PREVENTION AND MANAGEMENT OF TYPE 2 DIABETES: A REVIEW

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Abstract: **Diabetes Mellitus (T2DM) is considered to be one of the most common diseases. In type 2 diabetics, recently the high level of HBA1C is also considered one of risk factors on the risk of developing microvascular and macrovascular complications. High HbA1c can be improved through dietary management; thus, patients can be prevented from developing complications of diabetes. Awareness of complications of diabetes and as a result, improved knowledge, dietary attitudes and practices leading to better disease control. People can use information to estimate their diabetes risk, motivate them to seek adequate treatment and care, and inspire them to manage their disease for the rest of their lives to lifestyles that are more westernised and urbanised. The glycemic index (GI) is a dietary measure to rank the acute impact of available (digestible) carbohydrates on blood sugar. Nutrition information and fact sheets are provided on the labels of packaged foods in many developed and developing countries to help consumers make informed choices. Although carbohydrates are a must. The purpose of this review is that, information will play an important role in future development. Improve education and awareness of DM and diabetic retinopathy in diabetic patients. These are essential for disease management and is to reduce its complications. Raise people's awareness of healthy food choices to stay healthy.**

Keywords: **Diabetes Mellitus, Disease, knowledge, Awareness, Health, Diet, lifestyle**

1. INTRODUCTION

Diabetes is a metabolic disorder characterized by high blood glucose levels due to diminished ability to utilize carbohydrates or incomplete tissues, accompanied by changes in the metabolism of fats, proteins, water, and electrolytes. This disorder is due to a deficiency or reduced efficacy of the hormone insulin produced by beta cells in the islets. In many years, metabolic derailments are often associated with permanent, irreversible, functional and structural changes in in the body's vascular system.

(According to WHO) Diabetes is a chronic metabolic disorder characterized by elevated blood sugar (or blood sugar) levels that can cause serious damage to the heart, blood vessels, eyes, kidneys, and nerves over time. Formerly known as juvenile diabetes or insulin-dependent diabetes, type 1 diabetes is a chronic condition in which the pancreas itself produces little or no insulin. The most common is type 2 diabetes, which is usually found in adults. This happens when the body becomes resistant to insulin or does not produce enough insulin. Over the last three decades, the prevalence of type 2 diabetes has increased dramatically in countries of all income levels.

Diabetes is a group of metabolic disorders characterized by chronic hyperglycemia due to deficiencies in insulin secretion, insulin action, or both. Abnormal metabolism of carbohydrates, lipids and proteins is due to the importance of insulin as an anabolic hormone. Low levels of insulin to achieve proper response and / or insulin resistance of the target tissue, primarily skeletal muscle, adipose tissue, and to a lesser extent, insulin receptors, signaling systems and / or effector enzymes or because of these metabolic disorders that are responsible at the genetic level. The severity of symptoms depends on the type and duration of diabetes. Some diabetics are asymptomatic, especially in patients with type 2 diabetes early in the disease, those with marked hyperglycemia, especially in children with absolute insulin deficiency, polyuria, polydipsia. Visions that can suffer from drinking, polyphagia, weight loss, and hazy eyes. Uncontrolled diabetes can lead to stupor, coma, and if left untreated, can lead to death from ketoacidosis or, rarely, non-ketonic hyperosmolar syndrome. **[10,13,4]**

Diabetes mellitus, or type 2 diabetes, is one of the world's largest non-communicable and fastest-growing public health problems, difficult to treat and costly to manage. The number of diabetics worldwide is estimated to double over the next 25 years, from the current 190 million to 325 million. **[4-6]** People with type 2 diabetes are at increased risk of developing many debilitating complications such as cardiovascular disease, peripheral vascular disease, nephropathy, retinal changes, and blindness, which can lead to disability and premature death. It also entails significant medical and financial burden. Genetic susceptibility and environmental influences appear to be the most important factors involved in the development of this disease. However, recently, a dramatic increase in lack of exercise, obesity and type 2 diabetes has been observed. This fact indicates that obesity and lack of exercise may be the main reasons for the increased burden of diabetes in developed countries.**[25,21]**

Definitely need empower patients with the right information,every opportunity and creativity awareness of self-care management focusing on lifestyle changes, the behaviour changes. Education plays one an important role as well as prevention not only for diabetes itself, but also for prevention complications. Quality of life for patients having diabetes can be improved, disease complications are recognized early. So are all steps of education,Raising awareness improves overall happiness and extension of people's lifespan.

