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Fruit and vegetable consumption associated with reduced risk of epithelial ovarian cancer in southern Chinese women

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HIGHLIGHTS

- First report on fruit and vegetable intake and ovarian cancer in southern China
- High fruit and vegetable consumption appears protective against ovarian cancer.
- Intakes of nutrients derived from fruits and vegetables are inversely associated with ovarian cancer risk.

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ABSTRACT

Objective. To investigate the association between fruit and vegetable consumption and the risk of epithelial ovarian cancer in southern Chinese women.

Methods. A case–control study was undertaken in Guangzhou, Guangdong Province, between 2006 and 2008. Participants were 500 incident ovarian cancer patients and 500 hospital-based controls. Information on habitual fruit and vegetable consumption was obtained by face-to-face interview using a validated and reliable food frequency questionnaire. Unconditional logistic regression analyses were performed to assess the association between fruit and vegetable intakes and the ovarian cancer risk.

Results. The mean fruit and vegetable daily intakes of ovarian cancer patients (324.2 g (SD 161.9) and 582.7 g (SD 250.2)) were significantly lower ($p < 0.001$) than those of controls (477.3 g (SD 362.1) and 983.3 g (SD 739.9)). The adjusted odds ratios were 0.30 (95% confidence interval (CI) 0.21 to 0.44) and 0.07 (95% CI 0.04 to 0.12) for more than 490 g of fruits and 970 g of vegetables per day, relative to at most 320 g and 690 g per day, respectively. With the exception of lycopene, substantial risk reductions were evident for a variety of nutrients derived from fruits and vegetables.

Conclusion. Consumption of fruits and vegetables was inversely associated with the incidence of epithelial ovarian cancer in southern Chinese women.

Introduction

Ovarian cancer is the second most common gynaecological malignancy and the seventh leading cause of cancer-related deaths among women worldwide [1]. In 2008, approximately 225,000 new cases of ovarian cancer and 140,000 related deaths were reported [1]. Ovarian cancer is usually diagnosed at an advanced stage and has a five-year survival rate of only 25–30% [2]. Exploring ways to prevent this disease is therefore important. Besides genetic, familial and reproductive factors, physical activity and body size are known to be related with the development of ovarian cancer for Chinese women [3–6].

Fruits and vegetables are rich in cancer-preventive agents, such as carotenoids, vitamins, folate, dietary fibre and certain minerals [7]. A number of studies, mostly from Europe and North America, have investigated the effect of fruit and vegetable consumption on the ovarian cancer risk. While some case–control studies [8–10] and prospective cohort studies [11,12] observed inverse associations, others reported no associations between intakes of fruit and/or vegetable and ovarian cancer risk [13,14].

Few epidemiologic studies of ovarian cancer have been conducted among Chinese women in relation to their intake of fruits and vegetables. Despite apparent risk reductions at high levels of intake were found in women residing in Hangzhou, China [15], another study in Taiwan provided inconclusive evidence [16]. The present study aimed to investigate the association between fruit and vegetable consumption and the risk of ovarian cancer in southern Chinese women.

Methods

Study design and subjects

A hospital-based case–control study of epithelial ovarian cancer was conducted in Guangzhou, southern China, between August 2006 and

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July 2008 [4]. Details of the methodology have been reported elsewhere [17]. Subjects were recruited from four public hospitals, namely, The Overseas Hospital (affiliated with Jinan University), Zhujiang Hospital, General Hospital of Guangzhou Military Command, and Second Affiliated Hospital of Zhongshan University. Eligibility criteria were age 75 years or less and residence in metropolitan Guangzhou for at least the past 10 years.

Medical records and pathology reports were reviewed to identify newly diagnosed patients (within the past 12 months). Pathological diagnoses were based on the International Histological Classification of Ovarian Tumors [18]. Patients without histopathologically confirmed epithelial ovarian cancer (invasive and borderline malignancies) and those who had self-reported memory problems affecting their recall of past events were excluded. Of the total 504 patients identified, 500 consented to participate.

Controls were recruited from inpatients at the same hospitals from Ophthalmology, Orthopaedics, Respiratory Diseases, Gastroenterology and Physiotherapy departments. Exclusion criteria for controls were previous diagnosis of malignant disease; history of bilateral oophorectomy; having self-reported memory problems; on long-term medical diet; in addition to non-residency and age above 75 years. Whenever more controls were available than could be interviewed, the final selection was made using random numbers. Of the 512 eligible controls recruited to frequency matched with cases by age (±5 years), 500 women agreed to take part in the study. There were no significant differences in age, education level and marital status between participants and non-participants.

The study was approved by the participating hospitals and the Human Research Ethics Committee of Curtin University (number HR 78/2006). Written informed consent was obtained from all participants. They were assured of the right to withdraw any time without prejudice.

Data collection

All participants were interviewed by trained interviewers in either Mandarin or Cantonese, usually in the presence of their next-of-kin to help the recall of dietary habits. The structured questionnaire used composed of questions on demographic characteristics, anthropometry, reproductive history, hormonal status, past and family medical history and lifestyle, including diet. Current weight, weight five years before the interview and height were used to calculate body mass index (BMI) at both times. In addition, participants estimated their average time engaged in various physical activities. Total physical activity was quantified in terms of metabolic equivalent tasks (MET)-hours per week [4].

