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Original article

Fruit and vegetables in hypertensive women with asymptomatic peripheral arterial disease

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SUMMARY

Background and aims: Fruit and vegetables are considered a very healthy diet useful in the prevention of cardiovascular disease. The present study aims to evaluate intake of fruit and vegetables in hypertensive women and its correlation with asymptomatic atherosclerosis.
Methods and results: A group of 237 women with hypertension was evaluated. Fruit and vegetables consumption were assessed by a self-administered food frequency validated questionnaire completed by an interviewer administered 24 h diet recall. They all underwent ABI.
ABI measurement observed that fruit consumption was inversely associated with pre-clinical atherosclerosis suggesting a protective effect, moreover this association was stronger for vegetables. Increasing intake of vegetables was associated with a lower risk of asymptomatic PAD.
Conclusions: Women with a high intake of fruit and vegetables showed less instrumental sign of pre-clinical peripheral atherosclerosis. Can be suggests that fruit and vegetables play an important role in prevention of atherosclerosis in pre-menopausal women.

1. Background

Dietary factors play an important role in the development of CVD and its risk factors and may contribute to the geographic variability in CVD morbidity and mortality [1].

A low consumption of fruit and vegetables (less than 400 g [g] per day) is thought to be one of the top 10 risk factors for mortality and is estimated to result in 1.7 million global deaths a year [1]. Several population-based studies have shown the beneficial effects of high fruit and vegetable consumption on cardiovascular prognosis outcomes [2,3]. The PREDIMED study showed a reduction in PAD associated with the Mediterranean diet [2]. Similarly we reported that women with high adherence to Med D are less likely to developed preclinical atherosclerosis compared to women with a low adherence [3] The ankle-brachial index (ABI) is a symptom-independent tool that can be used reliably to evaluate asymptomatic pre-clinical atherosclerosis [4].

The present study aims to evaluate intake of fruit and vegetables in hypertensive women and its correlation with asymptomatic atherosclerosis.

2. Methods

A retrospective analysis on a group of 650 women (age range 45–54 years) was performed. Patients were refereed to our clinic from general practitioners for screening and prevention of CVD. We selected women only if they were free of symptoms of PAD, had ABI evaluation and a complete nutritional assessment. We excluded participants with a previous history of cardiovascular disease, (ischemic heart disease, heart failure and stroke), those who did not complete questionnaire, and those who did not undergo ABI evaluation and who did not sign the consent. (Figure 1 supplemental material). From the initial group we analyzed data from 237 women with hypertension [5].

Study was approved by the Local Ethical Review Board and participants signed an informed consent.

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2.1. Data collection

Nutritional status was assessed by measuring weight, body mass index (BMI), waist circumference and waist-to-hip ratio [3].

The prevalence of nutritional parameters was assessed by a self-administered food frequency questionnaire (FFQ) with 116 items and completed by an interviewer-administered 7-day diet recall questionnaire on the day of first visit [3].

The food list in the FFQ was Italianized, and foods commonly eaten in the Emilia Romagna region of Italy were added. For each food class color photographs of three different portions were displayed. Portion sizes were chosen according to many years of experience in dietary surveys in various parts of Italy [3].

Food frequency was evaluated using three categories: daily, weekly and monthly and from 1 to 6 number of times (i.e.: once a day, 3 times a week) and was integrated with specific questions on changes in nutrition habits and lifestyle within the last year. The Mediterranean score was calculated according to Panagiotakos [3]. We assessed fruit and vegetables intake. V/F were separated into colors based on their nutritional density: (1) green (vegetables rich in folic acid such as broccoli); (2) orange (V/F rich in beta-carotene such as carrots); (3) purple (vegetables rich in potassium and folic acid such as red cabbage); (4) yellow (fruits rich in vitamin C such as oranges); (5) red (fruits rich in potassium and vitamin C such as cranberries). Because of inconsistent classification of legumes as a subset of vegetables, we analyze total fruits and vegetables without legumes [6].