2. BACKGROUND

Diabetes mellitus (DM) is one of the most serious noncommunicable disease (NCD) hazards to public health around the world. Diabetes incidence trends show a disproportionate growth in emerging countries as a result of globalisation current demographic

shifts from traditional to non-traditional.[4] Diabetes knowledge can help diabetic patients avoid the onset of chronic DM comorbidities, which have a substantial impact on their quality of life. People can use information to estimate their diabetes risk, motivate them to seek adequate treatment and care, and inspire them to manage their disease for the rest of their lives to lifestyles that are more westernised and urbanised.[18]

Type 1 diabetes (T1DM) is becoming more common around the world. For effective therapy, a full understanding of insulin administration is required, including correct injection procedures, adequate storage, insulin dose adjustment, meal timing, site rotation, and compliance. Unintended weight loss, polydipsia (increased thirst), polyphagia (increased hunger), and polyuria (increased urination) are all hallmark indications of untreated diabetes.[9]

In type 1 diabetes, symptoms appear quickly (weeks or months), whereas in type 2 diabetes, symptoms appear considerably more slowly (years or decades) and may be absent or inconspicuous. Tiredness and weight loss are two other diabetes symptoms. There are a number of other signs and symptoms that indicate the development of diabetes, albeit they are not exclusive to diabetes. They include blurred vision, sluggish wound healing, itchy skin, headache, and weariness, in addition to the above-mentioned indications and symptoms. High blood glucose levels for an extended period of time can cause glucose absorption in the lens of the eye, resulting in changes in its shape and, as a result, vision alterations. Diabetic retinopathy can potentially cause long-term vision loss. Diabetic dermadromes refer to a group of skin rashes that emerge as a result of diabetes.

3. DISCUSSION

Diabetes mellitus is thought to be the most common and dangerous chronic disease in human history. It has tormented humans for thousands of years and is still afflicting mankind at an exponential rate.[1] Diabetes mellitus (DM) is a category of metabolic illnesses marked by high blood sugar levels. It's linked to changes in glucose, fat, and protein metabolism, and it can lead to long-term issues like microvascular, macrovascular, and neuropathic problems. Over the last two decades, the prevalence of diabetes mellitus has risen rapidly. The global prevalence of diabetes in adults is expected to rise to 5.5 percent in 2025 (up from 4 percent in 1995), with India accounting for the majority of the increase.[22]

T2DM is currently one of the most common illnesses in the world, and its prevalence is steadily increasing. In 2011, it was estimated that 366 million individuals globally, or 8.3% of the population aged 20 to 79, had T2DM. By 2030, this number is predicted to climb to 552 million (9.9%).[23]

4. CLASSIFICATION

The circumstances existing at the time of diagnosis play a large role in assigning a type of diabetes to an individual, and many diabetics do not neatly fall into a single category. A person with gestational diabetes mellitus (GDM), for example, may remain hyperglycemic after birth and be diagnosed with type 2 diabetes. Alternatively, a person who develops diabetes as a result of high doses of exogenous steroids may become normoglycemic if the glucocorticoids are stopped, but then develop diabetes following recurrent pancreatitis several years later. A person treated with thiazides who develops diabetes years later is another example because thiazides seldom produce severe hyperglycemia on their own, such people are likely to develop type 2 diabetes, which is aggravated by the medicine. Thus, it is more important for the clinician and the patient to understand the pathophysiology of hyperglycemia and to treat it successfully than it is to label the specific kind of diabetes.[3]

4.1 TYPE 1 DIABETES

This form of diabetes accounts for 5- 10% of all diabetes diagnoses. It's a pretty uncommon phenomenon that usually occurs before the age of 20, yet it might happen at any age. The irregularity of carbohydrate metabolism is severe because to the lack of endogenous insulin to control blood glucose levels, and the disease usually has a rapid beginning. The fundamental flaw is the loss of pancreatic beta cells, which results in insulin insufficiency. As a result, if the patient develops deadly ketoacidosis, insulin therapy is required. A long asymptomatic period during which the cells are being destroyed often precedes the clinical start. Only after the cells' secretory capacity has been reduced by 90% do hyperglycemia and other symptoms appear. Patients are typically slender and underweight, insulin-sensitive, insecure, and difficult to control, with symptoms ranging from diabetic coma to hypoglycemia. Genetics, autoimmune reactions, and environmental variables all contribute to the risk of developing cancer. There are two types of Type 1 Diabetes: immune mediated and idiopathic. Immune mediated diabetes is caused by an autoimmune attack on beta cells, while idiopathic diabetes is caused by an unknown cause.[15]

