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Review
Revue

Association of diet with the risk of prostate cancer in Western Algeria

Association alimentation–cancer de la prostate dans l'Ouest Algérien

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Abstract: *Aim :* Prostate cancer (Pca) is the most common cancer in men. Etiology of Pca is unknown. However, dietary factors are suspected. A case-control study was carried out in western Algeria to assess a possible association of diet with the risk of Pca.

Procedure : The study population consisted of 160 patients, aged 50–74 years, with histologically confirmed Pca and controls were 160 men of the same age group.

Results : Positive findings were obtained for the consumption of red meat (OR: 2.1, 95% CI: 1.1–3.9) and dairy products (OR: 2.2, 95% CI: 1.2–4.1), whereas the consumption of olive oil (OR: 0.5, 95% CI: 0.3–1.1) and green tea (OR: 0.6, 95% CI: 0.3–1.1) were negatively associated with Pca.

Conclusion : The risk was not statistically associated with all foods selected in this study. Possible mechanisms are discussed.

Keywords: Prostate cancer – Dietary factors – Case-control study

Résumé : *Objectif :* Le cancer de la prostate (CaP) est le cancer le plus fréquent chez l'homme. Son étiologie est inconnue. Cependant, les facteurs alimentaires sont suspectés. Une étude cas-t émoins a été réalisée dans l'Ouest Algérien pour évaluer une éventuelle association entre le régime alimentaire et le risque du CaP.

Matériel et méthodes : La population d'étude était formée de 160 cas, âgés entre 50–74 ans, avec un CaP histologiquement confirmé et 160 témoins du même groupe d'âge.

Résultats : Des résultats positifs ont été obtenus pour la consommation de viande rouge (OR : 2,1 et IC 95 % : 1,1 à 3,9) et produits laitiers (OR : 2,2 et IC 95 % : 1,2 à 4,1), alors que les consommations de l'huile d'olive (OR : 0,5 et IC 95 % : 0,3 à 1,1) et de thé vert (OR : 0,6 et IC 95 % : 0,3 à 1,1) étaient inversement associées au CaP.

Conclusion : Le risque n'était pas statistiquement associé à tous les aliments sélectionnés pour cette étude. D'éventuels mécanismes sont à discuter.

Mots clés : Cancer de la prostate – Facteurs alimentaires – Étude cas-témoins

Introduction

Prostate cancer (Pca) is not common among Algerian men. Incidence rate and mortality for Pca are low in Algeria with respectively 7.1 and 5.3 per 100 000 [6]. It is suggested that dietary habits are involved in the development of Pca. Many studies have reported that high intakes of fat increase the risk of Pca [5], whereas high intake of polyphenols and isoflavones may reduce the risk [9]. However, the incidence rate of Pca, in Algeria, may increase if the population will be exposed to new food industries. Because of the lack of studies between dietary factors and the risk of Pca among men in African countries, we aimed to assess a possible association of diet with Pca in population of patients recruited in two hospitals of western Algeria.

Materials and methods

The study was conducted in western Algeria from January 2007 to March 2011. Among a total of 204 incident patients, who had a confirmed histological prostate carcinoma, 44 patients could not participate in this study. The final group consisted of 160 Pca cases. Ninety-eight cases were obtained from the Department of Urology of Sidi-bel-Abbes UHC and 62 cases from the Department of Urology of Saida Hospital. The age range was 50–74 years. The stage distribution of Pca was as follows: localized 22%, regional 74% and disseminated 4%. During the same period, a total of 160 controls were selected from the departments of respiratory diseases, ophthalmology and dermatology of the same hospitals as

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the cases. Controls were matched to cases in frequency of 1:1 by age (±5 years). The distribution of controls by disease category was as follows: asthma (41.7%), cataract (50.2%) and dermatosis (8.1%). Exclusion criteria for controls were having other prostatic diseases or malignant tumours, being under dietary restriction and patients in critical conditions. This study was approved by the scientific committee of LREH of Sidi-Bel-Abbes UHC. Informed consent was given by all subjects.

