JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S12

Multidisciplinary Approach For Diabetes Management And The Keys To Preventing Long-Term Consequences And Complications

Abdulaziz Ahmed M Alqahtani[1]*, Ahmed Hamzah Bukhari[1],Abdulrahim Ali Alghamdi[1], Mohammed Abdulghani Sindi[1], Sagr Abdullah Aldawsari[1], Adel Obaidallah Aloufi[1], Ayed Salem Alghamdi[1], Hani Ruddah Alsufyani[1], Mohammed Mihmas Albaqami[1], Doaa Mahmoud Johari[1], Wed Ziyad Alnajjar[2], Roqayah Ibrahim Bellou[3], Hadeel Mohammed Mahjoob[4], Elham Hamid Ghabashi[5]

1. Taif Health Cluster, Ministry of Health,Al-Amana Street, Central District, Taif-26522, Saudi Arabia
2. King Fahad General Hospital, Al Mustashfa Al Am, Al Andalus, JCAB8231, 8231, Jeddah 23325, Saudi Arabia
3. Madinah Health Cluster, Ministry of Health, Saeed bin Alaas Street, Madinah-42351, Saudi Arabia
4. King Abdulaziz University, P.O. Box: 80200, Jeddah - 21589, Saudi Arabia
5. East Jeddah hospital,Jeddah First Health Cluster, Ministry of Health, 8742 King Abdallah Rd, Al Sulaymaniyah، JASA2277، 2277, Jeddah 22253, Saudi Arabia

*Corresponding author: E-mail: Aaq.87@hotmail.com

Abstract

Background: Diabetes Mellitus is a chronic disease that affects 200 million worldwide. Given the long-term systemic effects of the disease, it is essential to develop a management approach for diabetes to decrease its long-term complications along with the economic burden on patients. **Objective:** to establish a multidisciplinary approach to the management of diabetes and the comorbidities associated with it. **Materials and methods**: This review is a comprehensive search of PUBMED and medical literature from the year 2014 to 2024. **Conclusion** Diabetes is an ailment with multisystemic consequences that significantly affect the morbidity and mortality of the patient. Hence it is essential to assess and establish a comprehensive methodology to manage the disease that targets not only glycemic control, but the complications associated with it.

Keywords : Diabetes Mellitus; Diagnoses, Clinical Features, Management; Complications; Prevention

Introduction

WHO defines diabetes as a chronic metabolic disorder that is characterized by raised blood glucose levels in the body. It is associated with long-term multi-systemic complications which include the cardiovascular system, kidneys, eyes, and nerves. [1] About 14% of the adults aged 18 and above were known to be diabetic in 2022, with diabetes accounting to be the direct cause of 1.6 million in 2021.[2] Diabetes Mellitus (DM) is caused by dysregulation of the pancreatic enzyme insulin which is responsible for glucose metabolism in the body. Either due to deficient production or unresponsiveness of cellular receptors to the insulin produced in the body, diabetes can be classified as Type 1 DM or Type 2 DM. Both types of diabetes are associated with different age brackets and require different treatment modalities ranging from insulin replacement therapy to oral hypoglycemic agents. [3]

Table 1: The criteria for Diabetes Mellitus Types.

CRITERIA	TYPE 1 DIABETES MELLITUS	TYPE 2 DIABETES MELLITUS
Onset	Sudden	Gradual
Body size	Thin or normal	Often obese
Ketoacidosis	Common	Rare
Autoantibodies	Usually, present	Absent
Endogenous insulin	Low or absent	Normal, decreased or increased

Type 1 Diabetes Mellitus [3]

With an age predilection of around 20 years, this subtype involves the loss of insulin-producing beta cells in the pancreas, leading to severe insulin deficiency. The major cause is T-cell mediated autoimmune attack leading to loss of beta cells.[4] Genetic inheritance along with triggering environmental factors or viral infections have been implicated in the precipitation of the condition.The disease can develop later in life and is known as Latent autoimmune diabetes of adults (LADA). [5]

