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Impact of the Components of Mediterranean Nutrition Regimen on Long-Term Prognosis of Diabetic Patients with Coronary Artery Disease

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Abstract: The impact of different nutritional regimens on long-term prognosis and outcome in diabetic patients with Coronary Artery Disease (CAD) is questioned. The objective of the present study was to determine the effects of different nutritional components of Mediterranean regimen on long-term cardiovascular events in diabetic patients with CAD in Iranian population. In a prospective cohort study, researchers recruited 233 consecutive patients with the diagnosis of type 2 diabetes mellitus for at least 6 months with documented CAD. Nutritional assessment was obtained by a validated semi-quantitative Food Frequency Questionnaire (FFQ) and the diet score was calculated on the basis of Mediterranean Diet Quality Index (Med-DQI). For assessing long-term CAD prognosis, the patients were followed by telephone for 1 year. The study endpoint was long-term MACCE (defined as occurrence of one of these morbidities including death, non-fatal myocardial infarction or need to revascularization). About 1 year death was revealed in 19 (8.2%). The 2 patients (0.9%) suffered non-fatal myocardial infarction and 14 (6.0%) needed to revascularization within 1 year after discharge from hospital. Overall, 1 year MACCE in study population was 12.4%. There were significant relationships between death rate and dietary scores of saturated fatty acid, cholesterol, meats, fish and fruit and vegetables. Also, significant relationships were found between MACCE rate and dietary scores of saturated fatty acid, cholesterol and fruit and vegetables. Mediterranean dietary regimens including low level of cholesterol and saturated fatty acid can effectively improve long-term outcome, including 1 year death and MACCE in diabetic patients with CAD.

Key words: Diabetes mellitus, coronary artery disease, nutrition, patient, morbidities

INTRODUCTION

According to the results of the recent epidemiological surveys, diabetes mellitus confers an increased risk for Coronary Artery Disease (CAD) and leads to cardiac mortality and morbidity (Avogaro *et al*., 2007) that accounts currently for almost 32% of all deaths among diabetic patients (Hanefeld *et al*., 1997). The largest increase of mortality and morbidity due to CAD in diabetic patients is expected to occur in developing countries so that in Iran as a developing country, the prevalence of CAD among diabetic patients was estimated 28.0% (Janghorbani *et al*., 2006) and among patients with CAD who died in hospital, 75.6% were diabetics (Esteghamati *et al*., 2006).

Previous studies emphasized the role of some risk factors, such as advanced age, fasting glucose levels, smoking, hypertension and triglyceride levels as independent risk factors for development of CAD events in diabetic patients (Abu-Lebdeh *et al*., 2001; Alexander *et al*., 2003). However, the role of different nutritional regimens on severity of CAD in these patients is questioned. It has been shown that the optimal nutrition therapy is associated with a 2.0% decrease in glycated Haemoglobin (HbA_1C) in patients with newly diagnosed type 2 diabetes mellitus (Franz *et al*., 2003). Some studies showed the possibility of comprehensive lifestyle changes and improvements in coronary risk factors and quality of life by an optimal nutritional program in patients with concomitant CAD and diabetes mellitus in comparison to those without diabetes (Lemon *et al*., 2004; Weis *et al*., 2001). Furthermore, some others suggested that the combination of dietary change and physical conditioning are associated with improved

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glucose tolerance for diabetics and can improve patients' quality of life (Kaplan *et al*., 1987). However, fewer evidences are available regarding the role of nutritional habits, especially Mediterranean regimen as a predictor of CAD prognosis among diabetic patients. In the present study, researchers planned to determine the effects of different nutritional components of Mediterranean regimen on long-term cardiovascular events in diabetic patients with CAD in Iranian population.

MATERIALS AND METHODS

In a prospective cohort study, researchers recruited 233 consecutive patients with the diagnosis of type 2 diabetes mellitus for at least 6 months with documented CAD that diagnosed and hospitalized at the Tehran Heart Center in 2012. In this study, CAD was considered significant if there was a 75% or greater stenosis in the cross-sectional diameter and 50% or greater stenosis in the luminal view (Tavakoli *et al*., 2002). The data included for analysis were demographic characteristics, preoperative risk factors, paraclinical data and cardiac status (Davoodi *et al*., 2007). Diabetes mellitus was defined on the basis of the American Diabetes Association (ADA) criteria as the presence of diabetes symptoms plus plasma glucose concentration = 11.1 mmol L^{-1} or fasting plasma glucose = 5.6 mmol L^{-1} or 2-hp = 11.1 mmol L^{-1}. Studied patients were also interviewed on admission and asked to report how often they consumed each of the food items listed as the number of times/day/month/year during the previous year. Nutritional assessment was obtained by a validated semi-quantitative Food Frequency Questionnaire (FFQ), previously validated in Iran (Malekshah *et al*., 2006) and a 24 h dietary recall questionnaire to record the types, amounts and frequencies of foods consumed. Researchers used the sum of the consumption of each of several food items to estimate the overall consumption of the food group to which each item belonged (Martinez-Gonzalez *et al*., 2008; Daures *et al*., 2000).