A dietician, using a database system, computed food and nutrient intakes from FFQ and dietary recall. The nutrient database was compiled from food composition tables. Smoking and physical activity were also investigated.

2.2. ABI measurement

All patients underwent ABI measurement. The ABI is a simple, noninvasive test, measuring the SBP from both brachial arteries and from both the dorsalis pedis and posterior tibial arteries after the patient has been at rest in the supine position for 10 min by using a Doppler device. The ABI of each leg is calculated by dividing the higher of the dorsalis pedis pressure or posterior tibial pressure by the higher of the right or left arm blood pressure [4].

2.3. Statistical analysis

SPSS, V.21.0.1 (SPSS Inc, Chicago, Ill) was used for statistical analysis. Results are presented as mean ± SD or frequency expressed as a percentage.

To study the association of consumption of fruits and vegetables with PAD, we used Cox proportional hazards regression analysis. For these analyses, consumption of fruits and vegetables were used as continuous and categorical (0–1; 2; ≥3 servings per day) variables, in order to obtain the best fitting model. We performed analyses in which we first adjusted for age, BMI, smoking, physical activity, and adherence to Mediterranean Diet (model 1); and additionally for total cholesterol, HDL cholesterol, systolic blood pressure, and hs-CRP (model 2).

In interaction analysis, P interaction<0.05 was considered to indicate effect modifiers on the association of fruit and vegetable consumption with ABI.

3. Results

The mean MedD Score was 32.6 ± 3.3 (median score was 30.9). Antioxidants intake was higher in patients with a greater adherence to Med D and was mainly related to fruit and vegetables and in a lower percentage from wine and coffee. Mean consumption of fruits and vegetables were 1.8 ± 1.2 servings/day and 2.5 ± 0.8 serving/day, respectively. Mean plasma vitamin C concentration was 42.6 ± 15.2 μmol/L.

Table 1 shows association between clinical characteristics and fruit and vegetable consumption (linear regression analysis).

Table 2 illustrates the association of fruit and vegetables consumption with ABI value after adjustments for age, BMI, smoking, physical activity, and adherence to Mediterranean Diet (model 1)

Table 1
Clinical characteristics of patients and association with fruit and vegetable consumption (linear regression analysis).

Clinical characteristics		Fruit consumption B coeff	P value	Vegetables consumption B coeff	P value
Mean age (years)	54.6 ± 4.2	0.07	ns	0.08	ns
Weight (Kg)	82.3 ± 4.3	0.14	0.05	0.097	Trend to 0.0.5
Body mass index (mean)	28.1 ± 4.8	0.11	0.05	0.09	ns
Waist circumference (cm)	89.5 ± 3.3	0.03	ns	0.05	ns
Systolic blood pressure, mmHg	154.5 ± 7.3	0.093	ns	0.097	Trend to 0.0.5
Diastolic blood pressure, mmHg	92.4 ± 8.1	0.065	ns	0.067	ns
Smoking (cigarettes/day)	12 ± 8	0.11	0.05	0.12	0.01
Alcohol (abstainer) number of pts	25	0.02	ns	0.04	ns
hs-CRP, mg/L (available in 125 pts)	2.3 ± 1.4	0.05	ns	0.07	ns

Table 2
Association of Fruit and Vegetable consumption with asymptomatic PAD in adjusted model.