4.2 IMMUNE-MEDIATED DIABETES

This kind of diabetes, which affects only 5–10% of people with diabetes and was previously known as insulin-dependent diabetes, type 1 diabetes, or juvenile-onset diabetes, is caused by a cellular-mediated autoimmune destruction of the pancreatic -cells. Islet cell autoantibodies, insulin autoantibodies, GAD (GAD65) autoantibodies, and autoantibodies to the tyrosine phosphatases IA-2 and IA-2 are all markers of immunological damage of the -cell. When fasting hyperglycemia is first detected, one or more of these autoantibodies are present in 85–90 percent of people. In addition, the disease has substantial HLA correlations, including links to the DQA and DQB genes, and the DRB genes influence it. These HLA-DR/DQ alleles can be protective or predisposing. Autoimmune cell death is linked to a variety of genetic predispositions as well as yet-to-be-identified environmental influences. Although people with this type of diabetes are rarely obese, the presence of obesity is not incompatible with the diagnosis. Graves' disease, Hashimoto's thyroiditis, Addison's disease, vitiligo, celiac sprue, autoimmune hepatitis, myasthenia gravis, and pernicious anaemia are all common autoimmune illnesses in these patients.[3]

4.3 IDIOPATHIC DIABETES

The causes of several types of type 1 diabetes are unknown. Some of these patients have chronic insulinoplasia and are at risk of ketoacidosis, but no signs of autoimmunity.[3

4.4 TYPE 2 DIABETES

This kind generally develops in middle age or beyond the age of 40, while it can sometimes develop in younger people. It is responsible for 90-95 percent of all diabetes diagnoses. Insulin resistance and beta cell dysfunction are frequently associated with type 2 diabetes. Insulin levels may be normal, low, or high, but they are ineffective in combating insulin resistance or reduced tissue sensitivity to insulin, resulting in hyperglycemia. Glucotoxicity, which is caused by elevated glucose levels, has a negative impact on both insulin sensitivity and insulin secretion, and insulin production steadily diminishes as the condition advances. Exogenous insulin may be required to manage blood glucose levels in a high percentage of people with type 2 diabetes. Insulin resistance can also lead to diabetes. [15]

5. CAUSES

The Corpulence and diabetes are major causes of horribleness and mortality within the Joined together States.Corpulence and weight pick up, both are associated with an expanded hazard of diabetes among the individuals. [20] In type 2 diabetes, the deterioration of pancreatic cell function progresses noticeably over time. Although age, obesity, inadequate calorie consumption, alcohol use, smoking, and other risk factors for type 2 diabetes mellitus are all independent risk factors. Overeating, smoking, increased alcohol consumption, neurological and endocrine system abnormalities, cortisol elevation, aberrant sex hormone production, reduced energy consumption owing to lack of exercise, and genetic factors such as age can all contribute to diabetes mellitus (DM).[16]

6. COMPLICATIONS

The main problem of diabetes is that if it is not well controlled, it will lead to an increase in microvascular and macrovascular complications such as coronary heart disease, stroke, blindness, kidney failure, amputation of the legs, blood supply to the organs. Poor spending leads to increased morbidity. Patient education is becoming a central part of disease prevention and control. Chronic hyperglycemia in diabetes is associated with long-term damage, dysfunction and deterioration of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.[17]

7. PHYSICAL ACTIVITY & BEHAVIOUR

A wide number of cross-sectional, prospective, and retrospective investigations have discovered a link between physical inactivity and T2DM.[29] A prospective research was conducted on over a thousand nondiabetic people from the Pima Indians' high-risk community. It was discovered during a 6-year follow-up period that but diabetes rates remained higher in less active people. All BMI categories of men and women are represented.[11] An imbalance between energy expenditure and energy intake through food consumption is the key causative risk factor for type 2 diabetes. The mainstays of diabetes control include physical activity (PA; regular movement such as walking) and exercise (organised activities such as jogging or cycling), as well as food and medication. There is evidence that behavioural therapies targeting improved PA and exercise cause a clinically meaningful reduction in HbA1c in individuals with type 2 diabetes. Clinically meaningful improvements in HbA1c may be more likely if specific behaviour change approaches are used. More may be better when it comes to the use of behaviour modification approaches. [28]