Type 2 Diabetes Mellitus

It is the most common type of diabetes with approximately 95% of the reported cases of diabetes.[2] The etiological factor for Type 2 DM is the lack of responsiveness of the insulin receptors in the body. This leads to a condition where the blood glucose is not properly metabolized by the body, leading to elevated glucose levels.[3] Another manifestation of diabetes is seen during pregnancy. Gestational diabetes is hyperglycemia seen during pregnancy. It is linked with potential complications during the pregnancy such as increased birth weight, congenital heart and CNS abnormalities, respiratory distress syndrome, and future development of Type 2 DM in both mother and child.[2] Other conditions linked with the potential development of diabetes include: endocrinopathies such as Cushing's, acromegaly, thyroid disorders; genetic defects of beta cell function or insulin action, pancreatic defects like chronic pancreatitis, pancreatic neoplasia, cystic fibrosis; CMV or coxsackie virus; drugs such as corticosteroids, beta-adrenergic agonists.[4]

Clinical presentation and diagnosis

Patients present with a variety of complaints such as increased thirst with dry mouth, frequent urination, fatigue, blurred vision, numbness or tingling feeling in hands or feet, slow healing sores, and frequent skin and/or vaginal yeast infections.[6] The onset of symptoms is slow and often might go unnoticed for years.[2]

Diagnosis of diabetes is established on the basis of impaired glucose metabolism along with the glucose levels in the body. Tests that can be used for diagnosis include

- Fasting plasma glucose level ≥ 7.0 mmol/L (126 mg/dL)
- Plasma glucose ≥ 11.1 mmol/L (200 mg/dL) two hours after undertaking a glucose tolerance test (GTT)
- Symptoms of high blood sugar and plasma glucose ≥ 11.1 mmol/L (200 mg/dL) – fasting or not
- Glycated hemoglobin (HbA1C) ≥ 48 mmol/mol (≥ 6.5 DCCT %)

The WHO diagnostic criteria include: [7]

Table 2: Clinical presentation and diagnosis of patients with glucose level.

Condition	2-hour glucose (mg/dl)	Fasting glucose (mg/dl)	HbA_{1c} (DCCT%)
Normal	<140	<110	<6.0
Impaired fasting glycemia	<140	110-125	6.0-6.4
Impaired glucose tolerance	≥ 140	<126	6.0-6.4
Diabetes mellitus	≥ 200	≥ 126	≥ 6.5

Two fasting glucose measurements at or above 7mmol/L (126 mg/dl) are considered diagnostic for diabetes according to the recent diagnostic criterion. [7]

Complications of diabetes

Diabetes is considered an immunocompromised state and is known to be associated with several serious long-term complications that may or may not be due to mismanagement of the disease. The complications range from ketoacidosis to hypoglycemia, and other systemic impediments. [8]

Acute complications of diabetes mellitus

1. Diabetes Ketoacidosis (DKA)

It is commonly seen in emergency conditions commonly associated with type 1 DM. Due to the excess of ketone bodies, there is electrolytic imbalance leading to symptoms such as nausea, vomiting, acetone-smelling breath, Kussmaul breathing, and in severe cases, coma.[8]

Management of DKA involves quick diagnosis of the anionic gap. Mainstays of therapy include fluid replacement along with insulin therapy to suppress ketogenesis, providing electrolytes like bicarbonate and sodium.[9]

1. Hyperosmolar hyperglycemic state

It is a less commonly seen condition compared to DKA. It is more commonly associated with Type 2 DM. It is characterized by dehydration occurring secondary to severe hyperglycemia, resulting in an altered mental state and possibly coma.[10] The precipitating factors include infections, discontinuation/omission of antidiabetic medications, cardiovascular events, pancreatitis, and drugs. Blood glucose is significantly raised (≥30 mmol/L) along with osmolality (≥320 mOsm/kg) with the latter being an indicator of severity and monitoring of treatment. [11]

1. Hypoglycemia

It is a complication of insulin therapy wherein, in diabetic patients, the blood glucose level falls below 75 mg/dl.[12] The causative agents are exogenous insulin or insulin secretagogues such as sulfonylurea. A fall of blood glucose below 54 mg/dl is labeled as severe hypoglycemia. Severe hypoglycemia has grave consequences such as cognitive impairment along with seizures, loss of consciousness, and coma.Hypoglycemia can increase the risk of mortality in a range from 50% to 600%.[13] Diabetes mellitus is a lifelong disease state that is accompanied by secondary systemic disorders that affect the macro and microvasculature of the body.

Table 3: Long-Term complications of diabetes mellitus.

