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METHODS

The role of diet therapy and ECG monitoring in preventing cardiovascular diseases in diabetes mellitus: A review

Itra Singh*, Neha Rastogi and Rahul Rastogi

Agatsa Software Pvt. Ltd., Noida, India

***Correspondence:**
Itra Singh,
itra.singh@agatsa.com

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Background: Diabetes increases the risk of cardiovascular diseases. Corrective diet and Regular ECG monitoring can be used as a tool for prevention and timely diagnosis.
Introduction: Diabetes increases the risk of atherosclerosis, which is associated with Acute coronary syndrome. Almost 25 to 30% of patients who have ACS also have diabetes (1). Acute Coronary syndrome (ACS) represents a group of diseases with abnormal S T elevations, which is detectable through ECG graphs. Patients with diabetes frequently exhibit dyslipidemia, which is an abnormal level of 1 or more types of fat in blood, which over time can lead to vascular abnormalities (2). High concentration of serum- Low-Density Lipoproteins (LDL) indicates a tendency for clot formation. High Concentration of these fatty acids in the blood is largely a consequence of the unhealthy dietary habits of diabetic patients apart from the metabolic disorder itself.
Method: Search engines for example PUBMED and GOOGLE SCHOLAR were explored to find out the evidence in the given respect for past 10 years. Only English language studies were included.
Result and Discussions: Significant relationship has been established by previous research studies, suggestive of the coincidence of dyslipidemia in diabetic people ultimately associated with an increased risk of heart attack. Regular Electrocardiogram monitoring and a remedial diet are highly advisable to avoid cardiac emergencies in the diabetic population.

Keywords: diabetes, cardiovascular disease, dyslipidemia, Diet, ECG

Introduction

Diabetes mellitus (DM) is a metabolic condition marked by unnecessarily high blood glucose levels. Type 1, Type 2, maturity-onset diabetes of the young (MODY), gestational diabetes, neonatal diabetes, and other types of DM are among them (3). Heart failure is one of the most incapacitating cardiovascular problems that diabetes patients are predisposed to, in terms of prognosis. An epidemic of diabetes-related heart failure has emerged due to the rising prevalence of diabetes worldwide and the aging population (4). According to estimates, 10–11% of all vascular deaths are caused by heart disease, which is still a leading cause of morbidity and mortality in type 2 diabetes (5). Developing countries have a higher prevalence of non-communicable diseases as compared to other regions (6). It has been predicted that by 2040, 642 million individuals would have diabetes mellitus worldwide against 536 million in 2021 (7, 8). The primary risk factor for major health conditions, such as non-communicable illnesses, may be uncontrolled high blood sugar levels (9). In the current global-scenario, it is very important to understand the associated risk of both diseases, diabetes and cardiovascular disease.

Methodology

A literature survey was done on PUBMED and GOOGLE SCHOLAR using the key words “DIABETES AND CARDIOVASCULAR DISEASES,” ”DIABETES AND

DYSLIPIDEMIA," "ACUTE CORONARY SYNDROME AND ECG," "DIET IN DIABETES," 'DIET IN CARDIOVASCULAR DISEASE." Only books and documents, clinical trials, and randomized control trials in the past 10 years were included. Systematic reviews, meta-analyses, and review reports were excluded as these are considered as the secondary source of data and in this study, we were considering primary source of data only which are helpful to ensure the qualitative research and to avoid biasness toward pre-existed hypothesis. A total of 233 articles were found and 20 met the criteria and reviewed. OPEN AI (GPT-3) has been used selectively in the simplification of statistical analysis of the reviewed literature, to convert the given data analysis in a simplified manner to extract the information. There is no conflict of interest and this review is not sponsored.

Inclusion criteria

- Primary source of data-Original Research, Clinical Trials, and Randomized Controlled Trials.
- Study covered under the period of 10 years.

Exclusion criteria

- Drug intervention study.
- Secondary data information-review, systematic review, meta-analysis to avoid the biasness toward a hypothesis.
- Surgical intervention study.
- Study including critically ill patients.

