Tea consumption reduces ovarian cancer risk

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ABSTRACT

Objective: To ascertain the relationship between tea drinking and the risk of ovarian cancer among southern Chinese women, a case–control study was conducted in southern China during 2006–2008. *Methods*: Five hundred incident patients with histologically confirmed epithelial carcinoma of the ovary and 500 controls (mean age 59 years) were recruited from four public hospitals in Guangzhou. Information on frequency, quantity and duration of tea drinking, amount of dried tea leaves brewed, together with habitual diet and lifestyle characteristics, was obtained face-to-face from participants using a validated and reliable questionnaire. Logistic regression analyses were performed to assess the association between tea consumption variables and the ovarian cancer risk. *Results*: The control subjects reported higher tea consumption levels and prevalence (78.8%) than the ovarian cancer patients (51.4%). Regular drinking of green tea, black tea and/or oolong tea was associated with a lower risk of ovarian cancer, the adjusted odds ratio being 0.29 (95% confidence interval 0.22–0.39) after accounting for confounding factors. When compared with non-drinkers, apparent inverse dose–response relationships were observed for years of drinking, number of cups and quantity of tea consumed, as well as amount of dried tea leaves brewed ($p < 0.01$). *Conclusion*: Regular tea consumption is associated with a reduced risk of ovarian cancer for southern Chinese women.

1. Introduction

Ovarian cancer is the eighth most common cancer in women and the second most common gynaecological cancer, accounting for about 140,000 deaths annually worldwide [1]. The incidence of ovarian cancer per 100,000 females is only 3.8 in China, much lower than Western countries such as the USA (8.8) and Australia (7.7) [1]. The large differences in rates between countries suggest that dietary, lifestyle and environmental factors may influence the etiology of ovarian cancer, apart from genetic and familial risk factors [2]. Because ovarian cancer has few symptoms during its initial stages, it is typically diagnosed at an advanced stage [3]. Treatment of the malignancy is difficult and somewhat controversial [4,5]. Therefore, strategies that can enhance primary prevention are invaluable.

Tea is a natural beverage widely consumed around the world. There has been considerable interest in the protective role played by tea and its components, both *in vitro* and *in vivo* [6–8]. Recent experimental studies have demonstrated the chemo-preventive properties of tea polyphenols. Such compounds are known to offer protection against all stages of carcinogenesis by suppressing tumor promotion and inflammation, due to their antioxidant properties against free radicals, blocking signal transduction and nuclear oncogene expression, trapping of ultimate carcinogens, and inducing apoptosis and cell cycle arrest [9,10].

Despite the advances in laboratory experiments and animal studies, epidemiological evidence is still emerging and equivocal, mainly due to different tea consumption patterns and habits between populations, and particularly a lack of accurate measurements on tea exposure in most studies [8]. A literature search located 12 human observational studies investigating tea consumption and the ovarian cancer risk [11–22], but their results have been inconsistent. Furthermore, long-term tea consumption was seldom assessed. The onset of cancer typically requires many years to develop, information on long-term tea exposure is thus important. Taking these issues into consideration, the present case–control study aims to investigate whether tea consumption has an etiological association with the ovarian cancer risk among southern Chinese women, in view of their tea drinking practice specific to this region of China.

2. Patients and methods

2.1. Participants and eligibility criteria

A hospital-based one to one case–control study was conducted in the Guangdong Province of southern China, between August

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2006 and July 2008. Subjects were recruited from four public hospitals within Guangzhou, the capital city of Guangdong: The Overseas Hospital affiliated with Jinan University, Zhujiang Hospital, General Hospital of Guangzhou Military Command, and Second Affiliated Hospital of Zhongshan University. Cases were defined to be incident patients who had been histopathologically diagnosed with cancer of the ovary within the past 12 months. Eligible cases were required to be under 75 years of age and have resided in the metropolitan Guangzhou area for at least the past ten years.

Potential cases were identified by searching the daily census of the hospitals. All hospital medical records and laboratory pathology reports were reviewed to ensure complete ascertainment of cases. Pathological diagnoses were determined by the International Histological Classification of Ovarian Tumors [23]. Patients were excluded when ovarian cancer was histopathologically confirmed to be neither the primary nor final diagnosis, or if they admitted to suffer memory problems affecting their recall of past events. Five hundred patients with epithelial carcinoma of the ovary consented to participate and were capable of being interviewed after consecutively recruited 504 cases from the four hospitals.

