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EFFECT OF NON PHARMACOLOGICAL INTERVENTION ON DIABETIC COMPLICATION IN PATIENT WITH TYPE 2 DIABETES MELLITUS: A SYSTEMATIC REVIEW

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Abstract

Because of this, doctors and other healthcare professionals face the challenge of treating a significant number of diabetic patients in their day-to-day clinical practice. Because of this, it is imperative for them to be equipped with the knowledge and skills necessary to deal with situations such as these. Type 1 diabetes mellitus, commonly known as T1DM, and type 2 diabetes mellitus are the most prevalent kinds of diabetes that are diagnosed in clinical settings. Other forms of diabetes, such as gestational diabetes, are less common (also known as T2DM). Nevertheless, there is a very small percentage of people who also suffer from other forms of diabetes. Some of the lifestyle changes that are believed to be helpful in preventing type 2 diabetes mellitus or delaying the onset of the condition include eating a healthy, well-balanced diet, keeping a healthy body weight, engaging in regular physical activity, breaking the habit of leading a sedentary lifestyle, and staying away from tobacco use. Findings from the Diabetes Prevention Program (DPP) suggest that obtaining and keeping a healthy weight is one of the most essential things that can be done to lower one's risk of acquiring diabetes. Patients diagnosed with diabetes mellitus have access to a variety of non-pharmacological intervention strategies, including changes in their diet and lifestyle, which can be used to help reduce the risk of diabetic complications. The patient education that is provided can also be incorporated into reminders for the patient.

Keyword: *Complication; Diabetes Mellitus; Lifestyle; Non-pharmacologycal*

INTRODUCTION

The figures provided by the International Diabetes Federation (IDF) indicate that the condition affects one in every 11 persons around the globe, making the total number of people who are affected by the disease 425 million.[1] It is anticipated that the prevalence of diabetes will rise at an exponential rate over the course of time as a direct result of the epidemic of obesity that is currently sweeping the globe and is linked to unhealthy eating habits and a lack of physical activity.[2]

As a result, doctors and other healthcare professionals have the problem of treating a large number of diabetic patients in their day-to-day clinical practice, and they are required to have the knowledge and abilities in order to deal with instances like these. In clinical practice, the most common forms of diabetes that are diagnosed are type 1 diabetes mellitus (also known as T1DM) and type 2 diabetes mellitus (also known as T2DM). However, a tiny minority of patients also suffer from other types of diabetes.[3,4]

The goal of proper diabetes management is to achieve adequate control of plasma glucose levels within the normal physiological reference range, just as they would be in a healthy person who does not have diabetes, but without putting the patient at danger for hypoglycemia. Plasma glucose levels that are considered normal in a healthy individual are dependent on the food intake from the diet, the amount of physical activity the person gets, and the hormones that control glucose homeostasis, particularly insulin.[2,5]

As a result, the therapy of diabetes should focus on nutritional interventions, changes in lifestyle that include physical activity, and hormonal modulation (mostly insulin) and/or its effects. This article provides a summary of the various non-pharmacological strategies that can be used for the efficient management of diabetic patients.[6,7] This study presented evidence that non pharmacological intervention on diabetic complication in patient with type 2 diabetes mellitus.

METHODS

Protocol

We followed to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 checklist throughout the entire process of conducting this systematic review. On top of these guiding principles, which served as the foundation, the rules governing the procedure for conducting this systematic review were developed. These rules served as the basis.

Eligibility Criteria

This systematic review was developed to analyze papers on "metabolic syndrome" and "chronic kidney disease". These are the topics that were extensively covered in the study that was considered. In order for your work to be considered, the following conditions must be met: 1) Articles must be written in the English language. 2) Articles must have been published after 2012, but prior to the creation of this systematic review. Under no circumstances will the following types of textual contributions be considered for inclusion in the anthology: 1) Editorial letters, 2) submissions without a Digital Object Identifier (DOI), and 3) article reviews and submissions similar to those previously published in the journal.