Result and discussion

1. Cardiovascular manifestation of Diabetes Mellitus-Diabetes and heart failure (HF) are two conditions that are related to one another. Even in the absence of additional HF risk factors including coronary artery disease and hypertension, HF is more common in those with diabetes (10). Heart failure and diabetes have a complicated and reciprocal interaction. Nevertheless, the presence of cardiomyopathy solely related to diabetes has been the topic of debate because, among other things, there isn't a widely accepted definition. Additionally, there is no universal agreement on the pathophysiological findings required for the description of cardiomyopathy due to diabetes or its types (11). Clinical and experimental evidence is mounting that diabetics experience a heart muscle condition separate from atherosclerotic coronary artery disease (12). ACCORD-Action to Control Cardiovascular Risk in Diabetes Trial was a randomized, multicenter study that enrolled 10,251 middle-aged diabetic patients at risk of CVD. Participants were split up into the Overarching Glycemia Trial, the Blood Pressure Trial, and the Lipid-profile Trial. These studies evaluated the impact of therapies on different cardiovascular risk factors in diabetics. The mean age of the subjects was 62 throughout all trials, and they were disproportionately female, mostly White, and had a range of educational backgrounds. BP Trial participants had greater mean systolic and diastolic blood pressure levels than those in the other studies, indicating variances in cardiovascular health measures. The usage of antihypertensive drugs varied little among the trials. The greatest values of mean LDL-C were seen in the BP Trial, while lipid profiles exhibited variability in mean LDL-C levels. Men had higher levels of HDL-C than women did. Participants shared similar median and mean triglyceride levels across trials. Statin usage, which affects lipid levels, was largely constant across trials. Biochemical measurements including mean serum creatinine and potassium levels were comparable across trials, indicating a constant biochemical condition at baseline. Overall, despite some changes in cardiovascular risk variables between the study arms, participant baseline characteristics showed some recurrent patterns. For analyzing the trial data and evaluating the efficacy of the therapies used in the ACCORD study, it is essential to understand these baseline characteristics (13).
2. Dyslipidemia in Diabetes and associated diagnosis of Cardiovascular Diseases:

Metabolic dyslipidemia was linked to greater risks of CVD events in big diabetic sample size with BMI > 24. Type 2 diabetes (T2DM) is characterized by significantly high prevalence of metabolic dyslipidemia. Regular Monitoring of lipid profile can give a better understanding of the trends of lipoproteins in blood. Spikes in LDL or triglycerides can be managed by dietary modification and medicines. In the look-ahead study, 4,199 diabetic participants having a mean age of 58.4 years (62% women) were assessed through lipid profile and followed for 9.5 years for the cardiovascular risk assessment. The results show the prevalence incidence percentage as-

- n-TG and n-HDL: 26.4%,
- h-TG and n-HDL: 11.6%,
- n-TG and l-HDL: 22.5%,
- h-TG and l-HDL (metabolic dyslipidemia): 39.5%.

Of these, 500 patients were detected with composite cardiovascular diseases, 396 with coronary artery diseases (CAD), 423 had coronary artery disease without stroke, and 100 experienced strokes (11).

3. Preventive measures:

A. Foods to be recommended-For Vegetarians-diet therapy

- Whole grains pulses should be included in the diet as these are rich sources of fiber, having lower glycemic index than refined cereals. The husk of whole grain cereal & pulses contains Thiamine. Example-wheat, oats, sorghum, barley, pearl millet, and quinoa. Whole pulses include chickpeas, kidney beans, chickpea flour, red lentil, soybean (14).
- Saturated fats like coconut oil, butter, lard, and palm oil, have some very deleterious health effects. Try to stick with the 5:2 rule, i.e., in a week, no saturated fat (butter, cream, lard, and coconut oil) for 5 days and 2 tsp. saturated fat (butter, cream, lard, and coconut oil) in a day for 2 days. Recommended Cooking oils-olive, mustard, rice bran, canola (30 ml/day). A total of one handful of unsalted nuts 10 almonds, 10 pistachios, and two walnuts every day is advisable 1tsp (5 g) of flax seeds and chia seeds should also be taken daily (15).
- Heart-friendly foods include green leafy veggies. Make sure you consume 50 g or 100 g of green leafy vegetables every day or three times a week. A total of 150 g salad cucumber, onions, tomato, and lettuce as a mid-meal snack can be very helpful to add fiber to the diet, and also to avoid overeating.(16) A fibrous diet is helpful in maintaining healthy weight. Fruits 150 to 200 g apple/papaya/guava/blueberries/pear/melons/to be taken daily.

