RESEARCH ARTICLE

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Index-Based Dietary Patterns and the Risk of Prostate Cancer among Iranian Men

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Abstract

Background and objective: The second most common cancer in men after lung cancer is prostate cancer (PC). Previous studies assessed the association between food items or food groups and the risk of PC, but diet quality indices are unique approaches to study any relations between diet and disease. Our objective was to investigate the effect of healthy eating index (HEI-2010) and Mediterranean-Style Dietary Pattern Score (MSDPS) on PC risk. **Methods:** In this case-control study, we recruited 97 patients with MS and 205 control subjects . Dietary intake was evaluted using a valid and reliable food frequency questionnaire. The HEI and MSDPS were calculated. Logistic regression was used to evaluate the relationship between HEI and MSDP scores and PC risk after adjusting the confounders. **Results: I**n comparison to controls, cases had lower score on HEI (61 vs. 70.07; P< 0.001), and higher score on MSDP (26.20 vs. 24.49; P= 0.44). After comparing the highest and the lowest tertile of HEI, we observed a significant decreasing trend in the risk of PC (p for trend<0.001). **Conclusion:** Our findings suggested that a high quality diet, according to HEI, may decrease the risk of PC.

Keywords: Healthy Eating Index- Mediterranean-Style Dietary Pattern Score- diet quality- prostate cancer

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Introduction

Prostate cancer (PCa) is the most diagnosed malignancy of men in Western countries (Grubb and Kibel, 2007). The incidence of PC in Asian countries, including Iran, is lower than that in Western populations (Hosseini et al., 2010). Various factors, including genetic factors, screening methods, lifestyle, and diet contribute to this difference (Baade et al., 2009; Zhang et al., 2011). Numerous studies focused on the effects of a nutrient on PCa. Some studies reported the effects of single food or nutrient on PCa (Giovannucci et al., 2002; Chavarro et al., 2007; Park et al., 2007). Dietary components are consumed in combination, affecting the absorption and bioavailability of each other (Michels and Schulze, 2005). Hence, identifying individual effect of dietary components is very difficult.

Dietary patterns allow to discover the link between the overall diet and the risk of disease (Moeller et al., 2007). Two of the most popular indices for measuring healthy eating patterns are The Healthy Eating Index (HEI) 2010 and The Mediterranean-Style Dietary Pattern Score (MSDPS). HEI 2010 examines the diet quality based on its conformance with Food Guide Pyramid and Dietary Guidelines (Guenther et al., 2013; Guenther et al., 2014) and MSDPS examines adherence to the Mediterranean dietary pattern (Rumawas et al., 2009a; Rumawas et al., 2009b). High adherence to HEI and MSDPS has been associated with decreased risk of total mortality and cancers (Trichopoulou et al., 2000; Mitrou et al., 2007; Reedy et al., 2008). However, no study has investigated the association between PCa among Iranian men and HEI 2010 and MSDPS yet. So, the aim of this study was to determine the relation between performance on HEI 2010 and MSDPS and PC risk among Iranian male.

Materials and Methods

Participants and methods
Subjects

This hospital based case-control study, carried out in Tehran (the capital of Iran). Participants included 140 men with a confirmed histological diagnosis of PC in the preceding six months, who were referred to Shahid Labafi and Modares hospitals. Out of these 140 patients, 135 were selected based on our defined inclusion and exclusion criteria. The inclusion criteria were as follows: 1) aged between 40 and 80 years old; 2) did not undergo

