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ORIGINAL STUDY

Higher intakes of fruits and vegetables are related to fewer menopausal symptoms: a cross-sectional study

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Abstract

Objectives: The aim of this study was to explore the associations between fruit and vegetable (FV) intake, and its subgroups and menopausal symptoms along with its subtypes in postmenopausal women.

Methods: This cross-sectional study included 393 postmenopausal women in municipality health centers in the south of Tehran, Iran. Sociodemographic data, dietary intakes, and anthropometric measures were obtained from individuals. Menopause rating scale (MRS) questionnaire was employed to measure menopausal symptoms. The total MRS score (TMRSS) was the sum of the somatic score (SS), psychological score (PS), and urogenital score (US). Participants were divided into low and high total MRS and its domain scores.

Results: After adjustment for confounding variables, an inverse relationship was found between total FV with TMRSS (odds ratio [OR] 0.23, 95% confidence interval [CI] 0.06-0.81) and SS (OR 0.30, 95% CI 0.11-0.82). In addition, the consumption of total fruits was significantly related to lower SS (OR 0.27, 95% CI 0.10-0.71). Only intake of citrus fruits was inversely associated with TMRSS (OR 0.23, 95% CI 0.07-0.71) and SS (OR 0.28, 95% CI 0.11-0.70). Likewise, intakes of total FV (OR 2.46, 95% CI 1.37-4.41), total vegetables (OR 2.54, 95% CI 1.10-5.88), green leafy vegetables (OR 3.59, 95% CI 1.47-8.75), dark yellow vegetables (OR 2.28, 95% CI 1.00-5.18), other vegetables (OR 5.23, 95% CI 1.17-15.39), and citrus fruits were linked to higher US (OR 4.35, 95% CI 1.77-10.71).

Conclusion: The results of the present study showed that some FV subgroups had inverse associations with climacteric symptoms, whereas higher intake of some subgroups of FV appeared to be associated with more urogenital symptoms in postmenopausal women.

Key Words: Dietary pattern – Fruit – Hot flashes – Menopausal symptoms – Menopause – Vegetable.

Millions of women experience menopausal symptoms annually.[1] The decline of estrogen production at menopause may cause bothersome climacteric symptoms including vasomotor symptoms, vaginal dryness, insomnia, joint pain, and mood swings.[2] Vasomotor symptoms are attributed to hot flashes which contribute to night sweats around the head, neck, chest, and upper back.[3] Vaginal dryness, which is reported as irritation, itching, or discomfort during sexual intercourse, is caused by inflammation, decreased secretory function of the vaginal epithelium, mucosa layer, and microbiota changes.[4,5] Oxidative stress,[6] and chemical,[6] metabolic, and hormonal changes are involved in climacteric symptoms which may result in decreased quality of life in postmenopausal women.[7] In addition, some aspects of lifestyle such as body mass index (BMI),[8] smoking,[9] alcohol use,[10] physical activity,[11] and dietary factors[12] have been linked to the onset of menopause-related symptoms.

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There are a number of different options for relieving these symptoms. Hormone therapy (HT) is an acceptable method for the treatment of menopause-related symptoms,[13] but it is a temporally limited option because of increased health risks including breast cancer and pulmonary embolism.[14,15] Therefore, identification of modifiable lifestyle factors that might prevent or alleviate climacteric symptoms has become increasingly important. Indeed, dietary factors may have a critical role in estrogen production and metabolism, and consequently menopausal symptoms.[16]

The results of a prospective study revealed an association between higher intake of fat plus sugar and higher risk of hot flashes and night sweats among middle-aged women. However, consumption of fruits or Mediterranean-style diet, characterized by high content of vegetables, fruits, cereals, and nuts, was linked to fewer menopausal symptoms and complaints.[17] Nevertheless, in the Women's Health Across the Nation cohort study, dietary factors were not linked to menopausal symptoms.[16] Meanwhile, greater adherence to a fruit and vegetable (FV) dietary pattern was cross-sectionally associated with lower general, physical, and mental complaints of menopause symptoms.[48] Similar findings have been reported for a vegan diet[18] and a Mediterranean dietary pattern[19] in cross-sectional studies.

Regarding interventional studies, the results of a clinical trial suggested that adhering to a diet low in fat and high in whole grains, fruits, and vegetables leads to the elimination of menopausal symptoms after 1 year.[20] Likewise, the beneficial effects of omega-3 fatty acids[21] and tomato juice[22] in the treatment of climacteric symptoms have been observed.

Several publications have confirmed the inverse relationship between FV intake and the risk of chronic diseases.[23,24] FV contains dietary fiber and a wide range of vitamins, particularly vitamin E, C, and B6, plus minerals including potassium and magnesium, and phytochemicals.[25] These vitamins, minerals, and phytochemicals are associated with potential favorable metabolic outcomes.[26-28] Vitamin E, which is found in various vegetable oils, is related to maintaining the estrogen level and improving the intensity and frequency of hot flashes.[29] Additionally, vitamin E and C, rich in their antioxidant capacity, scavenge free radicals and neutralize oxidative stress.[30] Furthermore, FV consumption contributes to satiety and replaces more caloric-dense foods to impede weight gain.[31]

Few studies have explored individual FV and menopausal symptoms.[32-34] The results of these investigations suggested that intakes of yellow-green vegetables,[32] soy and cruciferous vegetables,[33] and dietary fiber[34] were linked to fewer hot flashes, and less depression and stress. However, the association of FV subgroups with menopausal symptoms subscales has not been evaluated. Accordingly, the current study aimed to address the relationship between climacteric symptoms and their subscales and total intakes of FV, and also their specific subtypes such as green, yellow, cruciferous and other vegetables, plus citrus, berry, and other fruit, separately.