B. For Non-vegetarians

- If the lipid profile is normal, six eggs per week can be taken.
- Two servings of low-fat chicken (150 grams each serving) or 2–4 servings (150 g per serving) of freshwater fish- salmon, mackerel, trout, tuna, and Katla per week is recommended (17).

C. Foods to stay away from:

- It includes jams, jellies, marmalade, honey, maple syrup (used in pancakes and pastries), sugar, jaggery, sugarcane, and jams. High Fructose Corn Syrup (HFCS) is used in sweetened breakfast cereals like cornflakes, Krispies, tetra packs for sweetened milk, and sweetened beverages like fruit juices, fudge, and toffees packed.
- Sweet bakery items cakes, biscuits, sweet pieces of bread, cookies, etc.
- Aerated beverages, fruit juices, pancake syrup, tinned fruits, etc.
- Saturated fats [ghee, butter, coconut oil, palm oil, cheese, and trans fats (reheating oil, majority of outside fried foods) saturated fat containing non-veg. Food Mutton, pork, and bacon should not be consumed (red and processed meat)].
- Regular ECG Monitoring

Acute Coronary syndrome comprises multiple conditions including ST-elevation myocardial infarction (STEM), non-ST elevation myocardial infarction (NSTEM), and unstable angina. ACS is responsible for 1/3 of deaths in people of mid-thirties. Some forms of Chronic Heart Disease (CHD) may not show any symptom but ACS always shows (18). Cardiovascular mortalities are the highest in numbers, globally. The approximate number of CVD was 271 million in 1990, which increased two folds to 523 million in 2019, worldwide. Whereas, the deaths due to cardiovascular diseases raised steadily from 12.1 million in 1990 to 18.6 million in 2019 (19). Most of such cardiovascular mortalities are preventable with early detection and timely intervention. ECG is the widely used imaging tool helping in detecting ACS (19). In diabetes, it becomes really important to monitor the cardiac health. For this, ECG at every 6 months is advisable.

Conclusion

The purpose of this review was to assess the relation between diabetes and onset of cardiovascular diseases. The results show that diabetic patients are at higher risk of developing dyslipidemia and eventually cardiac diseases. The correlation between dyslipidemia in diabetes and an elevated risk of heart attack has been demonstrated in this paper. The de-arranged lipid profile increases the risk of atherosclerosis many folds (20). To reduce the risk of cardiac crises in the diabetic population, regular electrocardiogram monitoring and dietary intervention are strongly recommended. Foods rich in fiber, mono and poly-unsaturated fatty acids, antioxidants, polyphenols, and protein have a protective and anti-inflammatory action on the tissues, which prevents oxidative damage as well as inhibits bad cholesterol deposition. Very often, coronary artery diseases remains asymptomatic in diabetic patients due to sensitive neuropathy (21). Regular complication assessment such as ECG, ECHO along with biochemical investigation is highly advisable by the healthcare providers to keep a check on cardiac health.

Author contributions and acknowledgment

I am thankful to NR and RR, the founders of Agatsa Software Pvt. Ltd., a med tech organization making portable ECG devices. Mrs. and Mr. Rastogi not only encouraged me to undertake the publication journey of Agatsa but also took social responsibility after developing diagnostic devices. Portable ECG devices are easy to use, quick, and accurate in interpretations and bridging the gap between a doctor and a patient in need of the hour and leading

to the timely diagnosis of atrial coronary syndromes. It is our collective responsibility to make society aware of such innovation since these days ECG usage is just not limited to cardiac patients; it can be used as a tool for those who are at risk and undiagnosed yet such as diabetic patients. Through this literature, we are trying to make the point that someone who has diabetes is already standing on the edge of cardiovascular disease precipitation. Remedial diet, exercise, and Regular ECG and ECHO monitoring along with lipid profile assessment are necessary for the prevention. Thanks to Mr. and Mrs. Rastogi for having faith in my knowledge and for allowing me to represent Agatsa.