MICROANGIOPATHIES			
System affected	**Pathogenesis**	**Consequences**	**Management**
Diabetic retionpathy[14]	Polyol pathway, Advanced glycated end products accumulation, Protein kinase C pathway, Hexosamine pathway	Vision loss due to diabetic macular edema (DME)	**Anti VEGF** -Ranibizumab, Pegaptanib **Nonspecific anti-angiogenic-** Squalamine, AKB-9778 **Intravitreal steroids-** Triamcinolone, DEX implant **IL-6 inhibitor-** EBI-031
Diabetic nephropathy [15]	Abnormal homeostasis along with Renin-angiotensin aldosterone system, advanced glycated end products, activation of transforming growth factor-β1, connective tissue growth factor, mitogen-activated protein kinase, reactive oxygen species	Leads to end stage kidney disease	ADA recommended targeted HbA_{1c} level of 7.0% Use of second-generation sulfonylurea such as glipizide and gliclazide Use of DPP-4 inhibitors [16] and SGLT2 inhibitors [17] ADA recommended blood pressure target of ,140/90 mmHg along with RAAS inhibitors-ARBs and ACE inhibitors [15] Vitamin D Receptor Activators[15] Pentoxifylline [18]
Diabetic neuropathy [19]	Demyelination, reduced Schwann cell-axon transport, ischemia, reduction is neurofilament	Leads to distal symmetric polyneuropathy (DSP), muscle weakness, diabetic amyotrophy	Improved glycemic control Dietary and lifestyle intervention Use of α-Lipoic acid and Benfotiamine administration Pain control by calcium channel a2δ ligands, serotonin and noradrenaline reuptake inhibitors (SNRIs), tricyclic antidepressants (TCAs), gabapentin, pregabalin.
Diabetic encephalopathy [20]	Oxidative and nitrosative stresses, changes in the thiol-disulfide system, mitochondrial and endothelial dysfunction, heat shock protein	Ischemic stroke, transient ischemic attacks, vascular dementia, and neurodegenerative processes.	Improved glycemic control Modulation of HSP70[20] Administration of Dendrobine [21]
Diabetic cardiomyopathy [22]	renin-angiotensin-aldosterone system and the sympathetic nervous system leading to hepatic lipolysis, lipogenesis, and gluconeogenesis, [22] mitochondrial dysfunction and ROS generation [23]	Decreased myocardial deformability, Diastolic dysfunction, heart failure [24]	DPP4 inhibitor- Sitagliptin SGLT-2 inhibitor-Dapagliflozin, Canagliflozin GLP1R agonist – Liraglutide [24]
Periodontal disease	Low levels of IL-10[25]	Chronic periodontitis	Control of glycemic levels Scaling and root planing Lycopene [26]

Macroangiopathies

These commonly lead to cardiovascular disease and are caused by dyslipidemia and hypertension. These can be cardiovascular, cerebral vascular, or involving the peripheral vasculature. These complications manifest as unstable or stable angina, dysesthesias, facial droop, hemiparesis, dizziness, slurred speech, gait difficulties, and

visual loss. In case of peripheral vasculature involvement, there can be exertional leg pain or ischemic ulcers.[27]

Management of Diabetes Mellitus

Diabetes is a lifestyle disease that progressively involves multiple systems and thus requires management that targets beyond systematic control to reduce the morbidity and mortality that the patient faces along with the economic burden of the disease. Shen et al reported that groups with good medication taking and lifestyle changes had lower HBA1C levels.Thus the management of the disease should encompass prevention of the disease, self-management, and pharmacological management of comorbidities to reduce the occurrence of long-term complications. [28]

Prevention

WHO suggests that diabetes prevention, especially Type 2 DM, can be achieved through lifestyle changes. These suggested changes include:

- Reaching and keeping a healthy body weight
- Moderate exercise of about 150 minutes each week
- A healthy diet with avoidance of sugars and saturated fats
- Avoidance of tobacco smoking
- Dental care and good oral hygiene [2]

Self-management and care coordination

Lin et al recommended that self-management scales aid in the detection of healthcare problems early along with creating patient awareness regarding glucose monitoring.[29] Rawlins et al also reported a decrease in A1C in groups with a care coordinator that motivated patient behavior changes toward glucose control.[30] WHO also recommends regular screening for nephropathy and eye exams for retinopathy.[2]

Diet control is a well-established method of managing diabetes. It is recommended to intake a balanced diet with approximately half a plate of non-starchy vegetables,1/4 plate of lean protein, and ¼ plate of grain/starch. Reduction in excessive carbohydrates along with regular 3 meals help to regulate the blood sugar levels, preventing the possibility of hypoglycemia. [31]Exercise along with weight reduction targeting abdominal obesity are beneficial in diabetes management. Exercise helps to reduce the risk of cardiac events, along with controlling dyslipidemia and increasing the effectiveness of insulin. American Diabetes Association states that exercise makes the muscle cells more sensitive to the action of insulin for up to 24 hours.[32] Weight loss is linked with a reduction in the progression of Type 2 DM along with the development of long-term complications. There are also links between the decrease in beta cell destruction and weight reduction.