8. PEOPLE CONSCIOUSNESS REGARDING DM

Diabetes management and awareness among patients continue to be key concerns for stakeholders across the world. Many research from underdeveloped nations have found that people don't know much about diabetes.[8] Diabetic patients must have a thorough understanding of their ailment in order to enhance their self-management abilities and, as a result, avoid complications.
 Self-care practises were shown to be less common among high-risk diabetes patients with lower educational levels, according to research. For example, whereas over 90% of our survey participants recognised that diabetes can be treated with dietary changes and medications, only roughly a third (mostly males) knew that exercise is an important aspect of diabetes. [17]

9. KNOWLEDGE, ATTITUDE & PRACTICE OF PEOPLE REGARDING DIET IN TYPE 2 DM

Self-dietary management is characterised by the American Diabetes Association as a vital step in equipping diabetics with information and expertise in regard to treatment, nutritional components, drugs, and consequences. According to a study, the targeted group of people who were at high risk of developing T2DM had low nutritional awareness. Males were found to consume more red meat and fried foods than females. The daily rice consumption ratio of males to females was substantially higher.[19] Nutritionists say that not only the type of food, but also the quantity of food consumed, has an impact on blood sugar levels. Meals should be eaten at regular intervals and should have low fat, high fibre, and a small quantity of carbs. [27]
Improvements in a patient's nutritional knowledge, attitudes, and habits can help them control their diabetes. These elements are seen to be an important aspect of comprehensive diabetes care. [14] Dietary attitude (DA) refers to one's views, thoughts, and feelings regarding food, as well as one's behaviours and connections with it. It has the potential to alter people's eating habits and health. [2] The major causes of problems among patients with type 2 diabetes mellitus include unhealthy eating habits, inability to stick to a rigorous diet plan, and physical inactivity (T2DM). [12] Patients with type 2 diabetes had a general dietary attitude that was unhealthy. These patients should be advised using an empowerment approach, since this can help them modify their food habits, which are firmly ingrained in their daily routine. Healthcare practitioners should also be well-informed about their patients' attitudes and beliefs regarding diabetes in order to develop customised educational and preventative programmes for this population.

Diabetes self-management education programmes should be offered on a regular basis, with a particular focus on nutrition and its components. [24] The eating habits of diabetics are largely impacted by their ethnic origins. There were substantial positive associations between diabetic diet knowledge and dietary behaviours in each of the aspects of dietary practises. Controlling food choices required a significant amount of knowledge. [6] Furthermore, patients' awareness of a suggested diet reflects their comprehension of dietary recommendations, which affected their food choices and eating habits. Participants' understanding of diabetes management impacted their eating habits. Participants' previous eating habits were connected to the difficulties they had while implementing dietary recommendations. Dietary self-efficacy, social support, and time management have all been identified as mediating factors that might impact dietary choices. [26]

10. PRODUCT LABELLING

The glycemic index (GI) is a dietary measure to rank the acute impact of available (digestible) carbohydrates on blood sugar. Currently, very few countries require the inclusion of GIs on food labels, although this information can help consumers manage their blood sugar. Australia and New Zealand regulate GI claims as nutritional claims and also recognize the Certified Low GI Mark from the GI Foundation as endorsement. The GI of South Africa endorses foods with low, medium and high GI symbols. In Asia, the Singapore Healthier Choice logo has provisions specific to low GI claims. Low GI claims are also allowed on food labels in India. In China, has no country-specific regulations on GIs; however, voluntary complaints are allowed. In the United States, GI claims are not specifically regulated but allowed, as they are considered to fall under the general food labeling provisions. In Canada and the European Union, GI claims is illegal under the applicable Food Code. Inconsistencies in food regulations around the world are eroding consumer and healthcare professional confidence and calling for harmonization. The global provisions for GI claims/claims in food standard codes will be in the best interest of people with diabetes and those at risk. Although there is a worldwide consensus that low GI foods, meals, and diets are beneficial for people with diabetes as well as those at risk for the disease, food labelling regulations for with GI is inconsistent and contradictory. Successful implementation of the low GI labeling law allowing claims and/or claims regarding GI nutrient content will require regulatory changes, public health education, and increased international food industry consumer acceptance to have a significant impact on global health.[7]

11. CONCLUSION

The review of various studies suggests that patients with type 2 diabetes need advanced education on DM including dietary management by stakeholders (care providers, healthcare facilities, etc.) to encourage them to better understand disease management, more appropriate personal care, and a better quality of life. The patient should also have a good knowledge of the disease and diet, for this purpose healthcare educators should educate the patient to change eating habits and food preparation. Their active lifestyle and effective dietary education can prevent the onset of diabetes and its complications.

