Efficacy of Mediterranean Diet on Blood Biochemical Factors in Type II Diabetic Patients: A Randomized Controlled Trial

Tip II Diyabetik Hastalarda Akdeniz Diyetinin Kan Biyokimyasal Faktörleri Üzerindeki Etkinliği: Randomize Kontrollü Bir Çalışma

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ABSTRACT

Introduction: Diabetes mellitus is one of the most common endocrinologic disorder and the seventh cause of mortality worldwide. In Mediterranean dietary, consumption of plant source food such as vegetables, fruits, seeds, beans etc. is much emphasized. There are many studies showed that this regimen can decrease the risk of cardiovascular disease and factors associated in diabetes mellitus. Therefore, in this study we investigated the efficacy of this regimen on blood biochemical factors in diabetic patients referred to diabetes clinic in Gorgan.

Methods: This was a clinical trial study in which 228 well-controlled type 2 diabetes mellitus patients between 40-60 years were included in the study. They were randomly assigned to two different groups: control and Mediterranean educational intervention group. They followed up for 6 months and before and after the intervention, we evaluated the glycemic and lipid profile and physiological parameters in them. Data were analyzed by SPSS software.

Results: Totally 228 patients with diabetes mellitus type II between 40 to 60 years old were recruited. The mean age of patients was 57.3±9.3 years old. Majority of participants were female (77.2%) with elementary level of literacy (77.6%). The mean of fasting blood glucose was 192.50±64.17 mg/dL in intervention group which was significantly lower than the amount in control group (P<0.001). A clinically and statistically significant fall in HbA1c was observed in intervention group rather than control group (P<0.001).

Conclusion: The present study represented a significant relationship between Mediterranean dietary intervention and both anthropometric and laboratory findings in patients with type 2 diabetes mellitus. We showed that this dietary could significantly lower the FBS, HbA1c, and LDL. Although we showed this meaningful difference, it should be more evaluated in Iranian race people to investigate more in this topic.

Key Words: Mediterranean dietary, type 2 diabetes mellitus, biochemical factors

Anahtar Sözcüklер: Akdeniz diyeti, tip 2 diabetes mellitus, biyokimyasal faktörler

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INTRODUCTION

Diabetes mellitus type II is a chronic status that recognized by high glucose levels due to insulin resistance or decreased insulin secretion. It is in epidemic pattern worldwide and is going to increase even further in the future (1, 2) and is currently a major cause of morbidity and mortality in public health burden in the world (3). Over the past few years, there has been a great effort to study the relationship between dietary patterns and human health. Interestingly, adherence to a healthy lifestyle was strongly associated with reduction in the risk of chronic illnesses with 83% reduction in coronary artery disease and 91% reduction in diabetes mellitus in females (4). The increasing incidence of diabetes worldwide has been highly linked to the westernized dietary patterns, physical inactivity, and increasing rates of obesity and metabolic syndrome (5).

Several studies have explored the efficacy of Mediterranean diet as one of the healthiest dietary patterns to protect chronic disease morbidity, higher life expectancy, and prevention of cardiovascular risks, Type 2 DM and non-alcoholic fatty liver (6). This pattern is distinguished by a high intake of legumes, nuts, cereals, fruits, and vegetables, a higher intake of olive oil with less saturated fats intake, a higher consumption of fish compared with meat and poultry intake, low to moderate dairy products intake and moderate alcohol intake regularly (7). The beneficial roles of this dietary pattern are mainly attributed to its nutrient and phytochemicals (8). Nearly all of the studies concentrated on determining the relations between Mediterranean dietary pattern and risk of disease; consequently, Mediterranean dietary quality index (Med-DQI), which developed by Gerber et al for the first time, is a beneficial tool to assess dietary quality through two various sources of fat oil and saturated and two various sources of protein (meat and fish) with reverse scores (9).

There are some studies assessed the effect of Mediterranean diet on different clinical problems and had suitable outcomes (10-13). However, there are limited experimental evidences have been reported the effectiveness of this diet in secondary prevention for diabetic patients (14). However, in recent years, there has been increased emphasis on investigating the role of diet in diabetes mellitus type II management and in systematic review with meta-analysis, the Mediterranean diet was shown to be associated with better glycemic control and improved cardiovascular risk than control diets (2). Therefore, in this study evaluated the efficacy of Mediterranean diet on blood biochemical factors in type II diabetic patients referred to diabetes clinic in Golestan Province, Northern Iran.

METHODS

This was a randomized paralleled clinical trial which is performed on 228 type II diabetic patients referred to Diabetes center of 5-Azar Hospital, Gorgan, Iran.

