Dietary Pattern of Patients with Diabetic Dyslipidemia

Gehad M. Galal [*1], Manal Elsayed Ez Eldeen [2], Dalia G. Mahran [3]
[1] Department of Family Medicine, Faculty of Medicine, Assiut University, Assiut, Egypt.
[2] Department of Internal Medicine, Faculty of Medicine, Assiut University, Assiut, Egypt.
[3] Department of Public Health and Community Medicine, Faculty of Medicine, Assiut University, Assiut, Egypt.

[*]***Corresponding Author:*** Gehad M. Galal
E-mail: *gehad.m.galal20@aun.edu.eg*

Abstract:

Introduction: A large percentage of T2DM patients, roughly 72% to 85% have dyslipidemia. The American Diabetes Association recommends a number of eating habits that are appropriate for managing type 2diabetes and reducing body mass index.

Patients and Methods: A cross-sectional study included 215 patients with T2DM. The study was conducted from July 2022 to January 2023 in the diabetic unit at Assiut University Hospital. A personal interview questionnaire was used, including the socio-demographic characteristics, dietary habits, and physical activity.

Result: Patients who follow a strict diet and engage in regular exercise had reduced blood pressure, fasting blood glucose, body mass index, and blood profile, as well as fewer problems related to diabetes.

Conclusion: The results of the study demonstrate the beneficial relationships between dietary habits and body mass index and the problems of diabetes. Walking, frequent exercise, and a diet high in fiber all contribute to physical activity and the management of diabetes problems.

Keywords: Diet; Type 2 diabetes mellitus; Hyperlipidemia; Body mass index; Physical activity.

Introduction:

72%–85% of people with type 2 diabetes have dyslipidemia, which is a very common condition [1]. A variety of lipoprotein abnormalities, such as increased LDL, decreased HDL, and raised triglyceride levels, are indicative of this illness. About 70% of people with type 2diabetes experience it, making it especially frequent [2]. Reduced HDL cholesterol and elevated triglycerides are the primary quantitative lipid abnormalities in diabetic dyslipidemia [1].

Patients with type 2 diabetes can effectively manage their problems with non-pharmacologic therapies, including diet and exercise. Nonetheless, statin medication is also advised for every diabetic patient [3]. There are two types of treatment for diabetic dyslipidemia: non-pharmacological and pharmaceutical. Physical activity, weight loss, and medical nutrition therapy are examples of non-pharmacological treatment. DASH, or the Mediterranean diet, is advised by the American Diabetes Association [2].

In this study, we assessed the effects of food patterns and lifestyle choices on the body weight and lipid profile of type 2 diabetes patients. A balanced diet combined with exercise has been linked to improvements in BMI, lipid profiles, and fasting blood glucose levels, according to an earlier study.

Patients and Methods

Between July 2022 and January 2023, 215 type 2 diabetes patients from the diabetic unit and outpatient clinics at Assiut University Hospitals in Egypt participated in a cross-sectional study.

The American Diabetes Association's (ADA) criteria for type 2 diabetes (the

study's focus), age between 30 and 70 years old, ADA diagnosis, and lack of inflammatory disease were the inclusion criteria. The exclusion criteria were pregnancy (to prevent fetal difficulties by altering the fetal immunity), the presence of an infectious disease, and Type 1 diabetes (which is not the aim of our study).

Ethical Considerations:

The study adhered to the regulations of the University Ethical Committee (IRB No: 17101592).

Clinical Trials registration ID: NCT05128747

Data Collection:

The data were collected by using a questionnaire that was divided into four sections.

The first section included socio-demographic characteristics, such as name, age, sex, occupation, educational level, and marital status.

The second section includes personal behaviors, such as smoking, and dietary patterns, which were assessed using questions about the frequency of various items from an earlier study [4]. The questionnaire was then divided into two primary dietary groups: unhealthy food (snacks) and healthy food (carbohydrates, dairy products, fish products, vegetables, and fruits). Physical activity behaviors: According to a prior study[5], inquiries are made on the amount of time spent engaging in physical activity, whether or not effort is put forth in work, and whether or not walking exercise is done.

The third section comprises the following: medical history: what kind of diabetes, how long it lasted, how it was treated, and whether there were any problems from the diabetes; whether hypertension was present or not, how long it lasted, and how it was treated were also recorded. It also covered the existence or lack of further illnesses.