METHODS

Participants

The present cross-sectional study recruited 393 postmenopausal women aged 40 to 76 years attending the municipality health centers affiliated with Tehran University of Medical Sciences in the south of Tehran, Iran, from September, 2016 to January, 2017. Sample size was calculated according to the previous article by Nomura et al,[33] which in this study the prevalence of climacteric symptoms in groups with high and low consumptions of cruciferous vegetables were 45% and 59%, respectively. Hence, by considering $\alpha = 0.05$, $\beta = 0.2$, and according to two proportion comparison formulas, sample size was determined to be approximately 393. Using random sampling, two regions were selected from six regions of the south of Tehran. Then, 10 urban health centers affiliated with Tehran University of Medical Sciences (TUMS) and 10 health centers affiliated with the municipality of Tehran were randomly chosen from these two regions. In total, 550 postmenopausal women were randomly invited to participate in the study, of whom 157 women did not fulfill inclusion criteria, declined participation, or had incomplete data. Thus, they were excluded from the study, resulting in 393 participants in the present study (Fig. 1). The participants were included in the study if they had been postmenopausal for at least 1 year. The exclusion criteria were as follows: having a BMI $\geq$40 kg/m^2, smoking, medical history or presence of particular comorbidities such as cancer, diabetes, stroke, multiple sclerosis, dementia, hyper or hypothyroidism, and undergoing HT for the past 6 months. The protocol was

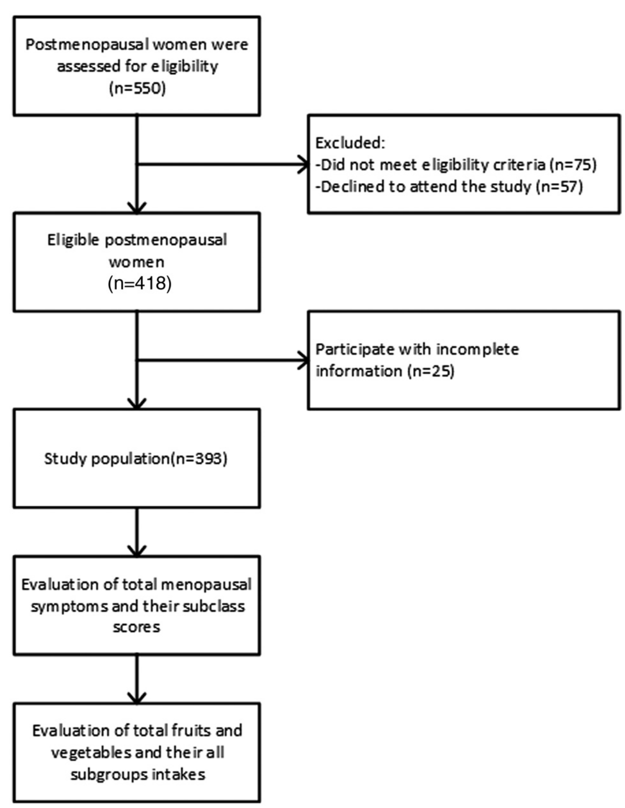

FIG. 1. Flow diagram for selecting women.

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approved by the Ethics Committee of Tehran University of Medical Sciences. All participants gave written consent after receiving information about the study.

General characteristics, and anthropometric and physical activity measurements

Individual characteristics such as age (year), years of education, marital status, age of menopause (year), socioeconomic status (low/high or moderate), drug and dietary supplement use (yes/no), and history of any diseases were asked by a face-to-face interview. Marital status was categorized as married versus single, divorced, or widowed. Further, the socioeconomic status was determined by asking about possession of objects (living items), including separate freezer or dual fridge freezer; personal car; personal home; computer; large-size, flat-screen color TV; handmade carpet; washing machine; villa or extra home, and microwave. Socioeconomic status was classified as follows: having three or fewer living items for low status; four to six living items for average status; and seven to nine living items at home for high status. All anthropometric measurements including height, body weight, and waist circumference (WC) were taken at baseline recruitment according to a standard protocol by trained interviewers. A digital weighing scale (Seca725 GmbH & Co. Hamburg, Germany) was used for body weight measurement to the nearest 0.1 kg. Height was measured to the nearest 0.5 cm, with women wearing no shoes in standing posture. BMI was computed via dividing the weight (kg) by the square of height (m). WC was measured at the midpoint between the lower border of the rib cage and the iliac crest using a flexible tape (cm). Each anthropometric measure was done just one time. The short form of the International Physical Activity Questionnaire (IPAQ)[35] was used to obtain information about physical activity to calculate the metabolic equivalent (MET) min/wk. The reliability and validity assessment of IPAQ across 12 countries showed that it can be used in many settings and in different languages.[36] The assessment of total physical activity, and the duration and frequency of physical activity days were multiplied by the MET value of the activity. Then, the sum of the scores was calculated as the total exercise min/wk.

Assessment of menopausal symptoms

Menopause rating scale (MRS) questionnaire with 11 items consisting of somatic, psychological, and urogenital symptoms was used to evaluate menopausal symptoms. The validity and reliability of this questionnaire had already been assessed in Iran.[37] The participants were asked to report their experiences of each of the following symptoms within the last month; somatic symptoms: hot flashes, sweating, trouble sleeping, heart discomfort, and joint and muscle complaints; psychological symptoms: depressive mood, irritability, anxiety, exhaustion, and difficulty concentrating; urogenital symptoms: sexual problems, bladder complaints, and vaginal dryness. Each item ranges from 0 (no symptom) to 4 (1, mild; 2, moderate; 3, severe; 4, very severe) score. The total MRS score (TMRSS) was the sum of the somatic score (SS), psychological score (PS), and urogenital score (US).

Dietary intake assessment

Typical dietary intake was assessed through an in-person interview using a validated semiquantitative 147-item Food Frequency Questionnaire (FFQ).[38] The validity and reproducibility of the FFQ for the main food groups including vegetables and fruits were determined. Correlation coefficients for reproducibility were 0.58 and 0.50, and for validity were 0.35 and 0.50 for fruits and vegetables, respectively.[38] The FFQ consisted of food items with a standard serving size commonly consumed by Iranian people.[39] A trained interviewer asked each participant to report the frequency and amount of consumption of each food item on a daily, weekly, monthly, or yearly scale over the previous year. Portion sizes of consumed foods reported in household measures were then converted to grams. Mixed dishes were disaggregated into their component items. The food items were analyzed for their energy and nutrients content using the Nutritionist IV software version 3.5.1 (1995),[40] modified for Iranian foods.[41] Iranian food composition table was used as an alternative for foods like Iranian bread (four items), cheese (two items), Kashk (whey), fruit (two items), sweets (nine items), and industrial fruit juice (one item), which are not included in the US Department of Agriculture (USDA) food composition table. The software database is derived from USDA food composition tables (May, 2015).[42] FVs were divided into specific subgroups, including cruciferous vegetables, green leafy vegetables, dark yellow vegetables, and other vegetables, plus berry, citrus fruits, and other fruits based on previous publications.[43,44] The intake of FV based on serving/d was also computed.

Statistical analysis

Statistical analyses were performed with SPSS for Windows (SPSS Inc. Version 23, Chicago, IL) (2015).[45] The Kolmogorov-Smirnov test was employed to check data normality, and square root transformation was applied to skewed variables. Data were reported as means $\pm$ SDs for continuous variables depending on distribution, while number and percentage for reporting the categorical variables.