Search Strategy

The search for studies to be included in the systematic review was carried out from December, 1st 2022 using the PubMed and SagePub databases by inputting the words "metabolic syndrome" and "chronic kidney disease". Where *"NON"[All Fields] AND ("pharmacologically"[All Fields] OR "pharmacologicals"[All Fields] OR "pharmacologics"[All Fields] OR "pharmacology"[MeSH Terms] OR "pharmacology"[All Fields] OR "pharmacologic"[All Fields] OR "pharmacological"[All Fields]) AND ("intervention s"[All Fields] OR "interventions"[All Fields] OR "interventive"[All Fields] OR "methods"[MeSH Terms] OR "methods"[All Fields] OR "intervention"[All Fields] OR "interventional"[All Fields]) AND ("diabetes complications"[MeSH Terms] OR ("diabetes"[All Fields] AND "complications"[All Fields]) OR "diabetes complications"[All Fields] OR ("diabetic"[All Fields] AND "complication"[All Fields]) OR "diabetic complication"[All Fields])* is used as search keywords.

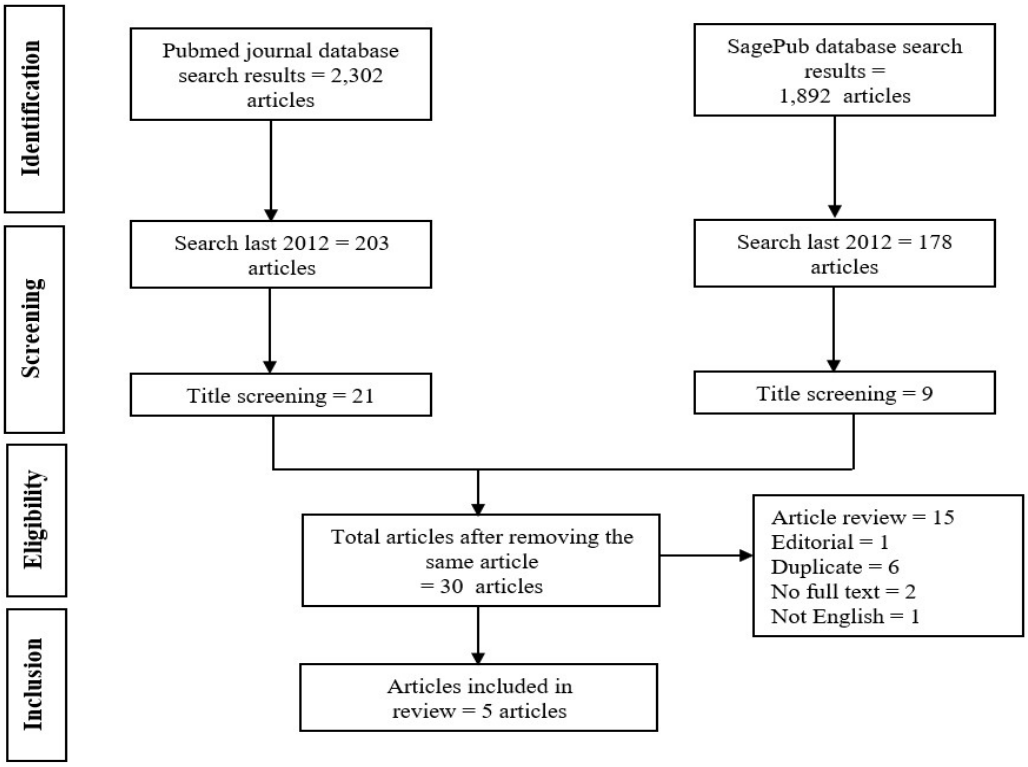

Figure 1. Article search flowchart

Data retrieval

The author of the study revised the inclusion and exclusion criteria for the study after completing a literature review and reading the titles and abstracts of previously published research. This step was taken after the author had completed the study. After looking at the research that had been done previously and published, the author made this change. This was done in order to determine which aspects of the situation should be included in the study and which should be excluded. Following a thorough review of additional studies that were presented in earlier publications, the author made these adjustments to the manuscript.