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any changes in his diet since diagnosis; 4) be willing to participate in the study; 5) being a male. Based on our inclusion criteria, 100 men with PC were selected as case group (participation rate=71%). Based on inclusion criteria, 100 men with PC selected as case group. In addition, 205 patients who were admitted to the same hospitals (due to ear, nose, or eye disorder, appendicitis or general surgery) without any special diets were selected as the control group. Individuals in case and control groups were matched in terms of age (with a ten-year-interval). At the end, 3 patients in the case group whose their log scale of total energy intake were either >3SD or <3SD from the mean were excluded from the study. Therefore, 97 cases and 205 controls were underwent further analysis. All participants were interviewed to obtain needed information, including history of diabetes, hypertension, smoking status, alcohol use, and marital status. The weight of each participant with the least amount of clothing and a sensitivity of 100 gram was obtained by a digital scale, and the height of each of them was measured without shoes with a sensitivity of 0.1 cm. We measured waist circumference through this procedure: find the top of hip and the bottom of ribs, place the tap measure midway between these points, and wrap it around waist. The study was approved by Ethics Committee of Shahid Beheshti University of Medical Sciences.

Dietary assessment

Data on usual dietary intake of participants over the past year were collected through a valid and reliable semi-quantitative food frequency questionnaire (148-item FFQ) (Esfahani et al., 2010). All participants were asked to record food consumption frequency of every food item with standard serving size per day, per week, per month, and per year. The amount of each food item was convert to gram per day using the household scales (Ghaffarpour et al., 1999). Analyses of energy and nutrients were carried out using the USDA FCT (McGuire, 2011). However, for some dairy products such as Kashk, vetch, wild plum, mint, sweet canned cherry, and sour cherry that are not listed in the USDA FCT, Iranian FCT was used alternatively (Movahedi and Roosta, 2000). In order to calculate healthy eating components, we used national nutrient database to convert values obtained from FFQ to cup or ounce equivalents per 1000 kcal (Bowman et al., 2014).

Calculation of the Healthy Eating Index-2010

Healthy eating index-2010 (HEI-2010), as a measure of quality of life, was designed according to recommendations presented by the dietary guidelines for American 2010 (McGuire, 2011). The HEI is used to examine the relationships between diet and health-related outcomes. A summary of HEI-2010 components and their point values as well as its scoring standards are presented in Table 1. HEI-2010 includes 12 components divided into 9 adequacy components and 3 moderation components. Adequacy components consist of total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy, seafood and plant proteins, fatty acids, and total protein foods. Moderation components are refined grains, sodium, and empty calories (Guenther et al., 2013). All components scores were calculated based on their point values that is presented in Table 1. The participant with zero intake of adequacy components except fatty acids received a score of zero. For all adequacy components, the maximum number of points assigned to participants with intake at the level of the standard or higher. Other components scoring was carried out based on the standard for maximum score and minimum score of zero . Then, scores for the intake between the minimum and maximum standards were calculated proportionately.

Calculation of the Mediterranean-Style Dietary Pattern Score (MSDPS)

Mediterranean-Style Dietary Pattern Score (MSDPS) is consisted of 13 components based on Mediterranean pyramid. These 13 food groups are whole-grain cereals, fruits, vegetables, dairy products, wine, fish and other seafood, poultry, olives/legumes/nuts, potatoes and other starchy roots, eggs, sweets, meat, and olive oil (Rumawas et al., 2009a). In our study, only 12 components were available because participants did not respond to alcohol intake questions due to religious beliefs (Hosseini-Esfahani et al., 2010). With the exception of olive oil, each group was scored from 0 to 10 depending on the degree of correspondence with the recommendations. Olive oil was scored differently, score 10 was allocated to exclusive olive oil intake, score 5 to use of olive oil along with other vegetable oils, and score 0 to olive oil non-consumption . We also took into account the negative implications of overconsumption, defined as exceeding the recommended intake of foods in the Mediterranean diet pyramid. Overconsumption incurs a penalty by subtracting a point proportionally to the number of consumed servings that exceeded the recommended intake for that group. Finally for each participant, all 12 scores were summed up, and then were divided into proportion of total energy intake from Mediterranean diet in order to calculate the energy adjusted MSDPS that ranged from 0 (minimal adherence to Mediterranean pyramid recommendations) to 100 (maximal adherence) (Rumawas et al., 2009a).