We created a nominal variable to participants having low/mild TMRSS (<9), SS (<5), PS (<4), and US (<2), or moderate/high TMRSS, SS, PS, and US (TMRSS ≥ 9, SS ≥ 5, PS ≥ 4, and US ≥ 2).[46] The intakes of FV and their all subgroups were divided into quartiles. The mean values of the quantitative variables across the FV quartiles were compared using the analysis of variance test.

We also used simple logistic regressions to estimate odds ratio (OR) and 95% confidence interval (CI) for the presence of TMRSS ≥ 9, SS ≥ 5, PS ≥ 4, and US ≥ 2 across quartiles of FV. In addition to the unadjusted analysis (model 1), we used multivariable models to assess the relationship between FV intake and moderate/high menopausal symptoms and their subtypes (model 2). In model 2, we adjusted for age (year), education (year), socioeconomic status (low or high/average), energy intake (kilocalorie/day), BMI (kg/m^2), physical activity (MET/min/wk), and time since menopause (year). These

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TABLE 1. *Characteristics of Iranian postmenopausal women according to quartiles (Q) of total vegetable[a] and fruit intake[b] in a cross-sectional study assessing the association of fruit and vegetable intake with menopausal symptoms*

	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[c]
Gram/d (median)	396.0	595.4	807.0	1129.6	
Age (y)	57.7 ± 6.6	56.7 ± 6.1	56.9 ± 5.9	57.2 ± 6.7	0.6
Education (y)	3.5 ± 3.8	3.5 ± 3.4	3.9 ± 4.7	4.2 ± 3.1	0.5
Time since menopause (y)	9.2 ± 7.4	7.0 ± 6.0	8.0 ± 6.4	8.5 ± 7.1	0.1
Socioeconomic status[d]					0.2
Low	65 (66)	56 (57)	68 (68)	67 (68)	
High/average	33 (34)	42 (43)	31 (32)	31 (32)	
Marital status, n (%)					0.3
Married	69 (70)	78 (79)	75 (75)	81 (82)	
Single/divorced/widowed	29 (30)	20 (21)	24 (25)	17 (18)	
Body mass index (kg/m^2)	30.4 ± 4.3	30.5 ± 4.1	30.4 ± 4.3	30.3 ± 4.5	0.9
Waist circumference (cm)	105.56 ± 10.8	103.43 ± 10.9	103.67 ± 11.5	104.83 ± 11.7	0.5
Physical activity (metabolic equivalent /min/wk)	632.4 ± 746.3	505.7 ± 477.2	678.5 ± 574.4	983.5 ± 928.1	<0.001
Dietary supplement use, n (%)	51 (52)	51 (52)	49 (49)	58 (59)	0.5
Energy intake (kcal/d)	1848.2 ± 433.8	2130.5 ± 438.7	2315.4 ± 449.9	2554.7 ± 506.1	<0.001

Values are means (standard deviations) or percentages unless stated otherwise.
[a]Vegetables include white cabbage, red cabbage, broccoli, cauliflower, spinach, lettuce, vegetable greens, carrot, yellow squash, cucumber, tomato, green squash, eggplant, celery, green peas, green beans, garlic, onion, bell peppers, turnip, mushroom, green peppers, olive, and corn.
[b]Fruits include strawberry, cranberry, blackberry, mulberry, orange, tangerine, sweet lemon, grapefruit, cantaloupe, melon, watermelon, pears, apricot, cheery, apple, plum, peach, persimmon, nectarine, green gage plums, figs, kiwi fruit, pomegranate, date, plum, sour cherry, banana, pineapple, apple juice, cantaloupe juice, grapes, raisin, dry peach, apricot, and natural fruit juice.
[c]Unadjusted model, ANOVA.
[d]Socioeconomic status represents: having three or less living items for low status, four to six living items for average status, and seven to nine living items at home for high status.

potential confounders were identified to be related with the outcome according to previous literature and theoretical considerations.[17,47,48] In addition, because some other dietary intakes such as dairy products, pickle, legumes, seeds, nuts, tea, coffee, fish, poultry, eggs, mayonnaise, liquid oils, solid fats, sweets, desserts, sugars, soft drinks, refined grains, potato, red meat, processed meat, organ meat, and snacks were associated with the menopausal symptoms in the participants of the present study,[49] the statistical analysis was adjusted for intake of these dietary factors as well. Also, for every FV subgroup, other FV subgroup intakes were adjusted. *P* for trend was calculated using logistic regression analyses on median values of intake in the quartiles. *P* values less than 0.05 were considered significant.

RESULTS

Tables 1-3 report the characteristics of participants according to quartiles of total FV, vegetables, and fruits. Most of the variables did not differ considerably across the quartiles, whereas individuals who reported a higher intake of FV, total vegetables, or total fruits had more energy intake and physical activity ($P < 0.03$) compared with individuals who reported a lower intake (Tables 1-3).

TABLE 2. *Characteristics of Iranian postmenopausal women according to quartiles (Q) of total vegetable intake[a] in a cross-sectional study assessing the association of fruit and vegetable intake with menopausal symptoms*

	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[b]
Gram/d (median)	179.4	255.1	357.5	535.7	
Age (y)	57.7 ± 5.8	57.1 ± 6.6	56.9 ± 6.5	56.9 ± 6.4	0.7
Education (y)	3.3 ± 3.6	3.9 ± 4.1	3.5 ± 3.5	4.4 ± 3.9	0.2
Time since menopause (y)	8.0 ± 6.3	8.1 ± 6.7	8.4 ± 7.4	8.3 ± 6.6	0.9
Socioeconomic status[c]					0.9
Low	63 (64)	65 (66)	63 (63)	65 (65)	
High/average	35 (36)	33 (34)	36 (37)	33 (35)	
Marital status, n (%)					0.7
Married	77 (78)	68 (69)	79 (79)	49 (50)	
Single/divorced/widowed	21 (22)	30 (31)	20 (21)	49 (50)	
Body mass index (kg/m^2)	30.4 ± 4.3	30.0 ± 4.6	30.7 ± 4.3	30.6 ± 3.9	0.6
Waist circumference (cm)	105.06 ± 11.0	102.77 ± 12.2	105.04 ± 10.8	104.62 ± 11.8	0.4
Physical activity (metabolic equivalent /min/wk)	508.4 ± 517.9	601.6 ± 591.7	815.4 ± 895.9	873.3 ± 764.1	0.001
Dietary supplement use, n (%)	57 (58)	46 (46)	50 (50)	56 (57)	0.3
Energy intake (kcal/d)	1903.6 ± 444.8	2164.0 ± 456.6	2285.2 ± 520.3	2496.3 ± 495.9	<0.001

Values are means (standard deviations) or percentages unless stated otherwise.
[a]Total vegetables were defined as in Table 1.
[b]Unadjusted model, ANOVA.
[c]Socioeconomic status represents: having three or less living items for low status, four to six living items for average status, and seven to nine living items at home for high status.