Inclusion criteria
Diabetes mellitus type II was confirmed if at least one or more of the following were reported: (a) HbAc1 ≥ 6.5 %, (b) fasting plasma glucose ≥ 126 mg/dL (7.0 mmol/l), (c) 2-h plasma glucose ≥ 200 mg/dL (11.1 mmol/l) during oral glucose tolerance test, and (d) a random plasma glucose ≥ 200 mg/dL (11.1 mmol/l) in patients with symptoms of hyperglycemia. Patients were between 40 to 60 years old and were well-controlled under suitable treatment.

Exclusion criteria
We excluded patients with renal insufficiency, advanced liver and heart failure, severe physical disability, smoking and subjects who was under previous Mediterranean diet.

Mediterranean diet intervention
We randomized patients with fixed block randomization method. Patients were randomized into intervention and control groups and evaluated for 6 months (Figure1). We performed 8 education sections for patients in intervention group while control group received usual care. The diet intervention was performed by nutritionist. We allocated patients with fixed block randomization method. Patients were randomized into intervention and control groups and evaluated for 6 months (Figure1). We performed 8 education sections for patients in intervention group while control group received usual care. We randomized patients with fixed block randomization method. Patients were randomized into intervention and control groups and evaluated for 6 months (Figure1). We performed 8 education sections for patients in intervention group while control group received usual care.

Data collection and measurements
Our main variables in this study were fasting blood sugar, lipid profile, body mass index (BMI) and type of treatment (routine vs routine+ Mediterranean diet). Patients underwent physical examination using standardized protocols in their visits and blood pressure measurements, laboratory tests and a dietary survey was recorded for them. BMI was calculated as weight (kg)/height (m²). HbA1c was measured in EDTA treated whole blood using an automatic HPLC analyzer.
Sample size

The sample size was calculated with power 80% and based on Itsiopoulos et al. study (16) as 105 patients in each groups.

Statistics

All data were entered in SPSS (SPSS 21.0 for Windows; SPSS Inc. Chicago, Illinois). We used Independent T-Test for normal distribution quantitative data and non-parametric test (Mann Whitney Test) for other ones. Paired T-Test was used for comparison of two groups about intervention on glycemic and lipid profiles. Chi Square Test was used for comparison of qualitative variables. P value lesser than 0.05 was considered as significant.

Ethics

This investigation was approved by ethical committee of Golsestan University of Medical Sciences with ethical code of IR.GOUMS.REC.1395.20 which was confirmed in May 2016. This study was registered in Iranian clinical trial registry with code of IRCT2017011131875N1 in February 2017.

Information of participants was saved confidential without name and used only for research purpose. Patients were informed about the objectives of the study and written informed consent was obtained from them.

RESULTS

Totally 228 patients with diabetes mellitus type II between 40 to 60 years old were recruited. Patients were randomized in two groups: intervention group (n= 105) and control group (n= 123). The mean age of patients was 57.3±9.28 years old. Majority of participants were female (77.2%) with elementary level of literacy (77.6%). Six subjects (2.6%) were underweight, 33 of them (14.5%) were in normal BMI, 121 of them (53.1%) were overweight, 41 of them were obese (18%) and other 27 participants (11.8%) were very obese. The subjects had a mean HbA1c of 8.7% (95% CI: 4.4-13.8) at recruitment and their mean duration of diabetes was 9.8 years (95% CI: 1-36).

There were no current smokers, however, 68 subjects (29.8%) were former smokers. There was no report of consuming alcohol. Table1 shows demographic characteristics of participants in both groups.

Table 1- Demographics of participants in both intervention and control groups

| Variables                  | Group          | Control | Intervention | P Value |
|----------------------------|----------------|---------|--------------|---------|
| Age (years)                | Mean Standard deviation | 57.8 ± 8.9 | 56.8 ± 9.5 | 0.52    |
| Time from first diagnosis (years) | Mean Standard deviation | 9.4 ± 7.2 | 10.3 ± 7.7 | 0.45    |
| Gender                     | Male Frequency Percentage | 22.8 ± 28 | 22.9 ± 24 | 0.98    |
|                            | Female Frequency Percentage | 95 ± 77.2 | 81 ± 77.2 |         |
| BMI (Kg/m²)                | Mean Standard deviation | 31.21 ± 2.49 | 30.14 ± 3.21 | 0.43    |
| Literacy                   | Illiterate Frequency Percentage | 54 ± 45.8 | 30 ± 34.1 |         |
|                            | High school Frequency Percentage | 54 ± 45.8 | 39 ± 44.3 | 0.06    |
|                            | Graduate Frequency Percentage | 10 ± 8.4 | 19 ± 21.6 |         |

Laboratory and physiological outcomes

The mean of fasting blood glucose was 192.50± 64.17 mg/dL in intervention group versus 208.48 ± 87.90 mg/dL in control group (P>0.05). This index was changed to 165.49± 50.39 mg/dL in intervention group which was significantly lower than the amount in control group (P<0.001). Other laboratory and physiological findings of our patients are highlighted in Table2. There were no significant differences in plasma lipids (except LDL), systolic and diastolic pressure or blood 2-hours post prandial blood glucose (B2SHPP) (P>0.05).