The final portion contained: **Overall assessment: A-Measuring anthropometric parameters:**

1. Weight: using a digital scale, the participant's weight is recorded while they are standing with their legs together and wearing light clothing. The scale was set up on a level, stable surface, and the repeatability was checked.

2-Height: The stadiometer was used to measure it while the patients were standing with their legs together and upright. By dividing the body weight in kilograms (kg) by the square of the expected body height in meters (m), one can get their BMI[6].BMI measurements for patients were taken in a separate area with the nurse's help. Additionally, they are classified as underweight (BMI<18.5), healthy weight (18.5 - 24.9), overweight (14.5 - 29.9), and obese (= 30.0), 2-Pulse frequency (bpm).

3-Blood pressure: A mercury sphygmomanometer is used to take blood pressure. After the patient had rested for at least five minutes, the blood pressure was measured while the patient was sitting and from the right arm. According to WHO [7], the systolic blood pressure was measured at the first audible Korotkoff sound, and the diastolic blood pressure was measured up to the point where the sound stops.

B-Laboratory Investigations:

1- Fasting blood sugar: Participants who have fasted for at least eight hours have a blood sample taken to measure their fasting plasma glucose (FPG) levels.

Normal fasting blood glucose concentrations are estimated to range from 70 mg/dL (3.9 mmol/L) to 100 mg/dL (5.6 mmol/L). Changes in lifestyle and glycemia monitoring are advised when fasting blood glucose levels range from 100 to 125 mg/dL (5.6 to 6.9 mmol/L). Diabetes is diagnosed if the fasting blood glucose level is 126 mg/dL (7 mmol/L) or greater on two different occasions. A person who has hypoglycemia or low fasting blood glucose is defined as having less than 70 mg/dL (3.9 mmol/L) [8].

2- CBC: Every participant's hemoglobin level was measured, and the results were interpreted using the guidelines provided by Kathleen Deska Pagana, Timothy J. Pagana, and Theresa Noel Pagana in Mosby's® Diagnostic and Laboratory Test Reference, 15th Edition, 2021. The following are the reference ranges for adult hemoglobin (Hb) concentrations:

- 14–18 g/dL for men and 12–16 g/dL for women.
- Female pregnant: >11 g/dL; • Elderly: slightly lower values

3-Lipid profile: Triglycerides (TG), LDL cholesterol (bad cholesterol), and HDL cholesterol (good cholesterol) are commonly measured as part of the lipid profile [62].

4-CRP: (C-reactive protein)**:** Was evaluated for each patient, and the results were interpreted as follows in accordance with the American Heart Association:

- If your CRP is less than 1.0 mg/L, your risk of cardiovascular disease development is low.
- If your levels fall between 1.0 mg/L and 3.0 mg/L, you have an average risk of cardiovascular disease.
- If your level of CRP is greater than 3.0 mg/L, you are at a higher risk of developing cardiovascular disease.

Notably, the latter half of pregnancy and the use of birth control pills (oral contraceptives) can also result in positive CRP readings.

Statistical Analysis:

The Statistical Package for Social Science (IBM SPSS Inc., Chicago, version 21) was used for all statistical computations. Frequency and percentage representations of qualitative variables. The relationship between the qualitative variables will be investigated using the Chi-square test or Fisher's exact test. Quantitative information that is displayed using the mean and standard deviation. When comparing quantitative data between two groups, the Student t-test or the Mann-Whitney U test was used. The Pearson correlation coefficient was used to investigate relationships between the variables. Evaluation of the "P" value at the significance level indicates a significant value of $P < 0.05$.

Results:

Sample Characteristics:

The current study included 215 patients with type 2 DM. The study included 78.1% female patients and 21.8% male patients. Regarding the socio-demographic characteristics of the studied group, the majority of the group was married. As regards education level, 72 (36%) patients of the studied group were illiterate, while 51 (23.7%), 66 (30.6%), and 24 (11.1%) patients had primary, secondary, and university level of education, respectively. Other detailed socio-demographic data of the studied participants were summarized in **(Table 1).**

Table (1): Baseline socio-demographic characteristics of the participant diabetic patients at Assiut University Hospital (2022-2023):