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TABLE 3. *Characteristics of Iranian postmenopausal women according to quartiles (Q) of total fruit intake[a] in a cross-sectional study assessing the association of fruit and vegetable intake with menopausal symptoms*

	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[b]
Gram/d (median)	171.7	288.7	425.9	717.1	
Age (y)	56.8 ± 6.8	57.1 ± 6.2	57.2 ± 6.0	57.5 ± 6.3	0.9
Education (y)	4.1 ± 4.3	3.5 ± 3.7	3.2 ± 3.4	4.4 ± 3.5	0.1
Time since menopause (y)	8.3 ± 7.2	7.9 ± 6.5	8.5 ± 6.7	8.0 ± 6.7	0.9
Socioeconomic status[c]					0.2
Low	57 (58)	65 (64)	67 (68)	66 (67)	
High/average	32 (42)	28 (36)	25 (32)	26 (33)	
Marital status, n (%)					0.1
Married	69 (70)	77 (78)	76 (76)	81 (82)	
Single/divorced/widowed	29 (30)	21 (22)	23 (24)	17 (18)	
Body mass index (kg/m^2)	30.4 ± 4.0	30.5 ± 4.2	30.4 ± 4.1	30.3 ± 4.7	0.9
Waist circumference (cm)	105.25 ± 10.5	104.25 ± 10.7	103.69 ± 11.3	104.32 ± 12.4	0.8
Physical activity (metabolic equivalent /min/wk)	619.6 ± 749.8	579.3 ± 515.6	727.2 ± 681.2	873.6 ± 868.6	0.02
Dietary supplement use, n (%)	47 (47)	59 (60)	51 (51)	52 (53)	0.3
Energy intake (kcal/d)	1882.3 ± 436.7	2170.9 ± 463.3	2278.8 ± 497.8	2517.3 ± 495.3	<0.001

Values are means (SDs) or percentages unless stated otherwise.
[a]Total fruits were defined as in Table 1.
[b]Unadjusted model, ANOVA.
[c]Socioeconomic status represents: having three or less living items for low status, four to six living items for average status, and seven to nine living items at home for high status.

TABLE 4. *Odds ratio (95% CI) of menopausal-related symptoms according to quartiles (Q) of total vegetables and fruits, vegetables, and its subtype's intake*

Daily intake	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[a]
Total vegetables and fruits g/d (median)	396.0	595.4	807.0	1129.6	
Cases with TMRSS $\geq$9 (n)	90	91	83	72	
Model 1	1 ref	01.15 (0.40-3.32)	0.46 (0.18-1.13)	0.24 (0.10-0.57)	
P		0.7	0.09	0.001	<0.001
Model 2	1 ref	1.18 (0.36-3.85)	0.51 (0.17-1.52)	0.23 (0.06-0.81)	0.01
P		0.7	0.2	0.02	
Cases with SS $\geq$5 (n)	83	85	73	58	
Model 1	1 ref	1.18 (0.53-2.63)	0.50 (0.25-1.03)	0.26 (0.13-0.51)	
P		0.6	0.06	<0.001	<0.001
Model 2	1 ref	1.50 (0.61-3.68)	0.51 (0.21-1.20)	0.30 (0.11-0.82)	
P		0.3	0.1	0.01	0.006
Cases with PS $\geq$4 (n)	77	71	66	50	
Model 1	1 ref	0.71 (0.37-1.38)	0.54 (0.28-1.03)	0.28 (0.15-0.53)	
P		0.3	0.06	<0.001	<0.001
Model 2	1 ref	0.86 (0.41-1.79)	0.64 (0.30-1.37)	0.42 (1.74-1.05)	
P		0.6	0.2	0.06	0.056
Cases with US $\geq$2 (n)	47	73	76	68	
Model 1	1 ref	3.16 (1.73-5.78)	3.58 (1.94-6.61)	2.46 (1.37-4.41)	
P		<0.001	<0.001	0.003	0.003
Model 2	1 ref	2.98 (1.45-7.99)	3.66 (1.67-7.99)	2.39 (0.93-6.16)	
P		0.003	0.001	0.07	0.02
Total vegetables g/d (median)		179.4	255.1	357.5	535.7
Cases with TMRSS $\geq$9 (n)	91	85	79	81	
Model 1	1 ref	0.50 (0.19-1.32)	0.30 (0.12-0.75)	0.36 (0.14-0.92)	
P		0.1	0.01	0.03	0.03
Model 2	1 ref	0.83 (0.28-2.44)	0.57 (0.19-1.70)	0.66 (0.20-2.19)	0.4
P		0.7	0.3		0.5
Cases with SS $\geq$5 (n)	80	79	71	69	
Model 1	1 ref	0.93 (0.53-2.74)	0.57 (0.35-1.61)	0.53 (0.26-1.14)	
P		0.6	0.1	0.06	0.03
Model 2	1 ref	1.31 (0.58-2.98)	0.84 (0.38-1.87)	0.88 (0.36-2.10)	0.5
P		0.5	0.6		0.7
Cases with PS $\geq$4 (n)	76	69	57	62	
Model 1	1 ref	0.68 (0.36-1.31)	0.39 (0.21-0.73)	0.49 (0.26-0.93)	0.01
P		0.2	0.003	0.03	0.3
Model 2	1 ref	0.91 (0.44-1.86)	0.54 (0.26-1.10)	0.74 0.33-1.64)	
P		0.8	0.09	0.4	
Cases with US $\geq$2 (n)	56	63	69	76	0.002
Model 1	1 ref	1.35 (0.76-2.39)	1.72 (0.96-3.10)	2.59 (1.39-4.81)	
P		0.3	0.06	0.003	0.03
Model 2	1 ref	1.69 (0.86-3.34)	1.93 (0.92-4.04)	2.54 (1.10-5.88)	
P		0.1	0.08		0.02