Epidemiological and dietary data were obtained using a standard questionnaire. Dietary information was obtained by a quantitative history approach in which subjects were asked about their usual frequency of intake and portion size of a list of 20 main food items including beverages, representative of usual diet of the Algerian population. The technique was similar to the one used by Czopp and Serfati [2], although somewhat modified and adapted to suit the Algerian diet. This questionnaire was not previously validated but was studied regarding its reproducibility. For each food item, the patient indicated mean intake frequency and the amount consumed over the past year or the year prior to onset of symptoms. For a more adequate evaluation of quantities consumed, we have used in interview photographs of food items in different portion sizes of known quantity. As measurements of consumption, standard cups, spoons and slices were used. The following food groups were analyzed in this study:

– *red meat, i.e. beef and lamb;*
– *fish, i.e. sardine;*
– *milk;*
– *dairy foods, i.e. cheese, butter and ice cream;*
– *olive oil;*
– *dry vegetables, i.e. beans and lentils;*
– *green-yellow vegetables, i.e. tomato and cauliflower;*
– *fruits, i.e. grenade and dates;*
– *bevarges, i.e. green tea, coffee and soft beverages (soda water and lemonade).*

Descriptive statistics were calculated using SPSS 11.5 package. Groups of cases and controls were described by their number, mean, median and standard deviation (SD). The characteristics of cases were compared to those of controls using the chi-square (χ^2) or Students *t*-test. Adjusted odds ratios (ORs) and 95% confidence intervals (CI) of foods and beverages for Pca were calculated by conditional logistic regression models with adjustment for tobacco smoking, total energy intake and a family history of Pca. *P-value* < 0.05 was considered statistically significant. Because some controls were selected from patients with smoking-related diseases, such as cataracts and respiratory diseases, we adjusted for tobacco smoking in the analyses. Energy adjustment was performed by a logistic regression model that used total energy as a confounding factor. A family history of Pca was considered as potential factor, because association with Pca risk was observed. To facilitate statistical analysis, food items and beverage intakes were classified into quartiles on the basis of their distribution among control subjects. The lowest quartile, with an OR of 1.00, was the reference quartile throughout the analysis.

Results

Sociodemographic characteristics of two groups of patients and family history of Pca in a first-degree relative are described in Table 1. There is no significant difference between cases and controls (*P-value* > 0.05). Cases were not much older than controls (71.6 *vs.* 68.3 years). Cases lived more frequently inside towns of Sidi-Bel-Abbes and Saida, and were more frequently urban residents (66.2%). Most cases had a low level of education, particularly in the primary level with a rate of 48.7%. Although these differences were not statistically significant (*P-value* > 0.05), cases were less educated than controls. For the type of occupational activity, cases show a high rate in the type of work (i.e. office work) and they worked more at office than controls (64.3 *vs.* 56.8%) (*P-value* < 0.05). On the other hand, family history of Pca was much more frequent among cases than controls (32.9 *vs.* 15%) (*P-value* = 0.01).

Table 1. Basic and demographic characteristics of Pca cases and controls.

Variables	*Cases (n = 160)*	*Controls (n = 160)*	*P-value*
Age *(years)*			
Mean (± SD)	71.6 ± 10	68.3 ± 9.4	*0.07*
Median	71	68	
Residence, *n (%)*			
Urban	106 (66.2)	113 (70.6)	
Rural	54 (33.8)	47 (29.4)	*0.1*
Education, *n (%)*			
Unknown	37 (23.1)	34 (21.2)	
Primary	78 (48.7)	60 (37.5)	
Secondary	21 (13.1)	39 (24.3)	
University	24 (15.1)	27 (17.0)	*0.3*
Occupational activity, *n (%)*			
Work at office	103 (64.3)	91 (56.8)	
Manual work	57 (35.7)	69 (43.2)	*0.04*
Family history of Pca, *n (%)*			
No	109 (68.1)	136 (85)	
Yes	51 (32.9)	24 (15)	*0.01*
Tobacco smoking, *n (%)*			
Never	55 (35,8)	64 (40)	
Former smoker	62 (43,4)	57 (35,6)	
Smoker	43 (20,8)	39 (24,4)	>0.05

Adjusted ORs of Pca for groups of fats are shown in Table 2. In conditional logistic regression models with terms of total energy intake and tobacco smoking as confounding factors, intake in the uppermost quartile was compared with the bottom quartile. These foods (red meat, fish, milk and dairy products) were selected because they were related to the previous research that suggested fats might be associated with Pca. As shown in Table 2, consumption of fish and olive oil was associated with decreased risk of Pca but no significantly (*P-value* > 0.05). ORs of the fourth vs. first quartile and 95% CI were 0.7 (0.4–1.5) for fish and 0.5 (0.3–1.1) for olive oil. Consumption of red meat was significantly associated with increased risk (OR of the fourth vs. first quartile was 2.1, 95% CI 1.1–3.9) (*P-value* < 0.01). Total energy intake and consumption of milk showed a modest increase in risk. ORs of the fourth vs. first quartile were 1.5 (0.9–2.7) for total energy intake and 1.5 (0.9–2.4) for milk. When dairy products were examined, there was also positive association that is highly significant with increased risk of Pca (OR 2.2, 95% CI 1.2–4.1) (*P-value* < 0.001).