PAD	Categories of Fruit 0-1serving/day references	Categories of Fruit 2 serving/day HR (95% CI)	Categories of Fruit >3–4 cups/day HR (95% CI)	Fruit consumption serving days HR (95% CI)
Model 1	1	0.87 (0.37–1.13)	0.82 (0.45–1.23)	0.82 (0.44–0.8)*
Model 2	1	0.96 (0.44–1.17)	0.95 (0.32–1.9)	0.95 (0.45–1.2)
	Categories of Veget. 0–1 serving/day references	**Categories of Veget. 2 serving/day HR (95% CI)**	**Categories of Veget. >3–4 cups/day HR (95% CI)**	**Veget consumption serving days HR (95% CI)**
Model 1	1	0.82 (0.21–1.1)	0.74 (0.32–0.9)	0.81 (0.44–0.85)**
Model 2	1	0.88 (0.49–1.2)	0.77 (0.45–0.83)	0.83 (0.36–0.92)**

Legend: *$p < 0.05$; **$p < 0.01$.

and additionally for total cholesterol, HDL cholesterol, systolic blood pressure, and hs-CRP (model 2).

4. Discussion

This retrospective analysis was performed to evaluate the relationship between fruit and vegetables intake and asymptomatic PAD in pre-menopausal women. We observed that fruit consumption was inversely associated with pre-clinical atherosclerosis suggesting a protective effect, moreover this association was stronger for vegetables. Increasing intake of vegetables was associated with a lower risk of asymptomatic PAD.

The Mediterranean Diet is characterized by a high intake of antioxidants from fruit and vegetables and was associated with a lower incidence of atherosclerosis in several studies [7,8].

A recent paper from the PURE study group found that higher fruit, vegetable, and legume consumption was associated with a lower risk of non-cardiovascular, and total mortality. Benefits appear to be maximum for both non-cardiovascular mortality and total mortality at three to four servings per day (equivalent to 375–500 g/day) [9].

The PREDIMED study analyzed fruit and vegetables intake and found a significant inverse association with CVD incidence for the sum of fruit and vegetable consumption. Participants who consumed in total nine or more servings/d of fruits plus vegetables had a hazard ratio 0·60 (95% CI 0·40, 0·96) of CVD in comparison with those consuming <5 servings/d [2].

Vegetables might be consumed raw or cooked and the cooking process might alter the bioavailability of nutrients (such as phytochemicals, vitamins, minerals, and fiber). Some evidence suggests that for some nutrients such as lycopene and β carotene, cooking might enhance their bioavailability.

In a large cohort from ten European countries, both raw and cooked vegetable intakes were inversely associated with risk of mortality, however a stronger beneficial effect was noted for raw vegetable consumption.

Little data exist on effects of fruit and vegetables consumption on pre-clinical atherosclerosis in pre-menopausal women, being the major of paper related to women's cancer. The present paper focused on fruit and vegetables consumption and their association with pre-clinical atherosclerosis in women. A high intake of carotenoids and vitamins is essentially the result of a diet rich in fruit and vegetables and possibly low in meat product. Because of their antioxidant properties, carotenoids, vitamin E, and vitamin C might protect against free oxygen radicals and lipid peroxidation. There are several hypotheses that try to explain the beneficial role of fruit and vegetables. The antioxidant hypothesis suggests that antioxidant compounds and polyphenols carotenoids and flavonoids may have an effect on the CV risk by preventing the oxidation of cholesterol and other lipids [10].

The antioxidants hypothesis in based on the theory that reversible oxidative process of protein S-glutathionylation (Pr–S–SG) of eNOS, that serves as a molecular switch modulating the vascular function through the balance of nitric oxide (NO) and superoxide production of eNOS is critical in the onset of endothelial dysfunction which is a central mechanism leading to CVD and that this redox switch could be modulated by dietary factors and antioxidants reducing the risk of CVD onset.

4.1. Limitation of the study

Due to methodological problem we exclude legumes from our analysis and this might have influenced results. However due to the beneficial effects of legumes on health we probably underestimates positive results.

Environmental factors (use of pesticides and herbicides, and water contamination) that might affect the nutritional quality of fruits, vegetables, and legumes were not measured.

In conclusion, can be suggests that fruit and vegetables play an important role in prevention of atherosclerosis in pre-menopausal women.

Conflict of interest

No conflict of interest.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.clnesp.2018.05.010.

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