Statistical analysis

Statistical analyses were conducted using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). Normal distribution of quantitative data was measured by the Kolmogorov-Smirnov test and normal distribution of qualitative data was measured by the Chi-square test. To compare differences between cases and controls, independent sample t-test and the Mann-whitney test were used for continuous variables and categorical variables, respectively.

Each of the density standards and the overall HEI score were categorized into tertiles based on the distribution among controls. We used binary logistic regression to estimate odds ratios and 95% confidence intervals for tertiles of each 12 component. Considered covariates included body mass index (continuous), waist circumstance, total energy intake (continuous), smoking status, and history of diabetes, and hypertension. Then, odds ratio was adjusted for this confounding factors.

Results

Characteristics of 97 PC patients as cases and 205 controls are shown in Table 1. Cases and controls were not significantly different in terms of age, energy intake, alcohol use, and marital status, but they indicated significant differences in terms of BMI, waist circumference, history of diabetes, heart disease, hypertension, physical activity, and smoking status (P<0.05). Table 2 shows a comparison between the case (PC) and control groups based on the scores of HEI components and daily intake. Total HEI-2010 was significantly higher in the control group than the case group (p<0.001). The control group compared with the case group had higher intake and scores on components of whole fruit, total fruit, total vegetables, fatty acids (p<0.001), seafood, and plant protein(p=0.023). Sodium intake was significantly lower in the control group than that in the case group. Table 3 shows odds ratios (OR) and confidence intervals (95% CI) for PC by HEI-2010 components as well as total HEI-2010 scores. After adjusting the impact of confounders (energy intake, BMI, waist circumstance, family history of diabetes and blood pressure and smoking status). Individuals in the highest tertile of total fruit intake (OR=0.14; 95% CI=0.05-0.42), total vegetables (OR=0.23; 95% CI=0.09-0.59), whole fruit (OR=0.15; 95% CI=0.05-0.44), and fatty acids (OR=0.12; 95%CI=0.03-0.37) showed a significant decrease in the risk of PC compared to those in the lowest tertile of intake. There was no difference in terms of MSDPS between case and control groups (Table 5).

Table 1. The Standard Scoring for HEI-2010

HEI-2010 components	Maximum points	Standard for maximum score	Standard for minimum score of zero
Total fruit[1]	5	≥0.8 cup equiv. per 1,000 kcal	No fruit
Whole fruit[2]	5	≥0.4 cup equiv. per 1,000 kcal	No whole fruit
Total vegetables[3]	5	≥1.1cup equiv. per 1,000 kcal	No vegetables
Greens and Beans[3]	5	≥0.2 cup equiv. per 1,000 kcal	No dark greens or beans and peas
Whole Grains	10	≥1.5 oz equiv. per 1,000 kcal	No whole grains
Dairy[4]	10	≥1.3 cup equiv. per 1,000 kcal	No dairy
Total Protein Foods[5]	5	≥2.5 oz equiv. per 1,000 kcal	No protein foods
Seafood and Plant Proteins[6]	5	≥0.8 oz equiv. per 1,000 kcal	No seafood and plant proteins
Fatty Acids[7]	10	(PUFAs + MUFAs)/SFAs ≥2.5	PUFAs + MUFAs)/SFAs ≤1.2
Refined Grains[8]	10	≤1.8 oz equiv. per 1,000 kcal	≥4.3 oz equiv. per 1,000 kcal
Sodium	10	≤1.1 gram per 1,000 kcal	≥2.0 grams per 1,000 kcal
Empty calories	20	≤19% of energy	≥50% of energy

1, includes fruit juice; 2, includes all forms except juice; 3, include any beans and peas; 4, includes all milk products, such, such as fluid milk, yogurt, cheese and fortified soy beverage; 5, if total protein foods standard not met, beans and peas are included here; 6, includes seafood, nuts, seeds, soy products (except beverages), beans, and peas; 7, ratio of PUFA+MUFA/ SFA; 8, calories from solid fats, alcohol, and added sugars