During the process of compiling the systematic review, the only research studies that were taken into consideration to be significant were those that fulfilled each and every criterion. Only these studies were taken into consideration for their significance. This step was taken in order to make sure that the evaluation is as thorough as it possibly can be. Information regarding each individual study, such as its title, author, publication date, place of origin, research design, and research variables, can be gathered if one so chooses. You can access this information via the internet. The recipient can receive this information in a variety of formats, which is one of the many possibilities available.

Quality Assessment and Data Synthesis

In order to determine which studies could be taken into consideration, the authors carried out their very own independent reviews of a selection of the research that was provided in the titles and abstracts of the articles. After this stage is complete, the full texts of the studies that are eligible for inclusion in the systematic review will be read in order to determine which pieces of research can be used to further the review's objectives. This will be done in order to ensure that the evaluation is as accurate as is practically possible.

RESULT

When compared with the intervention group, the incidence of microaneurysms was substantially greater in the control group (37/98, or 38%) than it was in the intervention group (27/113, or 24%) ($p = 0.029$). The model that included age, gender, a previous diagnosis of diabetes, body mass index (BMI), and treatment group found that the odds ratio for microaneurysms was significantly reduced in the intervention group (OR = 0.52; 0.28-0.97, $p = 0.039$). Serum triglycerides at baseline were the sole risk factor that accurately predicted the presence of microaneurysms (mean ± SD: 1.9 ± 0.9 vs. 1.6 ± 0.7 mmol/L, with and without microaneurysms, respectively, $p = 0.003$). In the regression analysis for age, gender, fasting glucose, and intervention group, triglycerides were found to be related with a lower risk of microaneurysms (odds ratio = 1.92, $p = 0.018$).[8]

Table 1. The litelature include in this study

Author	Origin	Method	Sample Size	Result
Aro, 2019[8]	Finland	RCT	522	Significantly more microaneurysms occurred in the control group (37/98, 38%) than in the intervention group (27/113, 24%) (p = 0.029). In the model that included age, gender, diabetes diagnosis prior to the retinal examination, body mass index (BMI), and treatment group, the odds ratio for microaneurysms was significantly reduced in the intervention group (OR 0.52; 0.28-0.97; p = 0.039). Serum triglycerides at baseline were the only predictor of microaneurysms (mean SD, 1.9 0.9 vs. 1.6 0.7 mmol/L, with and without microaneurysms, respectively, p = 0.003). In regression analysis for age, sex, fasting glucose, and intervention group, triglycerides were linked with decreased microaneurysms (OR = 1.92, p = 0.018).
Ramachandran, 2013[9]	India	Prospective, parallel-group, randomised controlled trial	8,741	50 (18%) people in the intervention group acquired T2DM, compared to 73 (27%) participants in the control group (hazard ratio [HR] = 0.64, 95% confidence interval [CI] = 0.45-0.92; p=0015). The number of individuals who required to be treated to avoid one instance of type 2 diabetes was 11 (95% CI = 6-55). One patient in the control group passed away unexpectedly at the conclusion of the first year. They did not record any additional severe adverse occurrences.
Nanditha, 2018[10]	India	RCT	271	Incidence of diabetes was reduced by 30% in the intervention group, with declining gap between-group differences over time (Kaplan-Meier analysis). Significant improvement in dietary adherence occurred in the intervention group at 2nd and 5th year follow up (trend $\chi2 = 21.35$, $p < 0.0001$). Cox regression analysis showed that the 5th year incidence of diabetes was significantly reduced in the intervention group. Higher body mass index and 2 h plasma glucose at 24 months increased the incidence of diabetes.
Davies, 2016[11]	United Kingdom	RCT	131	In the intervention group, the risk of developing T2DM was 26% lower than in the control group (HR = 0.74, 95% CI = 0.48-1.14, p = 0.18). Excluding individuals who did not attend the initial education session had no effect on the T2DM risk reduction (HR = 0.65, 0.41-1.03, p = 0.07). When data were analyzed across all time points, there were statistically significant improvements in HbA1c (-0.06, -0.11, -0.01), LDL cholesterol (-0.08, -0.15, -0.01), sedentary time (-26.29, -45.72, -7.32), and step count (498.15, 162.10, 834.20).
Diabetes Prevention Program Research Group, 2015[12]	United State	RCT	3,149	Diabetes incidence was reduced by 27% in the lifestyle intervention group (HR = 073, 95% CI = 065-083; p00001) and by 18% in the metformin group (HR = 082, 95% CI = 072-093; p=0001), compared with the placebo group, with diminishing between-group differences over time. Prevalences of the aggregate microvascular outcome did not differ substantially across treatment groups (placebo 124%, 95% CI 111-138; metformin 130%, 117-145; lifestyle intervention 113%, 101-127). In women (n=1887), however, the lifestyle intervention was associated with a lower prevalence (8.7%, 95% CI = 7.4-10.2%) than in the placebo (11.0%, 96-12.6) and metformin (11.2%, 97-12.9%) groups, with reductions in the lifestyle intervention group of 21% (p=0.03) compared with placebo and 22% (p=0.02) compared with metformin. Those who did not develop diabetes had a prevalence of microvascular problems that was 28% lower than those who did (relative risk 0.72, 95% CI 0.63-0.83; p <0.001).