REFERENCES

1. Aldasouqi, S. A., & Alzahrani, A. S. (2004). Terminology in diabetes; an example of resistance to change. *Saudi medical journal*, *25*(9), 1289–1291.
2. Alvarenga, M., Scagliusi, F. B., & Philippi, S. T. (2012). Comparison of eating attitudes among university students from the five Brazilian regions. *Ciencia & saude coletiva*, *17*(2), 435–444. https://doi.org/10.1590/s1413-81232012000200016
3. American Diabetes Association (2010). Diagnosis and classification of diabetes mellitus. *Diabetes care*, *33 Suppl 1*(Suppl 1), S62–S69. https://doi.org/10.2337/dc10-S062.
4. American Diabetes Association (2014). Diagnosis and classification of diabetes mellitus. *Diabetes care*, *37 Suppl 1*, S81–S90. https://doi.org/10.2337/dc14-S081
5. Awuchi, Chinaza & Echeta, Chinelo & Victory, Igwe. (2020). Diabetes and the Nutrition and Diets for Its Prevention and Treatment: A Systematic Review and Dietetic Perspective. 6. 5-19. ISSN: 2375-379X.
6. Backman, D. R., Haddad, E. H., Lee, J. W., Johnston, P. K., & Hodgkin, G. E. (2002). Psychosocial predictors of healthful dietary behavior in adolescents. *Journal of nutrition education and behavior*, *34*(4), 184–192. https://doi.org/10.1016/s144046(06)60092-4.
7. Barclay, A. W., Augustin, L., Brighenti, F., Delport, E., Henry, C. J., Sievenpiper, J. L., Usic, K., Yuexin, Y., Zurbau, A., Wolever, T., Astrup, A., Bulló, M., Buyken, A., Ceriello, A., Ellis, P. R., Vanginkel, M. A., Kendall, C., La Vecchia, C., Livesey, G., Poli, A., … Brand-Miller, J. C. (2021). Dietary Glycaemic Index Labelling: A Global Perspective. *Nutrients*, *13*(9), 3244. https://doi.org/10.3390/nu13093244.
8. Bassuk, S. S., & Manson, J. E. (2005). Epidemiological evidence for the role of physical activity in reducing risk of type 2 diabetes and cardiovascular disease. *Journal of applied physiology (Bethesda, Md. : 1985)*, *99*(3), 1193–1204. https://doi.org/10.1152/japplphysiol.00160.2005.
9. Cooke, D. W., & Plotnick, L. (2008). Type 1 diabetes mellitus in pediatrics. *Pediatrics in review*, *29*(11), 374–385. https://doi.org/10.1542/pir.29-11-374
10. Craig, M. E., Hattersley, A., & Donaghue, K. C. (2009). Definition, epidemiology and classification of diabetes in children and adolescents. *Pediatric diabetes*, *10 Suppl 12*, 3–12. https://doi.org/10.1111/j.1399-5448.2009.00568.x
11. Davis, S.N. and Granner, D.K. (2001) Insulin, Oral Hypoglycemic Agents and the Pharmacology Endocrine Pancreas. In: Hardman, J.G. and Limbird, L.E., Eds., Goodman and Gilman's T Pharmacological Basis of Therapeutics, McGraw Hill, New York, 1526-1531.
12. Gaede, P., Lund-Andersen, H., Parving, H. H., & Pedersen, O. (2008). Effect of a multifactorial intervention on mortality in type 2 diabetes. *The New England journal of medicine*, *358*(6), 580–591. https://doi.org/10.1056/NEJMoa0706245.

13. Galtier F. (2010). Definition, epidemiology, risk factors. *Diabetes & metabolism*, *36*(6 Pt 2), 628–651. https://doi.org/10.1016/j.diabet.2010.11.014.

14. Islam, S. M., Niessen, L. W., Seissler, J., Ferrari, U., Biswas, T., Islam, A., & Lechner, A. (2015). Diabetes knowledge and glycemic control among patients with type 2 diabetes in Bangladesh. *SpringerPlus*, *4*, 284. https://doi.org/10.1186/s40064-015-1103-7.