Table 2. Baseline Characteristics of PC Cases and Healthy Controls, in a Case Control Study of PC

Characteristics	Case (97)	Control (205)	P-Value*
Age (year)	59.82 (9.55)	59.59 (9.32)	0.85
BMI (kg/m^2)	25.61 (2.35)	29.12 (5.25)	<0.001
Waist circumstance (cm)	82.08 (11.12)	90.13 (10.32)	<0.001
Energy (kcal/day)	2837 (925.78)	2989 (938.74)	0.18
Marital status			0.1
Married	90 (92.8)	167 (81.5)	
Not married	7 (7.2)	38 (18.5)	
Smoking status			<0.001
Yes	9 (9.3)	0 (0.0)	
No	88 (90.7)	205 (100)	
Diabetes			<0.001
Yes	8 (8.2)	0 (0.0)	
No	89 (91.8)	205 (100)	
Hypertension			<0.001
Yes	21 (21.6)	0 (0.0)	
No	76 (78.4)	205 (100)	

Data are presented as frequency (percentage) or mean(SD); P-value was estimated using χ 2 or fisher test and t-test

Table 3. A Comparison between the Case (PC Patients) and Control Groups Based on Daily Intake and Scores of the Healthy Eating Index (HEI) Components

HEI-2010 components	Intake per day				HEI-2010 scores		
	Unit	Case (97)	Control (205)	pvalue	Case (95)	Control (205)	pvalue
HEI					61 9.37 ± (54.56-66.68)	70.07 ± (64.35-76.70)	<0.001**
Total fruit	Cup	1.19 0.78± (0.67-1.71)	1.68 ± 0.88 (1.11-2.14)	<0.001*	4.18 ±1.59 (4.21-5.00)	4.84 ± 0.62 (5.00-5.00)	<0.001*
Whole fruit	Cup	1.16 ± 0.76 (0.64-1.66)	1.64 ± 0.86 (1.08-2.09)	<0.001*	4.43 ±1.51 (5.00-5.00)	4.94 ± (5.00-5.00)	<0.001*
Total vegetables	Cup	1.1 ± 0.57 (0.69-1.45)	1.86 ± 3.55 (1.04-1.88)	<0.001*	3.99 ±1.12 (3.15-5.00)	4.68 ± 0.68 (4.76-5.00)	<0.001*
Greens and Beans	Cup	0.24 ± 0.22 (0.10-0.31)	0.47 ± 3.40 (0.08-0.30)	0.29	3.75 ± 1.45 (2.66-5.00)	3.5 ± 1.62 (2.01-5.00)	0.29
Whole Grains	OZ	1.36 ± 1.56 (0.31-1.91)	1.1 ± 1.31 (0.41-1.20)	0.32	5.81 ±3.75 (2.07-10.00)	5.39 ± 3.18 (2.76-8.06)	0.34
Dairy	Cup	0.83 ± 0.40 (0.58-1.03)	0.83 ±0.41 (0.54-1.11)	0.99	6.12 ± 2.42 (4.49-7.92)	6.15 ± 2.61 (4.17-8.54)	0.92
Total Protein Foods	OZ	1.63 ± 0.63 (1.12-2.01)	1.72 ± 0.70 (1.23-2.10)	0.35	3.18 ± 1.10 (2.25-4.03)	3.31 ± 1.13 (2.46-4.20)	0.35
Seafood and Plant Proteins	OZ	0.52 ± 0.42 (0.22-0.71)	0.46 ± 0.56 (0.12-0.63)	0.03*	3.59 ± 1.46 (2.22- 0)	3.91 ± 1.33 (2.90-5.00)	0.023*
Fatty Acids	gr	1.21 ± (0.89-1.40)	2.08 ± 0.78 (1.52-2.47)	<0.001*	2.49 ± 3.33 (0-5.61)	7.34 ± 2.54 (6.08-9.88)	<0.001*
Refined Grains	OZ	4.15 ± 2.31 (2.67-5.37)	4.19 ± 2.04 (2.73-5.39)	0.53	4.32 ± 3.65 (0-6.72)	3.99 ± 3.65 (0-6.59)	0.44
Sodium	gr	107.6 ± (55.30-143.86)	3.06 ± (1.62-3.31)	<0.001*	0.27 ± 1.57 (0-0)	2.95 ± 3.72 (0-6.59)	<0.001*
Empty calories	% of energy	17.31 ± 5.88 (13.68-19.38)	16.52 ± 5.62 (12.27-20.29)	0.29	18.94 ± 2.64 (19.60-20)	18.97 ± 1.96 (18.76-20.00)	0.74