	Total (n=215)
Age (years)	48.34 ± 8.33
Sex	
Male	168 (78.1%)
Female	47 (21.8%)
Education	
Illiterate	72 (33.48%)
Read& write	2 (0.9%)
Primary school	51 (23.7%)
Secondary school	66 (30.6%)
University/above	24 (11.1%)
Occupation	
Farmer	5 (2.3%)
Housewife	47(21.8%)
Worker	111 (51.6%)
Employee	35 (16.2%)
None	17 (7.9%)
Marital status	
Married	201 (93.4%)

Single	8 (3.7%)
Widow	4 (1.8%)
Divorced	2 (0.9%)
Smoking	14 (6.5%)

According to the disease characteristics of the studied group, it was found that 85 (39.5%) patients had hypertension. The majority of patients were treated with oral agents only **(Table 2).**

Table (2): Baseline disease characteristics of participant diabetic patients at Assiut University Hospital (2022-2023)

	Total (n= 215)
Duration of disease (years)	7.90±1.22
Therapy	
Oral agent	100 (46.5%)
Insulin	50 (23.2%)
Oral and insulin	65 (30.2%)
Hypertension	85 (39.5%)

According to the food recall sheet, the details for diabetic patients were provided in **Table 3**.

Table (3): Food recall sheet of the participant diabetic patients at Assiut University Hospital (2022 – 2023)

	Total (n= 215)
Number of daily meals	3.33 ± 0.44
Fruit/day	1.11 ± 0.46
Vegetable/day	1.44 ± 0.39
Dairy milk/day	1.63 ± 0.56
Carbohydrate/day	1.90 ± 0.54
Meats/day	0.94 ± 0.46
Fish/day	0.83 ± 0.47
Chicken/day	2.01 ± 0.55

Data expressed as mean (SD).

Regarding physical activity among diabetic patients, the number of patients practicing exercise was 115 (53.5%); other details about physical activity are demonstrated in **(Table 4).**

Table (4): Physical practice of the participant diabetic patients at Assiut University Hospital (2022 -2023)

	Total (n= 215)
Practice exercise	115 (53.5%)
Working hours	4.99 ± 3.01

Walking days/week	3.18 ± 1.54
Walking minutes/day	35.55 ± 7.09

Data expressed as mean (SD).

Regarding Examination and BMI, the mean body mass index was 34.45 ± 5.18 kg/m^2) **(Table 5).**

Table 5: Examination and body mass index among diabetic patients

	Total (n= 215)
Body mass index (kg/m^2)	34.45 ± 5.18
Systolic blood pressure (mmHg)	128.99 ± 15.67
Diastolic blood pressure (mmHg)	79.40 ± 8.51

Data expressed as mean (SD).

Regarding laboratory data among diabetic patients: mean HDL (41.88 ± 10.53 (mg/dl), mean LDL (130.40 ± 18.90 (mg/dl), and the mean of TGs (196.78 ± 14.14 (mg/dl) **(Table 6**).

Table 6: Laboratory data among diabetic patients

	Total (215)
C-reactive protein (mg/dl)	1.45 ± 0.45
Fasting blood sugar (mg/dl)	172.34 ± 66.17
HDL (mg/dl)	41.88 ± 10.53
LDL (mg/dl)	130.40 ± 18.90
TG (mg/dl)	196.78 ± 14.14

Data expressed as mean (SD). HDL: high-density lipoproteins; LDL: low-density lipoproteins; TGs: triglycerides

Discussion:

Compared to non-diabetics, persons with type 2 diabetes generally have greater plasma lipid levels; in patients with "poor" diabetic management, this anomaly is exacerbated. This relationship exists for a number of reasons. First, changes in the level of diabetic control have varying effects on plasma lipoprotein metabolism because insulin is crucial in regulating the metabolism of intermediate lipids. Second, a lot of T2DM patients have obesity, and hyperlipidemia can arise from obesity. Third, although being distinct hereditary illnesses, diabetes and hyperlipidemia are both prevalent in the population, and it is possible for the two conditions to occur coincidentally in the same person[10].

This cross-sectional study aims to investigate the dietary patterns of T2DM patients at the university hospital's diabetic unit, as well as the function that nutrition plays in managing dyslipidemia and physical activity in T2DM patients. The work field was established in July 2022 and ran through January 2023.