15. Khanna etal ;(2016),Textbook of Nutrition and Dietetics,Elite Publishing,ISBN 978-81-88901-53-1.

16. Kohei KAKU;2010,Pathophysiology of type 2 diabetes and its treatment policy. JMAJ, 53(1):41-46.

17. Konduru et al.(2017). Diabetes related KAP study, Indian Journal of Pharmacy Practice, Vol 10, Issue 1, DOI: 10.5530ijopp.10.1.8.

18. LM Moodley & V Rambiritch (Associate Professor) (2007) An assessment of the level of knowledge about diabetes mellitus among diabetic patients in a primary healthcare setting, South African Family Practice, 49:10, 16-16d, DOI: 10.1080/20786204.2007.10873652.

19. Mohieldein, Abdelmarouf & Alzohairy, Mohammad & Hasan, Marghoob. (2011). Risk Estimation of Type 2 Diabetes and Dietary Habits among Adult Saudi Non-diabetics in Central Saudi Arabia. Global Journal of Health Science. 3. 123-133. 10.5539/gjhs.v3n2p123.

20. Mokdad, A. H., Ford, E. S., Bowman, B. A., Dietz, W. H., Vinicor, F., Bales, V. S., & Marks, J. S. (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *JAMA*, *289*(1), 76–79. https://doi.org/10.1001/jama.289.1.76.

21. Panagiotakos, D. B., Pitsavos, C., Chrysohoou, C., & Stefanadis, C. (2005). The epidemiology of Type 2 diabetes mellitus in Greek adults: the ATTICA study. *Diabetic medicine : a journal of the British Diabetic Association*, *22*(11), 1581–1588. https://doi.org/10.1111/j.1464-5491.2005.01731.x

22. Pragnesh Parmar1, Gunvanti B. Rathod2, Sangita Rathod3, Rahul Goyal2, Sachin Aggarwal2and Ashish Parikh4 (2014), Int.J.Curr.Microbiol.App.Sci.Vol.3(8)680-685, ISSN: 2319-7706.

23. Rathmann, W., & Giani, G. (2004). Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes care*, *27*(10), 2568–2569. https://doi.org/10.2337/diacare.27.10.2568

24. Sami, W., Alabdulwahhab, K. M., Hamid, M., Alasbali, T. A., Alwadani, F. A., & Ahmad, M. S. (2020). Dietary Attitude of Adults with Type 2 Diabetes Mellitus in the Kingdom of Saudi Arabia:A Cross-sectional study. *Medicina (Kaunas, Lithuania)*, *56*(2), 91. https://doi.org/10.3390/medicina56020091.

25. Sánchez-Taínta, A., Estruch, R., Bulló, M., Corella, D., Gómez-Gracia, E., Fiol, M., Algorta, J., Covas, M. I., Lapetra, J., Zazpe, I., Ruiz-Gutiérrez, V., Ros, E., Martínez-González, M. A., & PREDIMED group (2008). Adherence to a Mediterranean-type diet and reduced prevalence of clustered cardiovascular risk factors in a cohort of 3,204 high-risk patients. *European journal of cardiovascular prevention and rehabilitation : official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology*, *15*(5), 589–593. https://doi.org/10.1097/HJR.0b013e328308ba61

26. Savoca, M., & Miller, C. (2001). Food selection and eating patterns: themes found among people with type 2 diabetes mellitus. *Journal of nutrition education*, *33*(4), 224–233. https://doi.org/10.1016/s1499-4046(06)60035-3.

27. Shai, I., Schwarzfuchs, D., Henkin, Y., Shahar, D. R., Witkow, S., Greenberg, I., Golan, R., Fraser, D., Bolotin, A., Vardi, H., Tangi-Rozental, O., Zuk-Ramot, R., Sarusi, B., Brickner, D., Schwartz, Z., Sheiner, E., Marko, R., Katorza, E., Thiery, J., Fiedler, G. M., … Dietary Intervention Randomized Controlled Trial (DIRECT) Group (2008). Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. *The New England journal of medicine*, *359*(3), 229–241.

28. Standards of Medical Care in Diabetes—2012. *Diabetes Care* 1 January 2012; 35 (Supplement_1): S11–S63. https://doi.org/10.2337/dc12-s011.

29. Weinstein, M. C., Toy, E. L., Sandberg, E. A., Neumann, P. J., Evans, J. S., Kuntz, K. M., Graham, J. D., & Hammitt, J. K. (2001). Modeling for health care and other policy decisions: uses, roles, and validity. *Value in health : the journal of the International Society for Pharmacoeconomics and Outcomes Research*, *4*(5), 348–361. https://doi.org/10.1046/j.1524-4733.2001.45061.x