Value presented as mean±SD (IQR); * Significant difference (Mann-Whitney, p-value<0.05);** Significant difference (t-test, p-value<0.05)

Discussion

The associations between MSDPS and HEI 2010 and risk of PC were evaluated in this study. We found that participants with a higher adherence to HEI-2010 had a reduced risk of PC. In contrast, no significant association was found between MSDPS and risk of PC. Only few studies examined the index-based patterns and risk of PC. Bosire et al., (2013) found that high AHEI-2010 and HEI- 2005 scores were associated with lower risk of total PC. The HEI-2010 seems to be more relevant than AHEI-2010 in decreasing cancer risk and mortality (Onvani et al., 2017). Differences between the two patterns may be due to this fact that HEI does not include alcoholic beverages and red and processed meat, whiles they are considered as AHEI components. According to previous studies, adherence to a Mediterranean dietary pattern was related to reduce risk of overall mortality and cancer incidence and mortality (Sofi et al., 2010; Verberne et al., 2010). However, several studies found no association between the Mediterranean diet score and PC (Tseng et al., 2004; Möller et al., 2013; Ax et al., 2014), our findings were consistent with those of other studies. The risk estimate is based on components of the Mediterranean diet pattern that is scored based on the intake of population distribution. The reported median intake in a Greek population is extremely higher than that in other populations listed here. The identified Mediterranean dietary pattern in these populations were not extensively Mediterranean, which may explain the different findings. Findings on dietary pattern and PC are inconsistent. A number of studies found no association between specific dietary patterns and PC (Tseng et al., 2004; Wu et al., 2006; Muller et al., 2009); however; the other studies reported a positive association between a western dietary pattern and PC (Ambrosini et al., 2008). Individual component analyses were also performed, indicating significant inverse association between PC and seafood and plant protein as well as the ratio of total unsaturated/saturated fatty acids in HEI-2010 and the components of vegetables and fruits in both HEI-2010 and MED. Previous studies also found an inverse association between fish intake and PC risk (Augustsson et al., 2003; Ambrosini et al., 2008; Chavarro et al., 2008; Pham et al., 2009). Augustsson et al., (Augustsson et al., 2003) showed that eating fish 3 or more times per week could reduce risk of metastatic PC 44% compared to its consumption less than 2 times per month. This association was also reported by Chavarro et al., (2008). A proposed mechanism for the protective effect of fish on PC is the long-chained ω-3 fatty acids present in fish. Both EPA and DHA have been found to inhibit the biological activity of eicosanoids and androgens (Faust et al., 1989; Zaccheo et al., 1998), which could stimulate the growth of PC cells (Ghosh and Myers, 1997; Rose, 1997). The results of this study on the consumption of plant protein seem to

Table 4. OR and 95% Confidence Interval for Risk of PC Based on Tertiles of HEI-2010 Components and Total HEI-2010