References

1. Babes E, Bustea C, Behl T, Abdel-Daim M, Nechifor A, Stoicescu M, et al. Acute coronary syndromes in diabetic patients, outcome, revascularization, and antithrombotic therapy. *Biomed Pharmacother.* (2022) 148:112772.
2. Yuan Y, Chen W, Luo L, Xu C. Dyslipidemia: Causes, Symptoms and Treatment International Journal of Trend in Scientific Research and Development (IJTSRD) Dyslipidemia: Causes, Symptoms and Treatment. *IJTSRD.* (2021) 5:1–4.
3. Dermatol D. Full text links. (2015) 12:8–9.
4. Ritchie R, Abel. Basic mechanisms of diabetic heart disease. *Circ Res.* (2020) 126:1501–25.
5. Barrett-connor E, Wingard D, Wong N, Goldberg R, Cowie C, Casagrande S, et al. Heart Disease and Diabetes. 3rd ed. In: Barrett-connor E, Wingard D, Wong N, Goldberg R, Cowie C, Casagrande S editors. *Diabetes in America*. Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases (2018).
6. Reynisdottir S, Ellerfeldt K, Wahrenberg H, Lithell H, Arner P. Multiple lipolysis defects in the insulin resistance (metabolic) syndrome. *J Clin Invest.* (1994) 93:2590–9.
7. Lorenzo-Almorós A, Cepeda-Rodrigo J, Lorenzo Ó. Diabetic cardiomyopathy [Miocardiopatía diabética]. *Rev Clin Esp.* (2022) 222:100–11.
8. Bereda G. Mini Review Pitfall Factors of Non Communicable Diseases: Current Furtherances and here after Point of View. *Qual Primary Care.* (2022) 29:146–9.
9. World Health Organization. *Non-communicable diseases key facts by WHO. News-room [Internet]*. Geneva: WHO (2022).
10. Oktay A, Aktürk H, Paul T, Keefe J, Hector O. *Diabetes, Cardiomyopathy, and Heart Failure*. South Dartmouth, MA: MDText.com, Inc (2020).
11. Bereda G. Clinical Management of Gestational Diabetes Mellitus. *J Diabet Nephrop Diabetes Manag.* (2022) 1:1–10.
12. Balducci S, Sacchetti M, Haxhi J, Orlando G, D'Errico V, Fallucca S, et al. Physical Exercise as therapy for type II diabetes. *Diabetes Metab Res Rev.* (2014) 32:13–23.
13. Buse J, Friedewald W, Bigger J, Byington R, Cushman W, Genuth S, et al. Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial: Design and methods. *Am J Cardiol.* (2007) 99:21i–33i.
14. Tighe P, Duthie G, Vaughan N, Brittenden J, Simpson W, Duthie S, et al. Effect of increased consumption of whole-grain foods on blood pressure and other cardiovascular risk markers in healthy middle-aged persons: A randomized controlled trial. *Am J Clin Nutr.* (2010) 92:733–40.
15. Pigsborg K, Gürdeniz G, Rangel-Huerta O, Holven K, Dragsted L, Ulven S. Effects of changing from a diet with saturated fat to a diet with n-6 polyunsaturated fat on the serum metabolome in relation to cardiovascular disease risk factors. *Eur J Nutr.* (2022) 61:2079–89. doi: 10.1007/s00394-021-02796-6
16. Bergeron N, Chiu S, Williams P, King M, Krauss R. Effects of red meat, white meat, and nonmeat protein sources on atherogenic lipoprotein measures in the context of low compared with high saturated fat intake: a randomized controlled trial. *Am J Clin Nutr.* (2019) 110:24–33.
17. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. *J Am Coll Cardiol.* (2020) 76:2982–3021.
18. Khazaeni B, Khazaeni L. Pathophysiology Treatment/Management. *Natl Libr Med Natl Institutes Heal.* (2022) 9:5–9.
19. Birnbaum Y, Nikus K, Kligfield P, Fiol M, Barrabés J, Sionis A, et al. The role of the ECG in diagnosis, risk estimation, and catheterization laboratory activation in patients with acute coronary syndromes: A consensus document. *Ann Noninvasive Electrocardiol.* (2014) 19:412–25.
20. Poznyak A, Grechko AV, Poggio P, Myasoedova V, Alfieri V, Orekhov A. The diabetes mellitus–atherosclerosis connection: The role of lipid and glucose metabolism and chronic inflammation. *Int J Mol Sci.* (2020) 21:1–13.
21. Kittnar O. Electrocardiographic changes in diabetes mellitus. *Physiol Res.* (2015) 64:S559–66.
22. Kaze A, Santhanam P, Musani S, Ahima R, Echouffo-Tcheugui J. Metabolic dyslipidemia and cardiovascular outcomes in type 2 diabetes mellitus: Findings from the look ahead study. *J Am Heart Assoc.* (2021) 10:e016947.