In the study, there were 72 patients (67.3%) who were illiterate, 51 patients (47.4%) who had some preparatory education, and 66 patients (61.2%) who had secondary education. There were 14 (13.1%)

smokers in total in the research. According to the study, patients who maintain a balanced diet and engage in regular physical activity saw greater improvements in their fasting blood glucose and BMI.

A substantial relationship between physical activity and a balanced diet was discovered, and these findings were consistent with. According to Esposito's (2011) research, diet regimens lasting longer than six months and involving energy restriction (-3.88 kg) or increased physical activity (-4.01 kg) had a stronger impact on body weight [11].

According to the study, following a diet plan resulted in a considerable drop in body mass index. Consistent with the current discovery, Ajala et al. [12], [13] found that a balanced diet was useful in helping people with type 2 diabetes lose weight.

After a year of follow-up, a post hoc analysis of the PREDIMED (Prevención con Dieta Mediterránea) trial revealed that a balanced diet was linked to a significant decrease in body weight for T2D patients[14]. Furthermore, a meta-analysis by Esposito et al.[11] evaluated the impact of a balanced diet on weight control in individuals with a range of co-morbidities and discovered that it significantly lowered body weight and BMI. Its advantageous impact on weight loss could be attributed to the large variety of plant-based meals that are high in dietary fiber and low in carbohydrates [15].

In line with certain clinical studies by S. Witkow et al., who indicate that a balanced food regimen considerably improves fasting blood glucose in T2DM patients, our investigation demonstrated that only the individuals with diabetes who followed a balanced diet showed a reduction in their fasting plasma glucose levels (32.8 mg per deciliter)[16].

The mechanisms behind these correlations most likely involve consuming fewer red and processed meats and more beneficial nutrients.

The primary diet staples include monounsaturated fatty acids, such as olive oil, and other health-promoting foods like fruits, vegetables, and whole grains[17].

Conversely, the diet's limited consumption of red and processed meat helps to lower dietary cholesterol and saturated fat intake, which improves body weight, lipid profile, and glucose metabolism[18].

The study discovered that following a diet plan, the lipid profile significantly improved. These findings were consistent with a study that demonstrated how a balanced diet significantly improved lipid particle (TG) levels in T2DM patients [19]. Additionally, a number of studies have shown that specific dietary plans can raise HDL cholesterol levels by 3–15% while lowering total and LDL cholesterol levels by 5–15%[20],[21].

Additionally, research has shown that in overweight dyslipidemic patients without type 2 diabetes, a balanced diet by itself dramatically lowered LDL cholesterol levels, TC, waist circumference, and BMI [19]. However, recent research revealed that T2DM patients did not benefit from a balanced diet in terms of BMI or waist circumference. These results are in line with prior studies that found weight reduction regimens to be less successful in treating T2DM in patients who are overweight or obese [22], [23], [24].

Conclusions:

Patients with diabetes have changed the foods they eat, eating more fruits and vegetables every day and eating more fish every week. It has been demonstrated that type 2 diabetic patients who eat a balanced diet have lower fasting blood glucose levels and a lower body mass index. Additionally, in individuals with dyslipidemia, a balanced diet and physical exercise have led to a considerable decrease in LDL and triglyceride levels as well as an increase in HDL.

List of Abbreviations:

(TG): triglycerides, (LDL): low density lipoprotein, (HDL): high density lipoprotein, (BMI): body mass index, (T2DM): type 2 diabetes mellitus.

Ethical Considerations:

The study adhered to the regulations of Assiut University's Ethical Committee and was approved by the committee with approval number (IRB No: 17101592).

Informed consent was obtained from the participants, including the objectives, benefits, and confidentiality of the study.

Consent for Publication:

Not applicable

Availability of data and materials:

The data sets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests:

The authors declare that they have no competing interests.

Funding:

This work didn't receive any funding.

Authors' Contributions:

Authors (Gehad M.Galal, Manal Elsayed Ez Eldeen, Dalia G. Mahran) contributed equally in the study. All authors have read and agreed to the submitted version of the manuscript.

Acknowledgment:

The authors would like to thank all patients with type 2 diabetes who have participated in the study.