Variable in tertile	Case (n)	Control (n)	OR[1]	CI	OR[2]	CI
HEI-2010 (SCORE)						
Tertile 1 (<66.08)	70	68	Ref		Ref	
Tertile2 (66.08-73.20)	18	69	0.25	(0.13-0.47)	0.19	(0.01-0.49)
Tertile3 (>73.20)	9	68	0.12	(0.059-0.27)	0.063	(0.01-0.28)
P for trend			<0.001		<0.001	
Total fruit[a]						
Tertile 1 (<1.22)	59	66	ref			
Tertile2 (1.22-1.85)	18	71	0.28	(0.15-0.53)	0.11	(0.03-0.32)
Tertile3 (>1.85)	20	68	0.32	(0.17-0.60)	0.14	(0.05-0.42)
P for trend			<0.001		<0.001	
Whole fruit[a]						
Tertile 1 (<1.20)	59	66	Ref		Ref	
Tertile2 (1.20-1.80)	19	70	0.3	(0.16-0.56)	0.12	(0.04-0.36)
Tertile3 (>1.80)	19	69	0.3	(0.16-0.15)	0.15	(0.05-0.44)
P for trend			<0.001		<0.001	
Total vegetables[a]						
Tertile 1 (<1.15)	61	68	Ref		Ref	
Tertile2 (1.15-1.73)	25	68	0.41	(0.23-0.72)	0.27	(0.11-0.67)
Tertile3 (>1.73)	11	69	0.17	(0.80-0.36)	0.23	(0.09-0.59)
P for trend			<0.001		0.001	
Greens and Beans[a]						
Tertile 1 (<0.10)	23	68	Ref		Ref	
Tertile2 (0.10-0.26)	42	68	1.82	(0.99-3.35)	2.55	(0.91-7.01)
Tertile3 (>0.26)	32	69	1.37	(0.72-2.57)	2.88	(1.04-7.93)
P for trend			0.37		0.06	
whole Grains[b]						
Tertile 1 (<0.51)	32	67	Ref		Ref	
Tertile2 (0.51-1.04)	20	69	0.6	(0.31-1.16)	0.7	(0.31-1.56)
Tertile3 (>1.04)	45	69	1.36	(0.77-2.40)	0.43	(0.17-1.03)
P for trend			0.23		0.35	
Dairy[a]						
Tertile 1 (<0.61)	31	65	Ref		Ref	
Tertile2 (0.61-0.95)	32	69	0.97	(0.53-1.77)	0.93	(0.38-2.23)
Tertile3 (>0.95)	34	71	1	(0.55-1.81)	0.99	(0.41-2.35)
P for trend			0.98		0.99	
Total Protein Foods[b]						
Tertile 1 (<1.40)	33	67	Ref		Ref	
Tertile2 (1.40-1.90)	33	69	0.97	(0.53-1.74)	0.47	(0.19-1.14)
Tertile3 (>1.90)	31	69	0.91	(0.50-1.63)	0.5	(0.21-1.19)
P for trend			0.76		0.11	
Seafood and Plant Proteins[b]						
Tertile 1 (<0.18)	18	68	Ref		Ref	
Tertile2 (0.18-0.49)	38	69	2.08	(1.08-3.99)	0.37	(0.14-1.00)
Tertile3 (>0.49)	41	68	1.19	(1.19-4.35)	1	(0.46-2.22)
P for trend			0.01		0.06	