The cumulative incidence of type 2 diabetes was lower in those who received mobile phone messages than in controls: fifty participants in the intervention group developed type 2 diabetes, compared with seventy-three participants in the control group (27%) (HR = 0.64, 95% CI = 0.45-0.92; p = 0.015). 11 patients needed to be treated in order to avoid one instance of type 2 diabetes (95% CI = 6-55). At the conclusion of the first year, the control group experienced the unexpected loss of one patient. There were no further major adverse events that they recorded.[9] For males at high risk for type 2 diabetes, text messaging is an effective and acceptable technique of delivering advice and support for lifestyle improvement.

Nanditha *et al* (2018) study showed incidence of diabetes was reduced by 30% in the intervention group, with declining gap between-group differences over time (Kaplan-Meier analysis). Significant improvement in dietary adherence occurred in the intervention group at 2nd and 5th year follow up (trend $\chi2 = 21.35$, $p < 0.0001$). Cox regression analysis showed that the 5th year incidence of diabetes was significantly reduced in the intervention group. Higher body mass index and 2 h plasma glucose at 24 months increased the incidence of diabetes.[10]

Davies *et al* (2016) showed risk of acquiring type 2 diabetes was reduced by 26% in the intervention arm compared to the standard care arm (HR = 0.74, 95% CI = 0.48-1.14, p = 0.18). However, this reduction was not statistically significant. The reduction in the incidence of T2DM was also not significant when those individuals who did not attend the initial education session were excluded (HR = 0.65, 0.41-1.03, p=0.07). When the data were analyzed taking into account all of

the different time points, there were statistically significant improvements in HbA1c (-0.06, -0.11, and -0.01), LDL cholesterol (-0.08, -0.15, and -0.01), sedentary time (-26.29, -45.26, and -7.32), and step count (498.15, 162.10, and 834.20).[11]

A study showed cumulative occurrences of diabetes were 55% in the lifestyle group, 56% in the metformin group, and 62% in the placebo group after 15 years. At the conclusion of the trial, the prevalences of the aggregate microvascular outcome did not differ substantially across treatment groups. In women (n=1887), however, the lifestyle intervention was associated with a lower prevalence (8.7%, 95% confidence interval [CI]: 7.4-10.2%) than in the placebo (11.0%, 96-12.6) and metformin (11.2%, 97-12.9%) groups, with reductions in the lifestyle intervention group of 21% (p=0.03) compared with placebo and 22% (p=0.02) compared with metformin. Those who did not develop diabetes had a prevalence of microvascular problems that was 28% lower than those who did (relative risk 0.72, 95% CI = 0.63-0.83; p <0.0001).[12]

DISCUSSION

Diabetes is one of the most prevalent noncommunicable diseases (NCDs) worldwide. This chronic condition is caused by either inadequate insulin synthesis by the pancreas or inefficient insulin usage by the organism. The growing prevalence of diabetes mellitus over the past few decades is a major public health concern.[13] The global prevalence of diabetes was 422 million in 2014. Since 1980, the age-standardized global prevalence of diabetes mellitus has nearly doubled, from 4.7% to 8.5%, and in 2012, diabetes mellitus caused 1.5 million fatalities. Notification is given that the prevalence and proportion of diabetes-related deaths are higher in low- and middle-income countries (LMICs) than in high-income nations.[1,13]

