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The Effect of Nutrition Consultation on Dietary Diversity Score of Cardiac Patients Referred to Cardiac Rehabilitation Research Center Isfahan Cardiovascular Research Institute during 2008–2013

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ABSTRACT

Background: Dietary diversity score (DDS) measurement was used to assessment of diet quality in different disease like cardiovascular disease. One way to improve the cardiovascular patient's ability is cardiac rehabilitation program that include exercise training, nutrition consultation and psychological treatment. No study was designed to compare the DDS before and after dietary consultation among cardiac rehabilitation patients, so this study was designed to examine this purpose.

Methods: Subjects were participated in the 2-month cardiac rehabilitation program. All patients that completed the cardiac rehabilitation program and 2 dietary records (before and after nutritional counseling in cardiac rehabilitation program) enrolled in study. Kant *et al* method was used for scoring dietary diversity. Data were analyzed using the statistical package for social sciences (SPSS version 20). Wilcoxon test were used to compare DDS score for each subgroup and pair sample T test was used to compare total DDS after and before nutrition counseling. $P < 0.05$ was considered as statistically significant.

Results: The differences between DDS of grain, fruit, vegetable and meat before and after nutrition counseling were not significant ($P = 0.635$, $P = 0.423$, $P = 0.826$, $P = 0.207$ respectively), but differences of DDS for dairy and total DDS before and after nutrition counseling were significant ($P = 0$, $P = 0.001$).

Conclusions: Dietary diversity was increased after nutrition counseling among patients with cardiac disease.

Keywords: Cardiac rehabilitation, dietary diversity score, nutrition consultation

INTRODUCTION

Cardiovascular disease (CVD) is leading to mortality among patients who were in developed countries. In the early of 20th century, <10% of the world's deaths were attributed to CVD. The half of deaths in developed countries and 25% of deaths in developing countries were due to coronary vascular disease.[1] A recent study was showed that incidence of CVD is rising in Iran.[2] One way to improve the cardiac patient's ability is cardiac rehabilitation program that was begun in 1960 for the first time. The aim of this program was the secondary prevention of coronary heart disease (CHD), re-admissions to hospital and deaths from cardiovascular events.[2-4] Cardiac rehabilitation programs are generally including interventions for the management of disease and smoking cessation, correction of nutrition status and physical activity.[5] Diet has been recognize as a risk factor in preventing and reducing the risk of heart disease.[6] The study which was conducted by Donner Alves *et al.*, reported that food guide for outpatients with heart failure are important in two aspects, awareness about nutrition and food and modification of diet quality.[7] In recent years, the posterior and anterior dietary patterns are used to study of the relationship between food, nutrition, and chronic diseases. The anterior dietary pattern is known as a dietary quality index.[8] Diet quality index was developed in 1994 by Patterson *et al.* for the first time.[9] There are several indexes to the assessment of diet quality. One of them is dietary diversity score (DDS). To assessment of DDS according to US Department of Agriculture's food guide pyramid, five main groups, including grains, vegetables, fruits, meat, and meat substitutes and dairy products are used, and each of these five groups is divided into several subgroups.[10]

DDS was used to assessment of diet quality in several disease for instant, a cross-sectional study that was conducted in 2006 among 581 Tehranian adults with hypercholesterolemia, (hypertriglyceridemia and low-density lipoprotein cholesterol were diagnosed according to ATP III guidelines of the National Cholesterol Education Program) showed that higher values of DDS was associated with lower CVD risk factors.[11] The role of oxidative stress and obesity in the etiology and prevalence of CVDs is well known.[12,13] Narmaki *et al.* in 2015 assessed the association between dietary diversity and antioxidant markers and revealed that oxidative stress was inversely associated with dietary diversity.[14] A study that was done in 2011 showed that overweight stunted children consumed food with low dietary diversity and high dietary energy density,[15] also in another study that was conducted among 289 healthy female students, which was selected randomly from Isfahan University of Medical Sciences revealed that

low body mass index (BMI) and waist circumference was associated with high DDS, so concluded that DDS was reversely correlate with abdominal adiposity and obesity among female students.[16] DDS was assessed in a different disease, but no study has evaluated DDS before and after nutrition counseling among patients undergoing cardiac rehabilitation, so this study was designed to examine this purpose.