Table 4. Continued

Variable in tertile	Case (n)	Control (n)	OR[1]	CI	OR[2]	CI
Fatty Acids[d]						
Tertile 1 (<1.67)	81	67	Ref		Ref	
Tertile2 (1.67-2.22)	11	69	0.13	(0.06-0.26)	0.09	(0.02-0.34)
Tertile3 (>2.22)	5	69	0.06	(0.02-0.15)	0.12	(0.03-0.37)
P for trend			<0.001		<0.001	
Refined Grains[c]						
Tertile 1 (<3.13)	35	68	Ref		Ref	
Tertile2 (3.13-4.81)	34	69	0.95	(0.53-1.70)	0.95	(0.39-2.30)
Tertile3 (>4.81)	28	68	0.8	(0.43-1.45)	1.17	(0.51-2.72)
P for trend ined Grains			0.47		0.69	
Sodium[c]						
Tertile 1 (<1.84)	3	68	Ref		Ref	
Tertile2 (1.84-2.74)	2	66	0.68	(0.11-4.24)	0.66	(0.05-7.17)
Tertile3 (>2.74)	92	71	29.73	(8.87-97.22)	19.83	(4.40-88.10)
P for trend			<0.001		<0.001	
Empty calories[e]						
Tertile 1 (<13.32)	21	68	Ref		Ref	
Tertile2 (13.32-18.76)	46	69	2.15	(1.16-3.99)	0.62	(0.23-1.62)
Tertile3 (>18.76)	30	68	1.42	(0.74-2.74)	1.49	(0.66-3.34)
P for trend			0.75		0.94	

1, crude odds ratio; 2, odds ratio adjusted for energy intake (continuous), hypertension (yes or no), diabetes (yes or no), smoking (yes or no), BMI (continuous), and waist circumstance (continuous); a, Density measure calculated as daily cups per 1,000 kcal; b, Density measure calculated as daily ounces per 1,000 kcal; c, Density measure calculated as daily grams per 1,000 kcal; d, Ratio of poly- and monounsaturated fatty acids to saturated fatty acids; e, total calories from solid fat, alcoholic beverages, and added sugar expressed as percent of total kcal.

be consistent with those reported by other studies which found statistically significant inverse association between PC risk and intake of legumes ref , beans ref, peas/beans/lentils, and nut (Mills et al., 1989; Jain et al., 1999; Kolonel et al., 2000). The constituents of plant proteins that have anticarcinogenic properties and can be considered potentially protective against cancer could potentially account for a protective effect include fiber, protease inhibitors (Rao and Sung, 1995; Kennedy, 1998), saponins (Rao and Sung, 1995), inositol hexaphosphate (Fournier

Table 5. A Comparison between the Case and Control Groups Based on Daily Intake and Score Distribution of the Mediterranean-Style Dietary Pattern Score (MSDPS) Components; a Case-Control Study of PC in Iran.

MSDPS		Intake distribution			MSDPS scores distribution		
components	Unit	Case (97)	Control (205)	pvalue	Case (95)	Control (205)	Pvalue*
MSDPS total	_	_	_		26.20 (18.98-35.94)	24.49 (19.20-33.63)	0.44
Whole grain	Cup/daily	2.39 (0.70-5.00)	1.83 (1.09-2.89)	0.15	2.99 (0.88-6.25)	2.28 (1.37-3.61)	0.12
Fruits	Cup/daily	3.40 (1.83-4.97)	4.31 (2.86-6.14)	<0.001	7.92 (6.11-8.58)	8.29 (7.39-8.72)	0.003
Vegetables	Cup/daily	2.22 (1.64-3.44)	3.27 (2.43-4.61)	<0.001	3.72 (2.74-5.74)	5.40 (4.02-7.47)	<0.001
Dairy	Cup/daily	2.14 (1.52-2.84)	2.27 (1.49-3.20)	0.29	8.42 (7.01-8.80)	8.34 (7.30-8.69)	0.34
Fishe and other seafood	60 gr/weekly	1.48 (0.68-2.79)	0.94 (0.36-2.60)	0.21	2.48 (1.14-4.67)	1.55 (0.60-4.41)	0.17
Poultry	60 gr/weekly	2.83 (1.41-4.25)	1.06 (0.21-2.60)	<0.001	7.08 (3.54-8.85)	2.66 (0.54-6.50)	<0.001
Olives, legumes, nuts	Cup/weekly	4.79 (2.60-9.78)	5.20 (2.67-8.32)	0.9	7.36 (5.58-8.40)	7.70 (5.94-8.56)	0.43
Potatoes	Cup/weekly	0.78 (0.43-1.59)	1.60 (0.78-2.80)	<0.001	2.63 (1.43-5.32)	5.25 (2.62-7.99)	<0.001
eggs	weekly	2.08 (1.04-3.16)	0.99 (0.01-2.99)	<0.001	6.92 (3.46-7.89)	3.32 (0.04-7.99)	<0.001
sweets	Oz/ weekly	0.94 (0.41-2.02)	0.95 (0.36-2.69)	0.48	10.00 (10.00-10.00)	10.00 (10.00-10.00)	0.051
Red meat	60 gr/mounthly	16.85 (7.20-27.07)	23.35 (12.22-3417)	<0.001	5.78 (3.23-8.19)	4.16 (1.45-6.94)	<0.001
Olive oil	daily	0.17 (0.00-0.60)	0.00 (0.00-0.16)	<0.001	_	_	<0.001