The diet score was calculated on the basis of Mediterranean Diet Quality Index (Med-DQI) that the construction of the score for this index is mentioned in Table 1 (Gerber, 2001). The index assigns a score of 0, 1 or 2 according to the daily intake of each of the 7 components and then final score was reported as a summation of all nutrient scores ranged between 0 and 14. A lower score on this index indicates a better nutrition quality.

For assessing long-term CAD prognosis, the patients were followed by telephone for 1 year. The study endpoint was long-term MACCE (defined as occurrence of one of these morbidities including death, non-fatal myocardial infarction or need to revascularization).

Table 1: Construction of the score for the mediterranean dietary quality index

Scorings	0	1	2
Saturated fatty acids (% energy)	<10	10-13	>13
Cholesterol (mg)	<300	300-400	>400
Meats (g)	<25	25-125	>125
Olive oil (mL)	>15	15-5	<5
Fish (g)	>60	60-30	<30
Cereals (g)	>300	300-100	<100
Vegetables+fruits (g)	>700	700-400	<400

Results were reported as mean±Standard Deviation (SD) for quantitative variables and number (%) for categorical variables. Categorical variables were compared using Chi-square test or Fisher's exact test if required. The p-values of 0.05 or less were considered statistically significant. All the statistical analyses were performed using SPSS version 13.0 (SPSS Inc., Chicago, IL, USA).

RESULTS AND DISCUSSION

Demographic characteristics and clinical data of studied patients are summarized in Table 2. Mean age of studied patients was 59.00±8.39 (ranged 38-75 years) and almost two third of them were male. The most common general risk factors for CAD included hypercholesterolemia (76.4%), hypertension (58.4%) and family history of CAD (50.2%). Mean left ventricular ejection fraction was 49.37±10.05 and 82.4% of them had functional class 1-2. In the review of angiographic reports, it was found that the majority of patients (79.0%) suffered from three coronary vessels disease.

About 1 year death was revealed in 19 (8.2%). The 2 patients (0.9%) suffered non-fatal myocardial infarction and 14 (6.0%) needed to revascularization within 1 year after discharge from hospital. Overall, 1 year MACCE in study population was 12.4%. Long-term death and MCCE rates in different dietary groups are shown in Table 3. There were significant relationships between death rate and dietary scores of saturated fatty acid, cholesterol, meats, fish and fruit and vegetables. Also, significant relationships were found between MACCE rate and dietary scores of saturated fatty acid, cholesterol and fruit and vegetables.

Improving the contents of nutrients for diabetic patients facilitates health cares in these patients and this critical issue can influence medical and clinical outcomes and patient quality of life. It has been confirmed that promoting healthy food choices can lead to decrease the risk of diabetes, especially cardiovascular complications. In the present study, researchers tried to consider the impact of different Mediterranean dietary components on

Table 2: Demographic characteristics and clinical data of studied patients (n = 233)

Patient's characteristics	Ranges
Male gender	62.7
Age (year)	59.00±8.39
Body mass index (kg m^{-2})	28.31±4.19
Education level	
Primary	58.8
Secondary	26.6
Higher	14.6
Family history of CAD	50.2
Current cigarette smoking	29.6
Opium addiction	11.2
Alcohol using	11.3
Hypercholesterolemia	76.4
Hypertension	58.4
Cerebrovascular disease	6.0
Peripheral vascular disease	37.8
Recent myocardial infarction	45.9
Congestive heart failure	14.2
NYHA score	2.11±0.780
Ejection fraction (%)	49.37±10.05
Functional class	
1	33.5
2	48.9
3	17.6
Euroscore	2.46±2.27
Coronary vessels involvement	
Single-vessel disease	2.6
Two-vessel disease	18.5
Three-vessel disease	79.0
Laboratory indices	
Last fasting blood sugar (mg dL^{-1})	126.14±45.97
Last creatinine (mg dL^{-1})	1.26±0.300
Triglyceride (mg dL^{-1})	175.40±79.21
Cholesterol (mg dL^{-1})	158.55±47.66
High density lipoprotein (mg dL^{-1})	40.04±8.570
Low density lipoprotein (mg dL^{-1})	83.52±34.82
Hemoglobin A_1C (%)	6.90±1.590
Albumin (g dL^{-1})	4.64±3.340