METHODS

Design and subjects

This was an experimental before-after study based on data that was collected from patients admitted to the Cardiac Rehabilitation Research Center, Isfahan Cardiovascular Research Institute between 2008 and 2013. Patients were participated in the 2-month cardiac rehabilitation program. The exclusion criteria include patients who cardiac rehabilitation was contraindications for them such as unstable angina, acute phase of myocardial infarction, and unstable arrhythmia, and inclusion criteria include all patients who complete 2-month cardiac rehabilitation program and two dietary records (before and after cardiac rehabilitation). Selected the samples were conducted through all people counting method, so all patients who were admitted for rehabilitation program based on inclusion and exclusion criteria were enrolled. We admitted 250 patients to participate in a cardiac rehabilitation program but among them, 53 patients were not completed cardiac rehabilitation program and 3 days dietary records, so they excluded from the study.

This study is registered by registration ID "IRCT2015090923957N1" with Iranian Registry of Clinical Trials.

Data collection

Demographic characteristics of patients (gender, age, education, income, marital status) having risk factors of heart disease (smoking, obesity, type 2 diabetes mellitus, hypertension, dyslipidemia), having a history of CHD among family members, were complete through a questionnaire form. Hip circumference, weight, height, and cause of recourse to cardiac rehabilitation and admission date of the people for cardiac rehabilitation were recorded. For measurement of weight, Digital scale was used with accuracy nearest of 0.1 kg and minimal clothes. Height was also measured by elastic meter with 0.1 cm currency. BMI was calculated through dividing weight (kg) by the square of height (m). Elastic meter was used to measurement of waist and hip circumferences with an accuracy of about 0.5 cm. These measurements were conducted two times for those who completed cardiac rehabilitation program, once before and once after the period of rehabilitation. Cardiac rehabilitation

program includes exercise training, nutrition consultation, and psychological treatment. The rehabilitation program included 24 exercise sessions that was done three times per week, programmed over 8 weeks. Each session lasted for 60–90 min (10–20 min for warm up the bodies, 20–40 min for aerobic exercise according to the severity of disease and patient risk, 10 min to cool down and 20 min to relax the bodies after each session was ended). Team of cardiac rehabilitation was consisted of general practitioner, a physiotherapist, a nutritionist, and a nurse in every exercise session.

Cardiac rehabilitation program was started 6–8 weeks after coronary artery bypass graft, 4 weeks after myocardial infarction and unstable angina, and immediately after percutaneous coronary interventions and CHD diagnosed by angiography. During 8 weeks of rehabilitation program some educational session conducted for patients and their family, for example, educations about cardiovascular risk factors, diagnose and treatment CVD, drugs, methods for reduced their stress, cessation smoking, and Activities to improve nutrition status.

Dietary assessment and consultations

Three days dietary records were completed by each patient at the beginning of the treatment period. The expert dietitian was trained participants about how they completed dietary records. Ask to patients to complete the dietary record in 3 days, including 2 days a week and a holiday. After completing dietary records by subjects, dietary recommendation was done according to therapeutic lifestyle change (TLC) dietary pattern and individual status. TLC dietary pattern including: (fat: 25%–35% of total calorie intake, saturated fatty acid: <7% of total calories, trans fatty acid: 0 or as low as possible, poly-unsaturated fatty acid: up to 10% of total calories, monounsaturated fatty acid: up to 20% of total calories, carbohydrate: 50%–60% of total calories especially from whole grains, fruit, and vegetables, fiber: 25–30 g/day, plant sterols: 2 g/day, protein: approximately, 15% of total calories, cholesterol: <200 mg/day). The patient could ask their question during 2 months that they referred to this center for exercise training. Patients who were completed two dietary records (after and before cardiac rehabilitation) were enrolled to study. All patients had the same protocol treatment and nutritional counseling which was conducted by two experienced nutritionists. All food items that were collected from dietary records were converted to gram, then serving of food items were calculated. Kant *et al.* method was used for scoring dietary diversity[17] which was intended five food groups including bread and grains, vegetables, fruits, meat, and dairy products.[10] Each group was divided into some subgroups. Bread and grains subgroups included whole grain, refine grain, pasta, rice, biscuit and flour, the subgroups of vegetable consisted of fresh vegetable,