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TABLE 4 *(Continued)*

Daily intake	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[a]
Cruciferous vegetables g/d (median)		3.1	5.2	6.8	10.3
Cases with TMRSS ≥9 (n)		90	91	75	80
Model 1	1 ref	0.62 (0.24-1.57)	0.37 (0.15-0.90)	0.39 (0.16-0.95)	
P		0.3	0.02	0.04	0.01
Model 2	1 ref	0.72 (0.24-2.16)	0.41 (0.12-1.34)	0.51 (0.12-2.16)	
P		0.5	0.1	0.3	0.2
Cases with SS ≥5 (n)	81	82	68	68	
Model 1	1 ref	0.78 (0.38-1.58)	0.57 (0.28-1.14)	0.47 (0.24-0.93)	
P		0.4	0.1	0.03	0.02
Model 2	1 ref	0.90 (0.39-2.06)	0.71 (0.29-1.74)	0.54 (0.17-1.69)	
P		0.8	0.4	0.2	0.3
Cases with PS ≥4 (n)	75	73	59	57	
Model 1	1 ref	0.72 (0.38-1.35)	0.53 (0.28-0.99)	0.42 (0.23-0.78)	
P		0.3	0.050	0.007	0.004
Model 2	1 ref	0.70 (0.34-1.43)	0.55 (0.24-1.24)	0.43 (0.15-1.20)	
P		0.3	0.1	0.1	0.09
Cases with US ≥2 (n)	65	67	63	69	
Model 1	1 ref	0.91 (0.51-1.64)	1.06 (0.58-1.95)	1.20 (0.66-2.20)	
P		0.7	0.8	0.5	0.5
Model 2	1 ref	0.73 (0.36-1.50)	0.62 (0.26-1.44)	0.36 (0.11-1.16)	
P		0.4	0.2	0.08	0.1
Green leafy vegetables g/d (median)		18.6	36.1	58.0	86.5
Cases with TMRSS ≥9 (n)	89	83	80	84	
Model 1	1 ref	0.56 (0.23-1.34)	0.42 (0.18-0.99)	0.60 (0.24-1.47)	
P		0.1	0.04	0.2	0.2
Model 2	1 ref	0.78 (0.27-2.28)	0.94 (0.32-2.72)	0.83 (0.25-2.68)	
P		0.6	0.9	0.7	0.8
Cases with SS ≥5 (n)	87	73	67	72	
Model 1	1 ref	0.36 (0.17-0.80)	0.26 (0.12-0.56)	0.35 (0.16-0.75)	
P		0.01	0.001	0.008	0.007
Model 2	1 ref	0.46 (0.19-1.11)	0.41 (0.17-0.99)	0.48 (0.18-1.26)	
P		0.08	0.04	0.1	0.1
Cases with PS ≥4 (n)	78	64	53	69	
Model 1	1 ref	0.48 (0.25-0.91)	0.29 (0.15-0.55)	0.61 (0.31-1.17)	
P		0.02	<0.001	0.1	0.06
Model 2	1 ref	0.55 (0.26-1.16)	0.44 (0.21-0.92)	0.96 (0.42-2.22)	
P		0.1	0.03	0.9	0.7
Cases with US ≥2 (n)	48	69	73	74	
Model 1	1 ref	2.47 (1.37-4.45)	2.92 (1.60-5.31)	3.21 (1.75-5.89)	
P		0.002	<0.001	<0.001	<0.001
Model 2	1 ref	2.65 (1.29-5.45)	4.22 (1.90-9.38)	3.59 (1.47-8.75)	
P		0.008	<0.001	0.005	0.001
Dark yellow vegetables g/d (median)	3.5	8.5	17	34	
Cases with TMRSS ≥9 (n)	85	88	84	79	
Model 1	1 ref	1.61 (0.66-3.91)	0.98 (0.44-2.19)	0.65 (0.30-1.37)	
P		0.2	0.9	0.2	0.2
Model 2	1 ref	1.86 (0.66-5.24)	1.61 (0.60-4.31)	1.68 (0.61-4.64)	
P		0.2	0.3	0.3	0.2
Cases with SS ≥5 (n)	76	79	75	69	
Model 1	1 ref	1.32 (0.66-2.65)	0.98 (0.51-1.91)	0.69 (0.36-1.31)	
P		0.4	0.9	0.2	0.2
Model 2	1 ref	2.21 (0.97-5.02)	1.50 (0.69-3.23)	1.79 (0.79-4.07)	
P		0.059	0.3	0.10	0.1
Cases with PS ≥4 (n)	73	67	63	61	
Model 1	1 ref	0.79 (0.42-1.48)	0.64 (0.34-1.17)	0.57 (0.31-1.04)	
P		0.4	0.1	0.07	0.053
Model 2	1 ref	0.87 (0.43-1.76)	0.78 (0.39-1.57)	1.10 (0.52-2.33)	
P		0.7	0.4	0.7	0.9
Cases with US ≥2 (n)	52	64	77	71	
Model 1	1 ref	1.75 (0.98-3.11)	3.31 (1.77-6.18)	2.29 (1.27-4.13)	
P		0.05	<0.001	0.006	0.001
Model 2	1 ref	1.63 (0.81-3.29)	3.64 (1.70-7.79)	2.28 (1.00-5.18)	
P		0.1	0.001	0.04	0.005
Other vegetables g/d (median)		117.2	191.5	286.5	427.8
Cases with TMRSS ≥9 (n)	91	84	80	81	
Model 1	1 ref	0.46 (0.17-1.19)	0.32 (0.12-0.81)	0.36 (0.14-0.92)	
P		0.1	0.01	0.03	0.03
Model 2	1 ref	0.73 (0.24-2.17)	0.70 (0.22-2.27)	0.93 (0.24-3.62)	
P		0.5	0.5	0.9	0.9

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TABLE 4 *(Continued)*

Daily intake	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[a]
Cases with SS ≥5 (n)	81	75	72	71	
Model 1	1 ref	0.68 (0.33-1.38)	0.56 (0.28-1.11)	0.55 (0.27-1.09)	
P		0.2	0.09	0.08	0.08
Model 2	1 ref	0.82 (0.36-1.85)	1.07 (0.45-2.56)	1.19 (0.41-3.46)	
P		0.6	0.8	0.7	0.6
Cases with PS ≥4 (n)	73	70	59	62	
Model 1	1 ref	0.85 (0.45-1.60)	0.50 (0.27-0.92)	0.59 (0.32-1.08)	
P		0.6	0.02	0.09	0.03
Model 2	1 ref	1.24 (0.61-2.55)	0.89 (0.41-1.90)	1.42 (0.54-3.69)	
P		0.5	0.7	0.4	0.6
Cases with US ≥2 (n)	61	60	66	77	
Model 1	1 ref	0.95 (0.53-1.70)	1.21 (0.67-2.17)	2.22 (1.18-4.18)	
P	0.8	0.5	0.01	0.009	
Model 2	1 ref	1.28 (0.63-2.61)	1.80 (0.80-4.03)	5.23 (1.78-15.39)	
P	0.4	0.1	0.003	0.004	