CAD = Coronary Artery Disease; NYHA = New York Heart Association score

Table3: Mean of physical and psychological components summary scores in different dietary groups (n = 233)

Dietary groups	Death	MACCE
Saturated fatty acid		
0 (n = 85)	0 (0.0)	1 (1.1)
1 (n = 64)	4 (6.3)	8 (12.5)
2 (n = 33)	15 (45.6)	20 (60.6)
p-value	<0.001	<0.001
Cholesterol		
0 (n = 134)	1 (7.5)	5 (3.7)
1 (n = 24)	5 (20.8)	8 (33.3)
2 (n = 24)	13 (54.2)	16 (66.7)
p-value	<0.001	<0.001
Meats		
0 (n = 66)	2 (3.0)	7 (10.6)
1 (n = 108)	14 (13.0)	19 (9.2)
2 (n = 8)	3 (37.5)	3 (37.5)
p-value	0.006	0.106
Olive		
0 (n = 19)	1 (4.5)	2 (9.9)
1 (n = 52)	6 (11.5)	9 (17.3)
2 (n = 111)	12 (10.8)	18 (16.2)
p-value	0.650	0.731
Fish		
0 (n = 24)	0 (0.0)	2 (8.3)
1 (n = 45)	3 (6.7)	7 (15.6)
2 (n = 113)	16 (14.2)	20 (17.7)
p-value	0.037	0.351
Cereal		
0 (n = 121)	11 (9.1)	13 (10.7)
1 (n = 57)	7 (12.3)	15 (26.3)
2 (n = 4)	1 (25.0)	1 (25.0)
p-value	0.364	0.079
Fruits and vegetables		
0 (n = 147)	11 (7.5)	10 (6.8)
1 (n = 28)	4 (14.3)	15 (53.6)
2 (n = 7)	4 (57.1)	4 (57.1)
p-value	0.003	<0.001

The data analyzed using Chi-square test or Fisher's exact test

long-term outcome in diabetic patients suffered from CAD. Researchers found that 1 year death in these patients was dependant to the consumption of some nutrients components, such as saturated fatty acids, cholesterol. Epidemiological studies strongly support the suggestion that low intakes of cholesterol and free fatty acids protect against the development of type 2 diabetes mellitus and people who consume foods with the lowest levels of these nutritional agents are less likely to develop diabetes and its-related complications than higher level consumers (Venn and Mann, 2004; Priebe *et al*., 2008). The effect of low-fat diets in the prevention of CAD has also been demonstrated. It has been concluded that a relationship between cereal intake and CAD was seen with considerable reduction in risk for those who eat this food habitually versus those who eat them rarely (Flight and Clifton, 2006; Seal, 2006; Kelly *et al*., 2007). Some studies also showed that the consumption of rich-cholesterol foods exerts a potentially effect on plasma lipoprotein risk factors for cardiovascular disease. Plasma total and low density lipoprotein cholesterol concentrations were significantly lowered and the ratios of plasma high-density-lipoprotein cholesterol to total cholesterol and of apolipoprotein A-I to B were significantly increased with the consumption of this dietary group (Kestin *et al*., 1990). Therefore, it seems that low consumption of Mediterranean diet including low contain of saturated fatty acids and cholesterol can improve 1 year survival in diabetic patients with CAD via regulation of lipids metabolism and loss of body weight.

In the study, it was also showed a relationship between the consumption of saturated fatty acids and cholesterol and mid-term MACCE rate. It has been confirmed that the consumption of saturated fatty acids induces hyperlipidemia and obesity causing progression of atherosclerosis especially in diabetic patients (Kusunoki *et al*., 2007). Furthermore, the increase of adipose tissue stores can disturb insulin-mediated regulation of lipolysis and increase circulating fatty acid concentrations which may promote insulin resistance and

cardiovascular complications and therefore these pathways can predispose diabetic CAD patients to poor prognosis (Blaak, 2003; Petry *et al*., 2008).

In the present study, researchers finally showed that the Mediterranean diet in diabetic patients with CAD including low cholesterol, high cereal and fruits and vegetables, as well as high olive and fish can be acceptable regimen for these patients lading to favorable outcome. Besides, it seems that overall dietary patterns in various populations are dependant to socioeconomic status, demographic characteristics and patients' lifestyle (Deshmukh-Taskar *et al*., 2007). It is recommended to investigate the impact of these factors on dietary patterns in different populations especially diabetic patients.

CONCLUSION

It can be concluded that nutritional pattern of Mediterranean regimen, particularly consumption of lower level of cholesterol and saturated fatty acids can effectively improve long-term outcome of diabetic patients with CAD.

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