potato, tomato, legumes, starch vegetable, yellow vegetable, and green vegetable. For fruit groups, we considered two subgroups included fruit and fruit juice, berry and citrus fruit. The meat subgroups were fish, sausage, egg, poultry, soy, red meat. Subgroups of dairy consisted of cheese, yogurt, kashk (Iranian foods which made from yogurt), and milk. Maximum DDS that was awarded to each of the five groups was 2. Finally, the total score was calculated by the sum of these numbers, so the minimum DDS was zero and the maximum was 10. If persons consumed half serving of each subgroup was considered as a consumer of that subgroup.

Statistical analyses

Data were analyzed using the SPSS software, version 20 (IBM SPSS, TOKYO, Japan). Some variables including subgroups of food did not follow a normal distribution according to Kolmogorov–Smirnov test so Wilcoxon test were used to compare DDS score for each subgroup but distribution of total DDS after and before nutrition counseling was normal according to Kolmogorov–Smirnov test so we used pair sample *t*-test to compare total DDS before and after nutrition counseling. $P < 0.05$ was considered statistically significant.

RESULTS

Demographic characteristics of participants were shown in Table 1. The median (interquartile), mean (±standard deviation [SD]) and P value differences between DDS score before and after nutrition counseling for each five subgroups and total DDS was shown in Table 2. The differences between DDS of grain, fruit, vegetable, and meat before and after nutrition counseling were not significant ($P = 0.635$, $P = 0.423$, $P = 0.826$, $P = 0.207$, respectively), but differences of DDS for dairy before and after nutrition counseling was significant ($P = 0$).

The mean ± SD of DDS before and after nutrition counseling was 3.9 ± 0.96 and 4.2 ± 1.13 respectively and statistically significant differences were found between two periods (after and before nutrition counseling), ($P = 0.001$). Figure 1 shows mean ± SD differences between DDS score for each subgroup and total DDS after and before nutrition counseling.

DISCUSSION

This experimental before-after study observed significant differences between dietary diversity before and after nutrition consultation and found that nutrition counseling in cardiac rehabilitation program could improve dietary diversity. Some studies were assessed dietary diversity in different disease and population.[18] Many factors were known as a risk factor of CVD, for example, some nutrient deficiency, metabolic syndrome,

and obesity. A study that was done by Azadbakht *et al.* assessed usual dietary intake of 581 healthy controls which was selected randomly from participants of Tehran lipid and glucose study by semi-quantitative food frequency questioner. They calculated DDS and defined metabolic syndrome according to ATP III criteria; finally, they concluded that DDS improvement was associated with reduced risk of having metabolic syndrome.[19] Prevention of metabolic syndrome as a risk factor of coronary vascular disease was useful.[20] the other study showed that DDS was associated with nutrient sufficiency proportion of calcium and Vitamin C that they had an inverse association with CVD.[21,22] The association between coronary vascular disease and obesity is well known.[23] Azadbakht *et al.* conducted a study to assessed DDS among Iranian female youth. They selected patient randomly from Isfahan University of Medical Sciences, Iran, then calculated BMI and DDS and they found the possibility of obesity decreased with increased in DDS.[16] study which was carried out on Sri Lankan adults concluded that lower DDS was associated with higher rate of obesity,[24] the same result was shown in a study that was conducted among US women but in the US men, the association between DDS and obesity was not clear.[25] higher dietary diversity was correlated with lower risk of cardiovascular and cancer mortality[17] and lower rate of morbidity.[26] In this study, we revealed that DDS increased after nutrition counseling so the risk of CVD may decrease but more assessment needs to explain this conclusion.