PS, psychological score; SS, somatic score; TMRSS, Total Menopause Rating Scale Score; US, urogenital score.
Model 1, unadjusted.
Model 2, adjusted for age (year), education (year), socioeconomic status (low or high/average), energy intake (kilocalorie/day), body mass index (kilogram/meter2), physical activity (metabolic equivalent /minute/week), time since menopause (year), the consumptions of dairy products (g), pickle (g), legumes (g), seeds (g), nuts (g), tea (g), coffee (g), fish (g), poultry (g), eggs (g), mayonnaise (g), liquid oils (g), solid fats (g), sweets (g), desserts (g), sugars (g), soft drinks (g), refined grains (g), potato (g), red meat (g), processed meat (g), organs (g), and snacks (g).
Total vegetables and total fruit intake were mutually adjusted. For each vegetable subgroups, other subgroups of fruits and vegetables intake were adjusted.
Total vegetables and fruits and vegetables were defined as in Table 1. Cruciferous vegetables include white and red cabbage, broccoli and cauliflower. Green leafy vegetables include spinach, lettuce, and green vegetables such as basil, parsley, cress, leek, spearmint, oregano, cilantro and scallion. Dark yellow vegetables include carrot, yellow squash. Other vegetables include cucumber, tomato, zucchini, eggplant, celery, green pea, green bean, garlic, onion, green pepper, turnip, mushroom, olive and corn.
Participants were classified as low; and high/moderate symptoms based on the following cut-off: total MRS (score ≥9), somatic symptoms (score ≥5), psychological symptoms (score ≥4), and urogenital symptoms (score ≥2) were identified as high/moderate symptoms.
[a]Tests for trend were performed by entering the categorical variables as continuous parameters in the models.

TABLE 5. *Odds ratio (95% CI) of menopausal-related symptoms according to quartiles (Q) of fruit and its subgroups intakes*

Daily intake	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[a]
Total fruits g/d (median)	171.7	288.7	425.9	717.1	
Cases with TMRSS ≥9 (n)	88	89	87	72	
Model 1	1 ref	1.24 (0.43-2.89)	0.82 (0.33-2.00)	0.31 (0.14-0.69)	
P		0.8	0.6	0.004	0.001
Model 2	1 ref	1.17 (0.40-3.39)	0.95 (0.33-2.73)	0.37 (0.11-1.15)	
P		0.7	0.9	0.08	0.06
Cases with SS ≥5 (n)	84	82	76	57	
Model 1	1 ref	0.85 (0.39-1.86)	0.55 (0.26-1.14)	0.23 (0.11-0.46)	
P		0.6	0.1	<0.001	<0.001
Model 2	1 ref	0.86 (0.36-2.04)	0.58 (0.24-1.35)	0.27 (0.10-0.71)	
P		0.7	0.2	0.008	0.004
Cases with PS ≥4 (n)	72	72	71	49	
Model 1	1 ref	1.00 (0.53-1.88)	0.91 (0.48-1.71)	0.36 (0.19-0.65)	
P		1.0	0.7	0.001	<0.001
Model 2	1 ref	0.30 (0.65-2.61)	1.18 (0.57-2.43)	0.62 (0.27-1.42)	
P		0.4	0.6	0.2	0.2
Cases with US ≥2 (n)	51	75	69	69	
Model 1	1 ref	3.00 (1.62-5.54)	2.12 (1.18-3.80)	2.19 (1.21-3.94)	
P		<0.001	0.01	0.009	0.2
Model 2	1 ref	2.97 (1.46-6.04)	1.77 (0.86-3.66)	1.95 (0.81-4.68)	
P		0.003	0.1	0.1	0.1
Berry fruits g/d (median)		0.40	1.6	3.4	9.8
Cases with TMRSS ≥9 (n)	74	77	78	67	
Model 1	1 ref	1.23 (0.51-2.91)	1.37 (0.56-3.31)	0.58 (0.27-1.27)	
P		0.6	0.4	0.1	0.2
Model 2	1 ref	1.45 (0.50-4.19)	2.73 (0.86-8.60)	1.01 (0.35-2.90)	
P		0.4	0.08	0.9	0.8
Cases with SS ≥5 (n)	65	72	68	55	
Model 1	1 ref	1.52 (0.73-3.14)	1.15 (0.57-2.30)	0.58 (0.30-1.11)	
P		0.2	0.6	0.1	0.08
Model 2	1 ref	1.74 (0.76-3.98)	1.34 (0.60-3.01)	0.72 (0.32-1.61)	
P		0.1	0.4	0.4	0.4

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TABLE 5 *(Continued)*

Daily intake	Q1 (n = 98)	Q2 (n = 98)	Q3 (n = 99)	Q4 (n = 98)	*P* trend[a]
Cases with PS ≥4 (n)	60	65	57	49	
Model 1	1 ref	1.27 (0.65-2.45)	0.82 (0.44-1.55)	0.55 (0.29-1.03)	
P		0.4	0.5	0.06	0.03
Model 2	1 ref	1.26 (0.60-2.64)	0.87 (0.42-1.79)	0.63 (0.30-1.30)	
P		0.5	0.7	0.2	0.1
Cases with US ≥2 (n)	60	58	65	62	
Model 1	1 ref	0.87 (0.46-1.63)	1.27 (0.65-2.45)	1.11 (0.58-2.13)	
P		0.6	0.4	0.7	0.5
Model 2	1 ref	0.59 (0.27-1.28)	1.18 (0.52-2.68)	0.99 (0.44-2.22)	
P		0.1	0.6	0.9	0.7
Citrus fruit g/d (median)		19.8	51.5	87.7	180.1
Cases with TMRSS ≥9 (n)		87	87	89	73
Model 1	1 ref	1.00 (0.41-2.42)	1.40 (0.54-3.66)	0.34 (0.15-0.73)	
P		1.0	0.4	0.005	0.003
Model 2	1 ref	0.86 (0.30-2.42)	1.36 (0.43-4.32)	0.23 (0.07-0.71)	
P		0.7	0.5	0.01	0.01
Cases with SS ≥5 (n)	84	82	74	59	
Model 1	1 ref	0.85 (0.39-1.86)	0.53 (0.25-1.11)	0.24 (0.12-0.47)	
P		0.6	0.09	<0.001	<0.001
Model 2	1 ref	0.90 (0.37-2.15)	0.58 (0.25-1.37)	0.28 (0.11-0.70)	
P		0.8	0.2	0.007	0.003
Cases with PS ≥4 (n)	73	70	69	52	
Model 1	1 ref	0.85 (0.29-1.24)	0.84 (0.14-0.58)	0.37 (0.24-1.02)	
P		0.6	0.5	0.001	0.001
Model 2	1 ref	0.96 (0.47-1.95)	0.95 (0.46-1.99)	0.52 (0.24-1.15)	
P		0.9	0.9	0.1	0.1
Cases with US ≥2 (n)	41	72	72	79	
Model 1	1 ref	3.85 (2.10-7.02)	4.00 (2.18-7.34)	5.23 (2.79-9.78)	
P		<0.001	<0.001	<0.001	<0.001
Model 2	1 ref	3.54 (1.71-7.31)	3.23 (1.55-6.75)	4.35 (1.77-10.71)	
P		0.001	0.002	0.001	0.001
Other fruits g/d (median)		126.1	219.7	326.6	584.6
Cases with TMRSS ≥9 (n)	89	88	85	74	
Model 1	1 ref	0.89 (0.34-2.29)	0.61 (0.25-1.49)	0.31 (0.13-0.71)	
P		0.8	0.2	0.006	0.001
Model 2	1 ref	0.95 (0.31-2.85)	1.07 (0.34-3.31)	0.77 (0.22-2.66)	
P		0.9	0.9	0.6	0.6
Cases with SS ≥5 (n)	81	84	75	59	
Model 1	1 ref	1.25 (0.58-2.72)	0.65 (0.32-1.31)	0.31 (0.16-0.61)	
P		0.5	0.2	0.001	<0.001
Model 2	1 ref	1.34 (0.56-3.23)	0.92 (0.39-2.15)	0.59 (0.22-1.55)	
P		0.5	0.8	0.2	0.1
Cases with PS ≥4 (n)	70	75	69	50	
Model 1	1 ref	1.30 (0.68-2.47)	0.92 (0.49-1.69)	0.41 (0.23-0.75)	
P		0.4	0.7	0.004	0.001
Model 2	1 ref	1.68 (0.81-3.49)	1.69 (0.80-3.56)	1.01 (0.43-2.36)	
P		0.1	0.1	0.9	0.9
Cases with US ≥2 (n)	53	74	73	64	
Model 1	1 ref	2.61 (1.42-4.80)	2.38 (1.31-4.33)	1.59 (0.89-2.84)	
P		0.002	0.004	0.1	0.2
Model 2	1 ref	2.09 (0.99-4.41)	1.80 (0.81-3.99)	1.06 (0.43-2.61)	
P		0.053	0.1	0.8	0.9