A clinically and statistically significant fall in HbA1c was observed in intervention group rather than control group (P<0.001). It showed that body mass index was not changed after 6-month intervention; however, it tended to decreased in intervention group which was not significant. Also, Table 2 demonstrated the comparison of pre and post intervention outcomes of laboratory and physiological outcomes. In intervention group all of indexes were developed significantly except TG (P<0.05). In control group there was no significant difference at baseline and after 6 months except B2HPP, DBP and HDL (P<0.05).
In this study we investigated the efficacy of this regimen on blood biochemical factors in diabetic patients referred to diabetes clinic in Gorgan. The mean of fasting blood glucose was 192.50± 64.17 mg/dL in intervention group versus 208.48± 87.90 mg/dL in control group. This index was changed to 165.49±50.39 mg/dL in intervention group which was significantly lower than the amount in control group. A clinically and statistically significant fall in HbA1c was observed after intervention (6.8% decrease). A clinically and statistically significant fall in diastolic blood pressure (12% in intervention group compared with control group). A clinically and statistically significant fall in triglyceride (23%) and cholesterol total (28.52 mg/dL in intervention group versus 28.36 mg/dL in control group).

**DISCUSSION**

In the PREMIUM study, both Mediterranean diet groups showed improvements in dyslipidemia compared with the low fat group (20) but we could not assess this in our study. A recent study found that a Mediterranean diet in newly diagnosed type 2 diabetes, was associated with a delayed need for anti-hyperglycemic drugs (21), and we have reported that in people with type 2 diabetes, a Mediterranean diet consumed, reduced HbA1c from 8.75% to 7.84%.

It is reported in another study that by using this diet, HbA1c reduced from 7.1% to 6.8% (16). Esposito et al. showed that in Type 2 diabetes, greater adherence to a Mediterranean type diet was associated with lower HbA1c and postprandial blood glucose concentrations. Mean HbA1c and 2h post-meal glucose concentrations were significantly lower in diabetic patients with high adherence to a Mediterranean type diet than those with low adherence (21). The Mediterranean diet includes foods that are recommended separately for medical nutrition therapy for diabetes, and is associated with reduced total and cardiovascular mortality. There is a good case for recommending a Mediterranean style diet for all, including people with type 2 diabetes (22). Previous studies of people with type 2 diabetes have shown benefits of replacing saturated fat with monounsaturated fatty acid (MUFA) which is enriched in Mediterranean diet; a 1998 meta-analysis of 10 randomized cross-over trials showed that a MUFA rich diet improved lipid profiles, glycemic control, when compared with a high carbohydrate diet, when energy intake was controlled (23). Barona et al. was able to show that Mediterranean-style low-glycemic-load diet for 12 weeks in thirty-five women with metabolic syndrome and high LDL levels (>100 mg/dl) significantly reduced oxidized LDL (12% in Mediterranean diet) (24).

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Shai et al. evaluated the Low-fat restricted calorie diet versus Mediterranean calorie-restricted diet versus low carbohydrate non-restricted calorie diet and demonstrated that fasting glucose decreased in Mediterranean arm (by -32.8 mg/dl in the Mediterranean diet compared to baseline and increased by 12.1 mg/dl in low-fat diet; P value 0.001) and there was no change in HbA1c (25). There were controversial outcomes in different studies. We showed that similar to majority of studies that this diet can significantly develop the glycemic and lipid profile control in type 2 diabetes mellitus rather than control group.

CONCLUSION

The present study represented a significant relationship between Mediterranean dietary intervention and both anthropometric and laboratory findings in patients with type 2 diabetes mellitus. We showed that this dietary can significantly lower the FBS and HbA1c and LDL. Although we showed this meaningful difference, it should be more evaluated in Iranian race people to investigate more in this topic. One of our limitation was moderately low study population, short time of follow up, lack of investigation in some indexes. It remains for future research to determine the replicability of the intervention, especially with more diverse populations, and its cost-effectiveness relative to other programs. The antioxidant characteristic of Mediterranean dietary rich content of fruits, vegetables and cereals seems to play a major role in its protective potential in diabetes mellitus beside dietary fiber which is believed to induce satiety and thus reduce caloric intake.

Conflict of interest

No conflict of interest was declared by the authors.

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