References:

1. Vergès B. Pathophysiology of diabetic dyslipidaemia: where are we? Diabetologia. 2015;58(5):886-99.
2. Jialal I, Singh G. Management of diabetic dyslipidemia: an update. World J Diabetes. 2019;10(5):280-90.
3. Bahiru E, Hsiao R, Phillipson D, Watson KE. Mechanisms and treatment of dyslipidemia in diabetes. Curr Cardiol Rep. 2021;23(4):26.
4. [Article title not provided]. Research Progress on Non-Drug Treatment for Blood Glucose Control of Type 2 Diabetes Mellitus. 2018:1-5.
5. American College of Sports Medicine, American Diabetes Association. Exercise and type 2 diabetes: American College of Sports Medicine and the American Diabetes Association: joint position statement. Med Sci Sports Exerc. 2010;42(12):2282-303.
6. Peterson CM, Thomas DM, Blackburn GL, Heymsfield SB. Universal equation for estimating ideal body weight and body weight at any BMI. Am J Clin Nutr. 2016;103(5):1197-203.
7. Saugel B, Kouz K, Meidert AS, Schulte-Uentrop L, Romagnoli S. How to measure blood pressure using an arterial catheter: a systematic 5-step approach. Crit Care. 2020;24(1):172.
8. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2009;32(Suppl 1):S62-7.
9. Friday KE. Specialized lipid profiles. Curr Atheroscler Rep. 2002;4(5):359-62.
10. Dunn FL. Hyperlipidemia and diabetes. Med Clin North Am. 1982;66(6):1347-60.
11. Esposito K, Kastorini CM, Panagiotakos DB, Giugliano D. Mediterranean diet and weight loss: meta-analysis of randomized controlled trials. Metab Syndr Relat Disord. 2011;9(1):1-12.
12. Ajala O, English P, Pinkney J. Systematic review and meta-analysis of different dietary approaches to the management of type 2 diabetes. Am J Clin Nutr. 2013;97(3):505-16.
13. Huo R, Du T, Xu Y, et al. Effects of Mediterranean-style diet on glycemic control, weight loss, and cardiovascular risk factors among type 2 diabetes individuals: a meta-analysis. Eur J Clin Nutr. 2015;69(11):1200-8.
14. Lasa A, Miranda J, Bullo M, et al. Comparative effect of two Mediterranean diets versus a low-fat diet on glycaemic control in individuals with type 2 diabetes. Eur J Clin Nutr. 2014;68(7):767-72.
15. Buckland G, Bach A, Serra-Majem L. Obesity and the Mediterranean diet: a systematic review of observational and

intervention studies. Obes Rev. 2008;9(6):582-93.
16. Shai I, Schwarzfuchs D, Henkin Y, et al. Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. N Engl J Med. 2008;359(3):229-41.
17. Ortega RM. Importance of functional foods in the Mediterranean diet. Public Health Nutr. 2006;9(8A):1136-40.
18. Micha R, Wallace SK, Mozaffarian D. Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus: a systematic review and meta-analysis. Circulation. 2010;121(21):2271-83.
19. Sartore G, Burlina S, Ragazzi E, Ferraresso S, Valentini R, Lapolla A. Mediterranean diet and red yeast rice supplementation for the management of hyperlipidemia in statin-intolerant patients with or without type 2 diabetes. Evid Based Complement Alternat Med. 2014;2014:432141.
20. Estruch R, Martínez-González MA, Corella D, et al. Effects of a Mediterranean-style diet on cardiovascular risk factors: a randomized trial. Ann Intern Med. 2006;145(1):1-11.
21. Vincent-Baudry S, Defoort C, Gerber M, et al. The Medi-RIVAGE study: reduction of cardiovascular disease risk factors after a 3-month intervention with a Mediterranean-type diet or a low-fat diet. Am J Clin Nutr. 2005;82(5):964-71.
22. Campos GM, Rabl C, Mulligan K, et al. Factors associated with weight loss after gastric bypass. Arch Surg. 2008;143(9):877-83.
23. Khan MA, St Peter JV, Breen GA, Hartley GG, Vessey JT. Diabetes disease stage predicts weight loss outcomes with long-term appetite suppressants. Obes Res. 2000;8(1):43-8.
24. Baker ST, Jerums G, Prendergast LA, Panagiotopoulos S, Strauss BJ, Proietto J. Less fat reduction per unit weight loss in type 2 diabetic compared with non-diabetic obese individuals completing a very-low-calorie diet program. Metabolism. 2012;61(6):873-82.