Table 2. Adjusted odds ratios (ORs) and 95% CI of fat intakes for Pca.

Variables	*Cases (n = 160)*	*Controls (n = 160)*	*OR*	*95% CI*	*P-value*
Total energy intake *(kcal/day)*					
≤ 1520	40	38	1		
1521–1810	36	57	0.3	0.3–0.8	
1811–2250	44	37	1.2	0.7–2.0	
>2250	40	28	1.5	0.9–2.7	*0.3*
Red meat *(gr/day)*					
< 25.1	27	26	1		
25.1–65.2	37	32	1.2	0.7–2.0	
65.2–110.8	65	85	0.6	0.3–0.9	
> 110.8	31	17	2.1	1.1–3.9	*< 0.01*
Fish *(gr/day)*					
< 35.3	73	70	1		
35.3–65.7	45	47	0.9	0.5–1.5	
65.7–121.4	25	22	1.1	0.4–2.1	
> 121.4	17	21	0.7	0.4–1.5	*0.9*
Milk *(ml/day)*					
< 20	42	45	1		
20–100	31	49	0.5	0.3–0.9	
100–200	28	21	1.4	0.7–2.6	
>200	59	45	1.5	0.9–2.4	*0.2*
Dairy products *(gr/day)*					
< 7.3	37	38	1		
7.3–100	47	54	0.7	0.4–1.2	
100–200	36	47	0.7	0.4–1.1	
> 200	40	21	2.2	1.2–4.1	*< 0.001*
Olive oil *(gr/day)*					
< 7.3	52	52	1		
7.3–50.2	61	45	1.5	0.9–2.5	
50.3–100	27	33	0.7	0.4–1.3	
>100	20	30	0.5	0.3–1.1	*0.03*

ORs and 95% CI were calculated by conditional logistic regression models with adjustment for total energy intake, tobacco smoking and family history of Pca.

ORs for green-yellow vegetable, dry vegetable and fruit intakes are shown in Table 3. Inverse associations with risk of Pca were observed for green-yellow vegetables (tomatoes and cauliflower), dry vegetables (beans and lentils) and fruits (grenade and dates). A modest decreased risk was found in the highest quartile for tomato with OR of 0.6 (95% CI 0.3–1.1) (*P-value* = 0.07), whereas consumption of cauliflower was significantly associated with decreased risk with OR of 0.5 (95% CI 0.3–0.9) (*P-value* < 0.01). Similarly, dry vegetables showed a negative association with the risk of Pca. This protective association was not significant (*P-value* = 0.6) with OR of 0.8 and 95% CI (0.5–1.3). With increasing intake of fruits, the risk of Pca tended moderately to decrease. ORs were 0.6 (95% CI 0.3–1.1) (*P-value* = 0.1) for grenade and 0.8 (95% CI 0.5–1.4) (*P-value* = 0.34) for dates.

ORs of beverage intakes are shown in Table 4. Consumption of green tea and coffee showed a negative association with risk of Pca, but were no significant (*P-value* > 0.05). ORs and 95% CI were 0.6 (0.3–1.1) for green tea and 0.7 (0.3–1.3) for coffee. Soft drinks were significantly associated with increased risk of prostate cancer (*P-value* = 0.01). OR and 95% CI of the highest quartile were 1.6 (1.1–2.7).

Discussion

Results of this study suggested that the low incidence of Pca in Algerian men might be related to higher intake of antioxidant components such as isoflavones and polyphones found mainly in dry vegetables, fruits and green tea. Recently, Algerian men have a tendency to eat frozen red meat and other foods high in fat imported from industrialized countries. This may expose population at high risk of Pca. In literature, data on the effect of energy intake are inconsistent. The evidence suggests that high energy intake may increase the risk of Pca. Epidemiological studies have suggested that total energy intake is positively associated with Pca [11]. In this study, energy intake increased the risk of Pca. However, the majority of Algerians consume more fish such as sardines. Various studies have indicated inverse associations of fish consumption with Pca [1,13]. Fatty acids in fish, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DPA), have been

Table 3. Adjusted odds ratios (ORs) and 95% CI of green-yellow vegetable, dry vegetable and fruit intakes for Pca.