During the same period, 512 controls were recruited from inpatient wards of the departments of ophthalmology, orthopedic, respiratory disease, gastroenterology and physiotherapy. These women were frequency matched to cases within 5 years of age. The same age limit and residency requirement also applied. Additional exclusion criteria were: (1) previous diagnosis of ovarian cancer or other malignant diseases; (2) a history of bilateral oophorectomy; (3) having memory problems; (4) on long-term modification of diet for medical reasons. Criterion (2) was needed to minimise the risk of misclassification, as some women might have been cases, but were not told or unaware of their disease. For criterion (4), a woman should be excluded as a true control if she had been on a modified diet due to her medical condition.

A systematic selection process for controls was adopted throughout the recruitment period. Inpatient ward numbers were initially selected by random sampling. After screening potential controls for case-matching based on the hospital daily census sheets, all eligible subjects had their diagnosis confirmed by histopathological reports to avoid misclassification. Twelve women who declined to be interviewed or not satisfying the eligibility conditions were subsequently excluded, resulting in a final sample of 500 controls available for analysis. There were no differences in age and major demographics between the excluded subjects and the consented participants.

2.2. Interview procedure

An appointment for interview was arranged with the assistance from nursing staff to minimize interference with treatment at the ward. Controls were interviewed before their discharge from hospital. All subjects were assured confidentiality and their right to withdraw without prejudice before obtaining their formal consent. The interviews, averaging 45 min in duration, were conducted face-to-face by research assistants in either Mandarin or the Cantonese dialect. All research assistants were fluent in both dialects, and were trained by the second author for the interviews following a standardised protocol. The presence of next-of-kin was encouraged to help the recall of dietary habits. However, all participants were blinded to the study hypothesis. The standardized study protocol was approved by the Human Research Ethics Committee of Curtin University (approval number HR 78/2006), the hospital administrations and the doctors in-charge of the relevant wards. Access to medical records and pathology reports was granted by the participating hospitals.

2.3. Questionnaire and exposure measurements

A structured questionnaire was administered to collect demographic data and lifestyle characteristics including age, weight (kg), height (m), education level, smoking status and alcohol consumption. Information on reproductive history, hormonal status and heredity was also obtained. Self-reported data were verified with medical records whenever available.

Information on habitual food and beverage consumption was obtained using a 125-item semi-quantitative food frequency questionnaire developed for the southern Chinese population [24,25]. This validated instrument covered most of the food and beverage items commonly consumed in southern China. Frequency and amount of intake were recorded in detail. The reference recall period for dietary variables was set at 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 [26]. We then estimated participant's total energy intake (kcal) by summing the energy intake across individual items consumed.

Specific questions on tea drinking were appended to the food frequency questionnaire. The reliability and reproducibility of these questions have been established for southern China [27]. Subjects were first classified as tea drinkers or non-drinkers (less than once per month). The tea drinkers were asked to report their frequency of habitual intake (number of cups per month, week or day), duration of regular tea drinking (in years), types of tea drank (green, black and oolong), and average amount of dried tea leaves used for brewing tea in "jin" (500 g) and "liang" (50 g) per year. Quantity of liquid tea consumed was measured in terms of the standard cup size of 180 ml. The common method of tea preparation in southern China is to brew dried tea leaves in a tea pot or tea cup using hot water without adding milk or sugar.

2.4. Statistical analysis

Comparisons of characteristics between case and control groups were made using chi-square and t-tests. To investigate the effects of tea exposure on the ovarian cancer risk, separate unconditional logistic regression analyses were performed for tea drinking (yes or no), duration of drinking, frequency of intake, quantity consumed, and amount of dried tea leaves brewed. The continuous consumption variables were classified into four increasing levels of exposure, with non-drinkers taken as the reference category. Both crude and adjusted odds ratios (OR) and associated 95% confidence intervals (CI) were reported, and tests for linear trend were conducted to assess the dose–response relationship. Analysis by tea type was not undertaken because most of the tea drinkers regularly drank a combination of green, black and oolong teas.

Besides tea consumption, independent variables included in the logistic regression models were age at interview (years), parity, oral contraceptive use (never, ever), body mass index (5 years ago), menopausal status (pre, post), education level (none or primary, secondary, tertiary), smoking status (never, ever), alcohol drinking (no, yes), total energy intake (kcal) and family history of ovarian or breast cancer (no, yes). These variables were considered plausible risk factors according to the literature. Statistical analyses were performed using the SPSS package version 20.

3. Results

Characteristics of the sample by case–control status are presented in Table 1. The participants were 59 years of age on average and predominantly post-menopausal. Most of them were non-smokers, still married, and seldom drank alcoholic beverages