In several study, the association between nutritional counseling and improvement of health outcome were assessed, for example, study that was done among type 2 diabetics patients and CVD patients showed a significant improvement in body mass index and treatment of CVD and type 2 diabetes in patients who received nutritional counseling,[27] also health outcomes were improved among patients with premature coronary artery disease and dyslipidemia after nutritional counseling.[28] study which was done by Rhodes *et al.* found that nutritional knowledge and body mass index were improved in patients who received medical nutrition therapy by dietitian,[29] so the nutrition counseling have a great role on health outcomes, that was consistent with finding of this study.

This study had some limitations. First, as we could not morally apply intervention for a group of subjects while the other group did not receive any intervention so the study cannot be designed as a randomized clinical trial, second, the dietary record that was used in this study affected the usual intake of patients, so under-reporting might be happened. However, design of this study was

Table 1: Demographic characteristics of participants

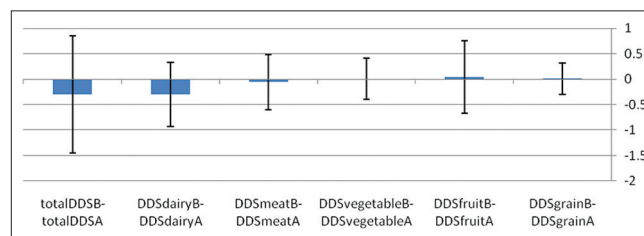|	Before intervention (*n*=197)	After intervention (*n*=197)	P
Weight*	72.37±10.7	71.2±10.36	0.001
Waist*	96.5±10.33	95.2±9.5	0.001
Hip*	102.47±9.8	101.94±6.9	0.4
Age*	59.6±9.2	-	-
Height*	164.2±9.16	-	-
Gender**			
Male	69.5	-	-
Female	30.5		
Occupational category**			
Housewife	28.4	-	-
Retired	33	-	-
Self-employed	16.8		
Employee	17.8		
No job	4.1		

*Mean±SD, **Mean (%). SD=Standard deviation

Figure 1: The mean ± standard deviation differences between dietary diversity score for each subgroups and total dietary diversity score before and after nutrition counseling

Table 2: The median (interquartile), mean±standard deviation and *P* value differences between dietary diversity score before and after nutrition counseling for each five subgroups and total dietary diversity score

	Before intervention		After intervention		P
	Median (interquartile)	Mean±SD	Median (interquartile)	Mean±SD	
Grain	1 (0.6-1)	0.85±0.24	0.6 (0.6-1)	0.84±0.27	0.635*
Vegetable	0.6 (0.3-0.6)	0.46±0.29	0.6 (0.3-0.6)	0.46±0.35	0.826*
Fruit	1 (1-2)	1.38±0.55	1 (1-2)	1.34±0.54	0.423*
Dairy	0.5 (0.5-1)	0.7±0.4	1 (0.5-1.5)	0.99±0.59	000*
Meat	0.6 (0.3-0.6)	0.52±0.29	0.6 (0-0.6)	0.58±0.51	0.207*
Total DDS	3.9 (3.1-4.6)	3.9±0.96	4.1 (3.4-5)	4.2±1.13	0.001**

*Comparing *P* value by Wilcoxon test, **Comparing *P* value by pair sample *t*-test. DDS=Dietary diversity score, SD=Standard deviation

the strength of this study because dietary intake of each patient was compared with itself, so the effect of within variation was decreased. Using of dietary records has some strength. This method is based on actual intake; it is completely open-ended, and it does not rely on memory.

CONCLUSIONS

Dietary diversity increased after nutrition counseling among patients with cardiac disease. Nutrition counseling was successful in increasing DDS which might be associated with improve diet quality of cardiac patients and it can reduce the risk of disease. Studies with larger sample size and shorter time duration and assessment of DDS in different kinds of cardiac disease were recommended.

Conflicts of interest

There are no conflicts of interest.

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