PS, psychological score; SS, somatic score; TMRSS, Total Menopause Rating Scale Score; US, urogenital score.
Model 1, unadjusted.
Model 2, adjusted for age (year), education (year), socioeconomic status (low or high/average), energy intake (kilocalorie/day), body mass index (kilogram/meter2), physical activity (metabolic equivalent /minute/week), time since menopause (year), the consumptions of dairy products (g), pickle (g), legumes (g), seeds (g), nuts (g), tea (g), coffee (g), fish (g), poultry (g), eggs (g), mayonnaise (g), liquid oils (g), solid fats (g), sweets (g), desserts (g), sugars (g), soft drinks (g), refined grains (g), potato (g), red meat (g), processed meat (g), organs (g), and snacks (g).
Total fruit intake was adjusted for total vegetables intake. For each fruit subgroups, other subgroups of fruit and vegetable intake were adjusted.
Total fruits were defined as in Table 1. Cruciferous vegetables include white and red cabbage, broccoli and cauliflower. Green leafy vegetables include spinach, lettuce, and green vegetables such as basil, parsley, cress, leek, spearmint, oregano, cilantro and scallion. Dark yellow vegetables include carrot, yellow squash. Other vegetables include cucumber, tomato, zucchini, eggplant, celery, green pea, green bean, garlic, onion, green pepper, turnip, mushroom, olive and corn.
Participants were classified as low; and high/moderate symptoms based on the following cut-off: total MRS (score ≥9), somatic symptoms (score ≥5), psychological symptoms (score ≥4), and urogenital symptoms (score ≥2) were identified as high/moderate symptoms.
[a]Tests for trend were performed by entering the categorical variables as continuous parameters in the models.

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The OR of TMRSS $\geq$9 and its subgroups across quartiles of FV intake, before and after adjustment for confounding variables, is presented in two different models in Tables 4 and 5. Participants in the highest quartile of total FV, total vegetable, and total fruit intake experienced lower TMRSS, SS, and PS compared with those in the lowest quartile (P trend $<$ 0.04). Concerning the subgroups of vegetables, the ORs of TMRSS $\geq$9 and PS $\geq$4 were lower in the highest quartiles of cruciferous vegetables and other vegetables (P trend $<$ 0.04) relative to the lowest quartiles. Additionally, the ORs of SS were decreasing significantly through higher consumption of cruciferous vegetables and green leafy vegetables (P trend $<$ 0.03) (Tables 4 and 5, model 1).

Regarding fruit intake, PS was lower in the highest quartiles in comparison to the lowest quartiles in all fruit subgroups (P trend $<$ 0.04). Additionally, the ORs of TMRSS and SS were less in the highest quartiles of citrus fruits and other fruits (P trend $<$ 0.004) (Table 5). Surprisingly, the unadjusted ORs of US was greater in the highest quartiles of FV and their all subtypes, except in cruciferous vegetables, total fruits, berry fruits, and other fruits (P trend = 0.01) (Tables 4 and 5, model 1).

After adjusting for confounding variables, our results altered noticeably. The adjusted model showed an inverse relationship between total FV and citrus fruits with TMRSS and SS (P trend $<$ 0.02) and total fruits with SS (P trend = 0.004). Moreover, a borderline inverse association between total FV intake and PS was detected (P = 0.056). Furthermore, after adjustment for confounding variables, a significant direct association was found between consumption of total FV, green leafy vegetables, dark yellow vegetables, other vegetables, and total vegetables and citrus fruits with US (P trend $<$ 0.04). (Tables 4 and 5, model 2).

DISCUSSION

Few studies have investigated the relationship between intake of FV, and also its subgroups and climacteric symptoms along with their subscales. The associations reported in the present study were more extensive than those found in previous studies. The results suggested that higher intakes of total FV and citrus fruit were associated with lower TMRSS and SS. In addition, an inverse association was found between total fruit consumption with SS. Also, it was indicated that higher consumption of total FV marginally linked to less PS. Furthermore, higher intakes of total FV, green leafy, dark yellow, other, and total vegetables and citrus fruits were associated with higher US. These associations were independent of several possible confounders.

Recent investigation of the participants of the present study revealed that dietary total antioxidant capacity (DTAC) was negatively associated with TMRSS, SS, and PS.[50] In another study in this population, greater adherence to the FV dietary pattern was associated with lower general, physical, and mental symptoms of menopause.[18] However, contrary to the mentioned study, a positive association was found between total FV, all kinds of vegetables, and also citrus fruits and US in the present study. A possible reason for this finding may be the focus of the present study on the intake of FV. Nevertheless, the results of the present study are generally consistent with findings from prior studies in these participants.

