encouraged to engage in regular physical activity and adopt a healthy diet, which, combined with appropriate medication, can significantly improve their health.

Challenges of modern medicine in the treatment of type 2 diabetes
Type 2 diabetes is one of the greatest challenges of modern medicine. Its growing prevalence, associated with global trends in obesity, a sedentary lifestyle and an unhealthy diet, requires modern and effective treatment strategies. In recent years, we have observed significant progress in understanding the mechanisms of this disease, but there are still many tasks to be done.
One of the key challenges is the personalization of treatment. Type 2 diabetes has a variety of causes and courses, which means that one treatment method will not necessarily be effective for all patients. Therefore, it is necessary to adapt the therapy to individual needs, which requires accurate diagnostics and regular monitoring of the patient's health. Modern technologies, such as telemedicine, can play an important role in collecting data and facilitating access to medical consultations. [30]
Another challenge is patient education. Understanding the disease, the principles of a healthy lifestyle and the right approach to pharmacological treatment is essential to achieve long-term glycemia control. Collaboration with dietitians, psychologists, and other specialists is

essential in the education process so that patients can make informed decisions about their health. [31]
The pharmacological treatment of type 2 diabetes also faces many challenges. Although there are many medications available that help control blood sugar levels, some of them may have side effects or be inappropriate for certain groups of patients. In addition, the rising cost of drugs and their availability are a significant problem, especially in countries with limited resources. International cooperation and innovative approaches to financing therapy can help alleviate these difficulties.
We must also not forget the role of scientific research in the development of new treatments. Progress in biotechnology and personalized medicine opens up new possibilities in the treatment of type 2 diabetes. Research into new active substances, as well as ways of delivering them, can bring breakthrough solutions that will improve the quality of life of patients. [32]
Finally, an important aspect is the prevention of type 2 diabetes. Prevention programs that promote a healthy lifestyle, physical activity, and an appropriate diet can significantly contribute to reducing the number of new cases. Collaboration with health institutions, schools and social organizations is crucial in creating effective preventive strategies. [33]
In summary, the challenges of modern medicine in the treatment of type 2 diabetes are complex and require an integrated approach. Personalization of therapy, patient education, development of pharmacology, scientific research and prevention are key areas that should be a priority in the fight against this disease. Collaboration of various specialists and health institutions is necessary to effectively face these challenges and improve the quality of life of people affected by type 2 diabetes.

Summary
Type 2 diabetes is a chronic metabolic disease that requires a multifaceted approach to treatment to achieve and maintain normal blood glucose levels and minimize the risk of complications. The treatment strategy for type 2 diabetes in adults is based on several key elements.
The first step in treatment is lifestyle changes, including a healthy diet and regular physical activity. These changes are aimed at reducing body weight, improving insulin sensitivity and controlling glucose levels. It is recommended to introduce a diet rich in fiber, vegetables, fruits, whole grains and limiting the intake of simple sugars and saturated fats.
If lifestyle changes are not sufficient to achieve the therapeutic goals, pharmacotherapy is introduced. There are many classes of drugs used to treat type 2 diabetes, including metformin, insulin secretagogues, SGLT2 inhibitors and GLP-1 agonists. Metformin is usually the first-line drug because it effectively lowers blood glucose levels and is well tolerated by patients.
Monitoring blood glucose levels and regular check-ups with a doctor are key to treating diabetes. They allow for ongoing assessment of the effectiveness of therapy and adjustment of treatment if necessary. Another important aspect is educating patients about self-control, which promotes better disease management.
In addition to glycemia control, treatment of type 2 diabetes should also include prevention and treatment of complications, such as cardiovascular diseases, nephropathy, neuropathy or retinopathy. In this context, monitoring blood pressure, lipid levels and the use of protective drugs such as ACE inhibitors, statins or antiplatelet drugs are important.
In summary, the treatment strategy for type 2 diabetes in adults requires an integrated approach that combines lifestyle changes, pharmacotherapy and regular monitoring and education of patients. This allows for effective disease management and minimizing the risk of complications, which translates into an improvement in the quality of life of patients.

Conclusions

Type 2 diabetes is a chronic metabolic disease that requires a comprehensive approach to treatment. Understanding the individual needs of the patient and early intervention are key to the treatment strategy. First, it is important to introduce lifestyle changes, such as a healthy diet, regular physical activity and weight control. These changes can significantly improve glycemic control and reduce the risk of complications.

If lifestyle changes alone do not bring sufficient results, it is necessary to introduce pharmacotherapy. Different groups of drugs are used in the treatment of type 2 diabetes, including metformin, insulin secretagogues and drugs acting on GLP-1 receptors. The choice of the appropriate drug should be tailored to the individual needs of the patient, their health condition and the presence of co-occurring diseases.

Monitoring blood glucose levels is crucial in managing diabetes. Regular tests of glycated hemoglobin (HbA1c) allow you to assess long-term glycemic control and adjust treatment. Patient education is also an important element, which allows for a better understanding of the disease and self-management of treatment.

Collaboration with a medical team, including a physician, dietitian, and mental health specialist, is essential to achieving optimal therapeutic outcomes. Consideration of psychosocial aspects, such as stress and social support, is also crucial in the treatment of type 2 diabetes.

Disclosure

Author's contribution

Conceptualization: Magdalena Agata Czerska; Methodology: Katarzyna Kamińska – Omasta; Software: Olga Krupa; Check: Daria Rybak, Kinga Furtak and Kuba Borys Romańczuk; Formal analysis: Zofia Martyna Wójcik; Investigation: Paulina Pietrukaniec; Resources: Katarzyna Kamińska-Omasta; Data curation: Bartosz Omasta; Writing -through preparation: Szymon Przemysław Stolarczyk; Writing -review and editing: Zofia Martyna Wójcik; Visualization: Szymon Przemysław Stolarczyk; Supervision: Paulina Dorota Pietrukaniec; Project administration: Daria Rybak; Receiving funding - no specific funding. All authors have read and agreed with the published version of the manuscript.

Financing statement

This research received no external funding

Institutional Review Board Statement

Not applicable

Informed Consent Statement

Not applicable

Data Availability Statement

Not applicable

Conflict of interest

The authors denny any conflict of interest

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