According to the findings of this study, an intensive lifestyle intervention that lasted for a period of four years and targeted persons who were overweight or obese and had IGT was related with a reduction in the manifestation of retinal microaneurysms (MA). Triglyceride levels in the serum were the only risk factor that could accurately predict the formation of MAs, but fasting glucose levels, 2 h glucose levels, and blood pressure readings did not have any association with the development of MAs. This is the only study that they are aware of that demonstrates a relationship between lifestyle intervention effects, a decreased risk of retinal MAs, and serum triglyceride levels.[8]

As far as they are aware, this is a groundbreaking finding. It is difficult to find older research that assess the effects of lifestyle interventions on microvascular problems in people who have impaired glucose tolerance.[12] In pre-diabetes, modifications in lifestyle that emphasize exercise and a balanced diet result in a considerable decrease in retinal microangiopathies, and serum triglycerides may play a role in the development of early retinopathy. To prevent microvascular problems in pre-diabetic individuals, they recommend comprehensive lifestyle change. Triglyceride-lowering medicine should be explored when non-medical lifestyle interventions are not feasible.[14–16]

In addition to the prevention or delay of diabetes observed to date, the lifestyle intervention and metformin in the Diabetes Prevention Program Outcome Study (DPPOS) cohort are associated with a reduction in CVD risk factors and metabolic syndrome, a reduction in the prevalence of lower urinary tract symptoms associated with obesity and diabetes, and an improvement in quality of life. A 10-year economic analysis comparing all medical costs outside the study to the prices of the interventions indicated that metformin was cost-effective and lifestyle intervention was cost-saving. Planned longer-term follow-up of the Diabetes Prevention Program (DPP) group will give insight on the effects of the interventions on cardiovascular disease and death, as well as provide a more comprehensive evaluation of the economic benefit of diabetes prevention.[12,17–19]

Due to the scalability and anticipated low cost of mobile phone messaging, its implementation in large-scale diabetes prevention programs merits evaluation, especially given that the benefits of preventing or delaying the onset of type 2 diabetes can last up to 20 years. In addition, benefits may extend to other cardiovascular risk factors and cardiovascular events. The implementation of cost-effective behavior modification programs remains a medical problem. Personal contact approaches are likely to remain costly, and creative solutions have been sought for primary care and the workplace. Messaging by mobile phone could be part of an alternative method.[20,21]

A balanced diet, maintaining a normal body weight, regular physical activity, altering a sedentary lifestyle, and avoiding tobacco use are some of the strategies that are thought to be useful in preventing type 2 diabetes mellitus or delaying the beginning of the condition. According to the findings of DPP, one of the most important factors in reducing the risk of developing diabetes is achieving and maintaining a healthy weight. Every kilo that is lost results in a 16% lower relative risk of developing type 2 diabetes, since this metric is significantly connected with a slower development to the disease.[22,23]

It was discovered in a clinical trial that was carried out in Da Qing, China, that interventions such as diet or exercise, and a combination of diet and exercise, were significantly associated with 31%, 46%, and 42% reductions of risk in developing diabetes, respectively. The trial was carried out by the Chinese Diabetes Association. Randomized controlled trials have shown that engaging in physical activity not only results in an increase in glucose tolerance but also a reduction in the chance of developing type 2 diabetes in high-risk populations.[15,24]

Additionally, regardless of a person's current weight, engaging in physical activity lowers the risk of acquiring type 2 diabetes. Non-pharmacological interventions are effective among people with impaired glucose tolerance in reducing the

risk of type 2 diabetes, and such interventions are often evident as effective as their pharmacological counterparts. Non-pharmacological interventions are also effective among people with normal glucose tolerance in reducing the risk of type 1 diabetes.[25]

CONCLUSION

Diet modification and lifestyle intervention are two non-pharmacological intervention methods that can be applied to patients with diabetes mellitus in preventing complications. The education carried out can also be part of patient reminders.

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