A 125-item semi-quantitative food frequency questionnaire including commonly consumed fruits and vegetables, developed and tested for the southern Chinese population, was used to collect dietary information and alcohol consumption [19,20]. Frequency and amount of intake were recorded in detail. The reference recall period for dietary variables was five years before diagnosis for cases and five years before interview for controls. The energy content of each food or beverage item was obtained from the Chinese Food Composition Tables to estimate total energy intake (kcal) [21].

Statistical analysis

Descriptive statistics were used to summarize the sample characteristics. Unconditional logistic regression analyses were performed to ascertain the effects of fruit and vegetable intakes on the epithelial ovarian cancer risk. Total vegetable intake was defined as the sum of daily consumption of green leafy vegetables (spinach, water spinach, watercress), cruciferous vegetables (Chinese cabbage, cabbage mustard, flowering stalk, cole, cabbage, cauliflower, radish), yellow orange

Table 1
Characteristics of participants by case–control status in southern China.

Variable	Cases n (%)	Controls n (%)	p[a]
Marital status			0.83
Never married	7 (1.4%)	8 (1.6%)	
Married	449 (89.8%)	443 (88.6%)	
Widowed or divorced or separated	44 (8.8%)	49 (9.8%)	
Education level			0.90
None or primary	204 (40.8%)	197 (39.4%)	
Secondary	171 (34.2%)	175 (35.0%)	
Vocational or tertiary	125 (25.0%)	128 (25.6%)	
Parity			<0.01
0	8 (1.6%)	14 (2.8%)	
1	172 (34.4%)	143 (28.6%)	
2	219 (43.8%)	176 (35.2%)	
≥3	101 (20.2%)	167 (33.4%)	
Oral contraceptive use			<0.01
Never	417 (83.4%)	380 (76.0%)	
Ever	83 (16.6%)	120 (24.0%)	
Menopausal status			0.24
Pre	28 (5.6%)	20 (4.0%)	
Post	472 (94.4%)	480 (96.0%)	
Tubal ligation			0.95
No	325 (65.0%)	324 (64.8%)	
Yes	175 (35.0%)	176 (35.2%)	
Hormone replacement therapy			1.00
No	493 (98.6%)	493 (98.6%)	
Yes	7 (1.4%)	7 (1.4%)	
Smoking status			0.37
Never	481 (96.2%)	485 (97.0%)	
Past	14 (2.8%)	8 (1.6%)	
Current	5 (1.0%)	7 (1.4%)	
Alcohol drinking			0.16
No	352 (70.4%)	372 (74.4%)	
Yes	148 (29.6%)	128 (25.6%)	
Family history of ovarian or breast cancer in first-degree relatives			0.39
No	480 (96.0%)	485 (97.0%)	
Yes	20 (4.0%)	15 (3.0%)	
	Mean (SD)	Mean (SD)	
Age at interview (years)	59.1 (5.7)	59.7 (6.5)	0.10
Body mass index (5 years ago, kg/m^2)	21.7 (2.5)	21.1 (2.3)	<0.01
Physical activity (MET-hours/week)	16.2 (14.1)	18.8 (13.0)	<0.01
Fresh meat consumption (g/day)	288 (157.9)	285 (166.9)	0.74
Seafood consumption (g/day)	122 (74.0)	141 (136.6)	<0.01
Vegetable consumption (g/day)	582.7 (250.2)	983.3 (739.9)	<0.001
Fruit consumption (g/day)	324.2 (161.9)	477.3 (362.1)	<0.001

[a] Chi-square or *t*-test for difference between cases and controls.

Table 2
Crude and adjusted odds ratios (95% confidence intervals) of epithelial ovarian cancer risk for fruit and vegetable consumption in southern China.

Daily intake (g)	Cases n (%)	Controls n (%)	Crude OR (95% CI)[a]	Adjusted OR (95% CI)[b]	p[b]
Total vegetables					<0.001
≤690	392 (78.4%)	165 (33.0%)	1	1	
691–970	78 (15.6%)	168 (33.6%)	0.20 (0.14, 0.28)	0.17 (0.12, 0.24)	
>970	30 (6.0%)	167 (33.4%)	0.08 (0.05, 0.13)	0.07 (0.04, 0.12)	
Total fruits					<0.001
≤320	287 (57.4%)	170 (34.0%)	1	1	
321–490	144 (28.8%)	167 (33.4%)	0.53 (0.39, 0.71)	0.49 (0.36, 0.67)	
>490	69 (13.8%)	163 (32.6%)	0.31 (0.22, 0.44)	0.30 (0.21, 0.44)	

[a] From separate logistic regression models adjusting for age at interview (years, continuous) and total energy intake (kcal/day, continuous).

[b] From separate logistic regression models adjusting for age at interview (years, continuous), education level (none or primary, secondary, vocational or tertiary), body mass index (5 years ago, kg/m^2, continuous), physical activity (MET-hours/week, continuous), fresh meat consumption (g/day, continuous), seafood consumption (g/day, continuous), total energy intake (kcal/day, continuous), parity (continuous), oral contraceptive use (never, ever), menopausal status (pre, post), tubal ligation (no, yes), hormone replacement therapy (no, yes), smoking status (never, past, current), alcohol drinking (no, yes), and family history of ovarian or breast cancer in first-degree relatives (no, yes).