* P-value estimated using Mann-Whitney; 1, Data are presented as median (5th, 95th percentile); 2, Total MSDPS was the sum of 12 components standardized to a 0–100 scale and weighted to the proportion of daily energy intake from Mediterranean diet foods.

et al., 1998), phytosterols (Steinmetz and Potter, 1996) and g-tocopherol (Steinmetz and Potter, 1996). We also found an association between other components and PC risk. The intake of fruits and vegetables, the components of both MED and HEI-2010, was inversely associated with PC risk. Previous reports also indicated that vegetables intake was associated with reduced PC risk (Kolonel et al., 2000; Takachi et al., 2009; Umesawa et al., 2014). There are several possible mechanisms for the inverse association between vegetable intake and risk of PC. For instance, vegetable components, including isothiocyanates and glucosinolates activate phase 2 enzyme, detoxificating carcinogen and stimulating cancer cell apoptosis (Hayes et al., 2008; Ho et al., 2009).

The results on the association between fruit intake and PC risk are contrasting. In some studies, fruits intake was associated with a reduced risk of cancer (Mills et al., 1989). While other studies showed that fruit consumption did not have any effects on cancer risk (Severson et al., 1989; Schuurman et al., 1998). Evidence for the protective effect of fruits is limited and the reported findings are contradictory (Umesawa et al., 2014). Previous reports highlighted increased risk of PC following animal fat and saturated fat consumptions (Le Marchand et al., 1994; Pelser et al., 2013). In the current study, an inverse association between higher ratio of USFA/ SFA intake and PC risk was found. The prospective studies showed that SFA intake was related to the risk of advanced or fatal PC (Pelser et al., 2013). This increased effect can be due to the effect of SFA on the level of sex hormones. Hill et al., (1979) showed that reducing the consumption of animal fats and replacing them with vegetable oils led to lower levels of estrogens and androgens.

Case-control studies are subject to limitations that should be considered in interpreting their results. First, the possibility of selection bias cannot be avoided in retrospective case–control studies. In addition, our controls might also have nutritional problems, which could dilute the association of dietary intakes and risk of PC due to sharing of the exposure. However, we preferred hospital controls (opposed to community controls) due to their higher participation and cooperation rates and to avoid selection bias. The present study had several strengths. First, the participation rate in this study was high. Second, patients whose disease was diagnosed during previous 6 months were registered in order to reduce the possibility of recall bias. This is due to the fact that dietary data collected at the time of disease ascertainment might not truly reflect past intakes or intakes during the development of disease. Third, we used a valid FFQ to reduce measurement error.

In conclusion, the present study was designed to determine the effect of diet quality on PC risk. The result of this investigation showed that healthy diet based on dietary guidelines for American 2010 can reduce the risk of PC. These findings enhance our understanding of the effects of dietary quality on PC risk. Further investigation on dietary indices is strongly recommended. Considerably more work is needed to be done to determine the best dietary recommendation for cancer prevention.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Note!!! It is very important to cite the references according to the journal rules and format.

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