These management methods help to prevent the worsening of glucose levels along with regular examination to prevent any further complications. These help to also reduce the burden on healthcare facilities. [33]

Pharmacological Management

1. Glucose control and monitoring

Management of hyperglycemia is known to aid in reducing the complications associated with long-term uncontrolled diabetes. Good glycemic control is the target of any medical therapy, with the American Diabetes Association recommending an HBA1C of 6.0-7.0%, without significant hypoglycemia.[34] Use of anti-diabetic medication such as insulin replacement therapy, which is used for Type 1 DM, and oral hypoglycemic agents such as metformin, sulfonylurea (glipizide, glimepiride, and gliclazide), and GLP1 agonists (semaglutide, liraglutide) are the mainstays of treatment of Type 2 DM. Semaglutide (Ozempic) has gained traction for its use in chronic weight management.[35] The increase in the use of continuous glucose monitoring devices has provided methods of efficient glucose monitoring along with conventional fingerstick glucose monitors.These devices can also be used for automated insulin dosing. [36]

1. Other systemic management and surgery

The use of statins to control dyslipidemia and drugs targeting the RAAS system to control hypertensionare used as adjuvant methods to control and prevent the long-term complications of diabetes. Bariatric surgery is often used to reduce weight and improve insulin sensitivity in diabetic patients. [37]

1. Vitamin and medicinal plants

The use of vitamins and medicinal plants is often implicated as beneficial in managing diabetes. Yedjou et al evaluated the peer-reviewed literature regarding the use of vitamins and medicinal plants and recommended their use as a cost-effective method for the prevention and management of diabetes, especially in developing countries. [38]

The role of physiotherapy in preventing long-term consequences and complications of diabetes:

Physiotherapy plays a crucial role in preventing long-term consequences and complications associated with diabetes through various therapeutic approaches. One effective method is magneto-laser-ultrasonic therapy, which has been shown to positively influence metabolic processes, including carbohydrate and lipid metabolism, thereby potentially preventing complications related to diabetes. When combined with EHF-puncture, this combination therapy has been identified as particularly effective in enhancing metabolic health. [39] Additionally, a specifically designed physical therapy treatment for diabetic neuropathic patients has

demonstrated significant benefits, including reductions in distal numbness and improvements in muscle function and mobility. [40]This is essential for maintaining quality of life and preventing further complications in diabetic patients. [39]

Conclusion

Diabetes is an ailment with multisystemic consequences which significantly affect the morbidity and mortality of the patient. Hence it is essential to assess and establish a comprehensive methodology to manage the disease that targets not only glycemic control, but the complications associated with it. Moreover, dosed exercise therapy is another vital component, as structured physical activity has been proven to improve metabolic processes and cardiovascular health, which are critical in managing diabetes. The integration of glucose-lowering drugs with these physical therapies further supports blood sugar control, reducing the risk of long-term complications.

Author Contributions

Although the corresponding author oversaw the first writers' writing of the original text, all authors made significant contributions by compiling information and conducting a literature search for the article. Each author accepted responsibility for every portion of the manuscript, participated in its critical review, and approved the final draft.

Acknowledgments

Authors, open access databases, web portals, and publishers whose works supplied the necessary literature for this article's completion are acknowledged and greatly appreciated by the authors.

Conflict of Interest

The authors declare they don't have any conflict of interest.