Variables	*Cases (n = 160)*	*Controls (n = 160)*	*OR*	*95% CI*	*P-value*
Green-yellow vegetables					
Tomato *(gr/day)*					
< 27.6	34	33	1		
27.6–43.9	58	44	1.5	0.9–2.4	
44–100.0	43	48	0.8	0.5–1.4	
> 100.0	25	35	0.6	0.3–1.1	*0.07*
Cauliflower *(gr/day)*					
< 20.4	23	22	1		
20.4–62.7	67	46	1.7	1.1–2.8	
62.8–100	38	42	0.8	0.5–1.4	
>100	32	50	0.5	0.3–0.9	*< 0.01*
Dry vegetables					
Beans and lentils *(gr/day)*					
< 14.2	46	44	1		
14.2–27.6	35	27	1.3	0.8–2.4	
27.7–42.8	18	21	0.8	0.4–1.6	
> 42.8	61	68	0.8	0.5–1.3	*0.6*
Fruits					
Grenade *(gr/day)*					
< 21.4	36	40	1		
21.4–64.2	51	40	1.2	0.8–2.2	
64.3–107	45	40	1.1	0.7–1.9	
> 107.1	28	40	0.6	0.3–1.1	*0.1*
Dates *(gr/day)*					
< 30.7	44	43	1		
30.7–62.1	42	37	1.2	0.7–1.9	
62.2–100.0	39	41	0.9	0.5–1.5	
> 100.0	35	39	0.8	0.5–1.4	*0.34*

ORs and 95% CI were calculated by conditional logistic regression models with adjustment for total energy intake, tobacco smoking and family history of Pca.

Table 4. Adjusted odds ratios (ORs) and 95% CI of beverage intakes for Pca.

Variables	*Cases (n = 160)*	*Controls (n = 160)*	*OR*	*95% CI*	*P-value*
Green tea *(cups/day)*					
≤ 1	42	41	1		
2–3	57	45	1.4	0.8–2.2	
4–6	43	46	0.9	0.5–1.4	
> 6	18	28	0.6	0.3–1.1	*0.08*
Coffee *(cups/day)*					
≤ 1	55	56	1		
2–3	84	76	1.2	0.7–1.8	
> 3	21	28	0.7	0.3–1.3	*0.1*
Soft drinks *(cups/day)*					
≤ 1	56	54	1		
2–3	17	29	0.5	0.2–1.0	
4–5	36	42	0.7	0.4–1.2	
> 5	51	35	1.6	1.1–2.7	*0.01*

ORs and 95% CI were calculated by conditional logistic regression models with adjustment for total energy intake, tobacco smoking and family history of Pca.

consistently shown to inhibit the proliferation of Pca cell lines in vitro and to reduce the risk and progression of these tumours in vivo [13]. Our results suggest that olive oil might be a protective factor against Pca. Studies suggested that protection has been attributed to the olive oil's components as squalene, phytosterols and β-sitost érol [14]. The present study showed increased risk of Pca associated with red meat intake. It was reported increased risk of advanced Pca associated with saturated fat, unsaturated fat and α-linolenic acid intakes [7]. This study also supports the hypothesis that higher intakes of calcium, a mineral widely found in dairy products, are associated with an increased risk of Pca. We observed an association for dairy products with increased risk. In vitro, high circulating levels of calcium and 1,25-dihydroxyvitamin D3 may increase insulin-like growth factor-1 (IGF-1), which may be associated with increased Pca risk [12]. In our study, tomato and cauliflower intakes showed protective effects against Pca. In literature, it was reported on the relationship between lycopene, present in tomatoes and tomato products, and Pca [8]. There is consistent evidence that cauliflower offers anticarcinogenic effects. An epidemiological review, published in 2002, concluded that there was modest support that high intakes of Brassica vegetables reduce Pca risk [10]. Although cruciferous vegetables are rich in polyphenols and isoflavones (which having a protective role against tumoural growth of prostatic cells), some studies showed no association [3]. This study showed that a decreased Pca risk appears to be associated with the intake of fruits. It was presumed, because of their antioxidant effects, that a grenade has the protective action of retinoid molecules, which are prevalent in fruits [3]. In this study, green tea and coffee intakes showed no significant reduction in the risk of Pca. Australian epidemiological study has shown Pca preventive effects of epigallocatechin-3-gallate (EGCG), a molecule present in

green tea [4]. Experimental studies have shown that green tea limited the proliferation of tumour epithelial cells in androgen-independent metastasic Pca [4]. Coffee contains many biologically active compounds, including caffeine and phenolic acids, which have potent antioxidant activity and can affect glucose metabolism and sex hormone levels. Because of these biological activities, coffee may be associated with a reduced risk of Pca [15].

Conclusion

Although our results are consistent with other studies, Pca risk in this study does not appear to be strongly associated with food intakes. However, it is difficult to have precise arguments of the food influence on the Pca's natural history. Research is limited by the methodological problems. We intend to continue with this case-control study using a large number of patients throughout the country to investigate the new factors or associations of other foods with Pca.

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