Evidence on the relationship between FV consumption and climacteric symptoms is very limited and incomplete. The results of the present study were in line with observational studies which suggested that a healthy eating strategy with increased consumption of total FV is related to lower climacteric symptoms.[17,47,50] In line with the findings of the present study, a clinical study suggested that women who reduced fat intake and increased FV consumption experienced fewer hot flashes or night sweats after 1 year.[20]

Regarding specific FV consumption, observational[32,33] and interventional[22] studies found interesting results. In contrast to the present study which proposed no relationship between green leafy vegetables or dark yellow vegetables and SS, a cross-sectional study showed that the consumption of yellow-green vegetables more than 1 to 3 times per week was linked to attenuated hot flashes in Korean middle-aged women.[32] Also, the results of the present study showed no relationship between cruciferous vegetables and climacteric symptom either, which was incongruent with a cross-sectional study which found an inverse association between intakes of about $\geq$0.7 serving/d cruciferous vegetables and menopausal symptoms.[33] This controversy may be explained by very low intake of cruciferous vegetables in the participants of the present study compared with the mentioned study. A clinical trial also demonstrated that consumption of tomato juice could improve menopausal symptoms including anxiety.[22] This advantageous impact of tomato has been explained by high lycopene content with antioxidant properties[51] and gamma-aminobutyric acid with psychological stress-reducing properties.[52] Likewise, a meta-analysis of 15 randomized controlled trials concluded that phytoestrogens such as isoflavones and lignans, which are found in a wide range of FVs, decrease the frequency of hot flashes in menopausal women.[53]

Concerning the significant positive association between consumption of total FV and some of its subtypes and genitourinary symptoms, acidic FV including tomato and citrus fruits are recognized as potential bladder irritants,[54] with the findings of the present study supporting this detrimental effect to some extent. However, the Nurses' Health Studies in menopausal women detected no association between intake of acidic fruits and development or progression of urinary incontinence.[55] In addition to acidic properties, these inconsistent effects on US may be attributed to vegetables' carbonate content which increase urine pH.[56] An alkaline environment in the urinary tract has been attributed to colonization of the vaginal wall with Enterobacteriaceae and subsequently experiencing more vaginal atrophic symptoms by menopausal women.[57] Another speculation is that the method of preparation of vegetables and added fats may counteract the protective effect of fresh vegetables. For example, in Iran, vegetables such as spinach, vegetable greens, tomato, green squash, eggplant, celery, green beans, garlic, carrots, onion, and mushrooms are mostly prepared by

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frying. It was reported that total polyphenols, carotenoids, and antioxidant capacity of some edible vegetables[58]—carrots and broccoli[59]—were significantly reduced in frying.

The beneficial effect of FV on climacteric symptoms is thought to be through provision of distinctive micronutrients and phytochemical compositions such as carotenoids, which have been shown to contribute to the body's defense against reactive oxygen species.[60] In addition, a wide range of phytoestrogens in FV may cause a reduction in menopausal symptoms.[53] It was also suggested that higher dietary intake of magnesium has been associated with lower systemic inflammation[61] and subsequently lower severe hot flashes in postmenopausal women.[62] Clinical trial data provide additional support for beneficial effects of vitamin E on hot flashes in menopausal women.[63] Furthermore, higher plasma levels of carotenoids with antioxidant and anti-inflammatory properties had a favorable effect on inflammatory markers,[64] which may cause fewer hot flashes.[62] High content of vitamin B6 in some FVs such as banana, potato, and carrot[65] plays a crucial role in the synthesis of neurotransmitters such as serotonin and dopamine, thereby regulating mood and mental function.[66] Folate, which is found naturally in green leafy vegetables and citrus fruits,[65] may have a favorable effect on psychological symptoms including depression in menopausal women.[67,68] Although the present study did not find any significant relationship between cruciferous vegetables and menopausal symptoms, glucosinolate content in these vegetables[69] may exert estrogenic effects with the potential to influence menopausal symptoms.[33]

There might be some limitations in the generalizability of the present findings to the other populations. Variation has been reported in the experience of menopausal symptoms in women worldwide.[70] These experiences and their management are under the influence of various biological, psychological, social, and cultural factors.[71] On the contrary, FV intake is also related to socioeconomic status.[72] It was shown that FV intake is positively associated with education and socioeconomic status,[73] and inversely associated with age.[73] Furthermore, the lifestyle of women in Iran including their food preparation methods may be different from that of women in other countries. For example, use of frying method for vegetable preparation in Iran is very popular. Therefore, confirming the findings of the present study in different sociocultural and dietary behavior contexts will better illuminate the relationship between FV consumption and menopausal symptoms.

The present study comprehensively evaluated the association between intake of FV, and also its subgroups and menopause-related symptoms along with its subtypes. However, the study had some limitations. First, the sample size was small. Second, the design of the present study was cross-sectional, thus it cannot interpret a cause and effect relationship between FV consumption and climacteric symptoms. Third, although the assessment of dietary intake was performed by trained interviewers, both the quantification of portion sizes and the frequency of consumption may have been subject to recall bias. In addition, participants were aware of their symptoms when they reported their dietary exposure, thus the potential for recall bias existed. Furthermore, the FFQ used in the present study required recall of up to 1 year, which may affect the recall of dietary intake in the women. Fourth, this study may have some measurement errors among women who had certain menopausal symptoms and might have had psychosocial stress. It is possible that experiencing these symptoms resulted in lifestyle modification including dietary choices. In addition, psychological symptoms including depression or stress may encourage loss of appetite and lead to lower dietary intakes which could result in potential bias. Fifth, regardless of adjusting for many confounding variables in the analysis, residual confounding together with unmeasured confounders may affect the results. Sixth, high intake of fruit and vegetable may be a marker of healthy lifestyle affecting menopausal symptoms, such as physical activity. However, adjustment for self-reported physical activity did not influence the observed relationship between FV and menopausal symptoms. However, regarding the imprecise measurement of physical activity, residual confounding due to this factor may exist. However, it is unlikely that these potential biases could fully explain the findings of this study.

CONCLUSIONS

Based on the results of the present study, an inverse association was found between intakes of total FV and citrus fruits with TMRSS and SS. Likewise, the inverse association between consumption of total FV and PS was approaching significance. In addition, an inverse association was found between SS and total fruit consumption. Furthermore, higher intakes of total FV, total vegetables, green leafy vegetables, dark yellow vegetables, other vegetables, and citrus fruits were associated with higher US. These results may lead to a basis for the development of nutritional interventions and dietary guidelines to prevent or reduce menopausal symptoms. However, further investigation is warranted to confirm the findings.

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