Ethical Approval

Not Applicable

References

1. **World Health Organization.** (n.d.). Diabetes. Retrieved October 11, 2023, from https://www.who.int/health-topics/diabetes#tab=tab_1
2. **World Health Organization.** (n.d.). Diabetes. Retrieved October 11, 2023, from https://www.who.int/news-room/fact-sheets/detail/diabetes
3. **Shoback D G, & Gardner D(Eds.) (2011).** Chapter 17. In Greenspan's basic & clinical endocrinology (9th ed., pp. 259-284). McGraw-Hill Medical.
4. **Kumar V, Abbas A, & Aster J(2021)**. Chapter 22: Diseases of the Endocrine System. In Robbins & Cotran pathologic basis of disease (10th ed., pp. 1065-1132). Elsevier.
5. **Petzold A, Solimena M, & Knoch K P(2015).** Mechanisms of Beta Cell Dysfunction Associated With Viral Infection. *Current diabetes reports*, *15*(10), 73.
6. **Cleveland Clinic**. (n.d.). Diabetes. Retrieved October 11, 2023, from https://my.clevelandclinic.org/health/diseases/7104-diabetes
7. **World Health Organization.(1999).** Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications (PDF). Retrieved March 8, 2003, from [Original URL removed]
8. **Penman I, Ralston S, Strachan M, & Hobson R(2023).** Chapter 15: Endocrine disorders. In Davidson's principles and practice of medicine (24th ed., pp. 703-753). Elsevier.
9. **Dhatariya K K, & Joint British Diabetes Societies for Inpatient Care(2022).** The management of diabetic ketoacidosis in adults-An updated guideline from the Joint British Diabetes Society for Inpatient Care. *Diabetic medicine : a journal of the British Diabetic Association*, *39*(6), e14788.
10. **Willix C, Griffiths E, & Singleton S (2019).** Hyperglycaemic presentations in type 2 diabetes. *Australian journal of general practice*, *48*(5), 263–267.
11. **Mustafa O G, Haq M, Dashora U, Castro E, Dhatariya K K, & Joint British Diabetes Societies (JBDS) for Inpatient Care Group(2023).** Management of Hyperosmolar Hyperglycaemic State (HHS) in Adults: An updated guideline from the Joint British Diabetes Societies (JBDS) for Inpatient Care Group. *Diabetic medicine : a journal of the British Diabetic Association*, *40*(3), e15005.
12. **Zahed K, Sasangohar F, Mehta R, Erraguntla M, & Qaraqe K(2020)**. Diabetes Management Experience and the State of Hypoglycemia: National Online Survey Study. *JMIR diabetes*, *5*(2), e17890.
13. **Amiel S A(2021**). The consequences of hypoglycaemia. *Diabetologia*, *64*(5), 963–970.
14. **Wang W, & Lo A C Y (2018)**. Diabetic Retinopathy: Pathophysiology and Treatments. *International journal of molecular sciences*, *19*(6), 1816.
15. **Samsu N.** (2021). Diabetic Nephropathy: Challenges in Pathogenesis, Diagnosis, and Treatment. *BioMed research international*, *2021*, 1497449.
16. **Panchapakesan, U., & Pollock, C. (2015).** The Role of Dipeptidyl Peptidase - 4 Inhibitors in Diabetic Kidney Disease. *Frontiers in immunology*, *6*, 443.

17. **Kim M K(2017)**. Treatment of diabetic kidney disease: current and future targets. *The Korean journal of internal medicine*, *32*(4), 622–630.
18. **Pérez-Morales R E, Del Pino M D, Valdivielso J M, Ortiz A, Mora-Fernández C, & Navarro-González J F (2019).** Inflammation in Diabetic Kidney Disease. *Nephron*, *143*(1), 12–16.
19. **Feldman E L, Callaghan B C, Pop-Busui R, Zochodne D W, Wright D E, Bennett D L, Bril V, Russell J W, & Viswanathan V** (2019). Diabetic neuropathy. *Nature reviews. Disease primers*, *5*(1), 42.
20. **Belenichev I, Aliyeva O, Popazova O, & Bukhtiyarova N (2023)**. Molecular and biochemical mechanisms of diabetic encephalopathy. *Acta biochimica Polonica*, *70*(4), 751–760.
21. **Shi Y S, Chen J C, Lin L, Cheng Y Z, Zhao Y, Zhang Y, & Pan X D(2023)**. Dendrobine rescues cognitive dysfunction in diabetic encephalopathy by inhibiting ferroptosis via activating Nrf2/GPX4 axis. *Phytomedicine : international journal of phytotherapy and phytopharmacology*, *119*, 154993.
22. **Lorenzo-Almorós A, Cepeda-Rodrigo J M, & Lorenzo Ó. (2022).** Diabetic cardiomyopathy. *Revista clinica espanola*, *222*(2), 100–111.
23. **Kobayashi S, & Liang Q(2015).** Autophagy and mitophagy in diabetic cardiomyopathy. *Biochimica et biophysica acta*, *1852*(2), 252–261.
24. **Zhao X, Liu S, Wang X, Chen Y, Pang P, Yang Q, Lin J, Deng S, Wu S, Fan G, & Wang B(2022)**. Diabetic cardiomyopathy: Clinical phenotype and practice. *Frontiers in endocrinology*, *13*, 1032268.
25. **Acharya A B, Thakur S, & Muddapur M V(2015).** Evaluation of serum interleukin-10 levels as a predictor of glycemic alteration in chronic periodontitis and type 2 diabetes mellitus. *Journal of Indian Society of Periodontology*, *19*(4), 388–392.
26. **Reddy P V, Ambati M, & Koduganti R(2015).**Systemic lycopene as an adjunct to scaling and root planing in chronic periodontitis patients with type 2 diabetes mellitus. *Journal of International Society of Preventive & Community Dentistry*, *5*(Suppl 1), S25–S31.
27. **Zimmerman R S(2016, September)**. Diabetes Mellitus: Management of Microvascular and Macrovascular Complications. Cleveland Clinic Center for Continuing Education. Retrieved December 13, 2024
28. **Shen Y, Wang T, Gao M, Wang F, Zhu X, Zhang X, Li D, Gan Y, Zhang Y, Gao Y, & Sun X(2020).** Association of glucose control and stages of change for multiple self-management behaviors in patients with diabetes: A latent profile analysis. *Patient education d counseling*, *103*(1), 214–219.
29. **Lin H C, Tseng C W, Hsieh P J, Liang H L, Sue S P, Huang C Y, & Lee M Y(2022)**. Efficacy of Self-Management on Glucose Control in Type 2 Diabetes Mellitus Patients Treated with Insulin. *Healthcare (Basel, Switzerland)*, *10*(10), 2080.
30. **Rawlins W S, Toscano-Garand M A, & Graham G(2017).**Diabetes management with a care coordinator improves glucose control in African Americans and Hispanics. *Journal of education and health promotion*, *6*, 22.
31. **McDermott M.(2022).** Diabetes Secrets. Elsevier. pp. 52–54. ISBN 978-0-323-79262-2.
32. **Care D. (2023)**. Standards of care in diabetes—2023. *Diabetes care*, *46*, S1-S267.
33. **McDermott M T, & Trujillo J M(2022)**. Diabetes secrets. Elsevier.
34. **American Diabetes Association.** (n.d.). Practice Guidelines Resources. Retrieved July 12, 2023, from https://professional.diabetes.org/standards-of-care/practice-guidelines-resources
35. **Chao A M, Tronieri J S, Amaro A, & Wadden T A (2023).** Semaglutide for the treatment of obesity. *Trends in cardiovascular medicine*, *33*(3), 159–166.
36. **Almurashi A M, Rodriguez E, & Garg S K (2023)**. Emerging Diabetes Technologies: Continuous Glucose Monitors/Artificial Pancreases. *Journal of the Indian Institute of Science*, 1–26. Advance online publication.
37. **Ooba N, Tanaka S, Yasukawa Y, Yoshino N, Hayashi H, Hidaka S, Seki T, & Fukuoka N(2016)**. Effect of high-potency statins on HbA1c in patients with or without diabetes mellitus. *Journal of pharmaceutical health care and sciences*, *2*, 8.
38. **Cheng J, Zhang W, Zhang X, Han F, Li X, He X, Li Q, & Chen J** (2014). Effect of angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers on all-cause mortality, cardiovascular deaths, and cardiovascular events in patients with diabetes mellitus: a meta-analysis. *JAMA internal medicine*, *174*(5), 773–785.
39. **I., Z., Samosiuk., O, Vladimirov., O, Chukhraeva., V, Maikovets., N., I., Samosiuk., Anna, Nalazek., Walery, Zukow.** (2011). Modern physiotherapy methods in medical rehabilitation of patients with diabetes mellitus type 2. Journal of Health Science, 1(4):101-124.
40. **Aline, A., Gomes., Cristina, D., Sartor., Sílvia, Maria, Amado, João., Isabel, C., N., Sacco., Marcia, Martins, Silveira, Bernik.** (2007). Efeitos da intervenção fisioterapêutica nas respostas sensoriais e funcionais de diabéticos neuropatas. Fisioterapia e Pesquisa, 14(1):14-21. doi: 10.1590/FPUSP.V14I1.75500