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The Protective Effect of Peanut, Walnut, and Almond Consumption on the Development of Breast Cancer

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Key Words
Breast Cancer · Cancer pathology · Gynecological cancer · Risk factor · Nutrition · Seeds

Abstract
Background/Aims: Breast cancer is the most common gynecologic malignancy known worldwide. The consumption of certain foods may modify the risk for its development. Peanuts and other seeds have shown anticarcinogenic effects in vitro, but there are a few studies that evaluate the effect of their consumption on the development of breast cancer. The aim of the present study was to determine whether there is an association between the consumption of peanuts, walnuts, and almonds and the development of breast cancer. ***Methods:*** We analyzed 97 patients presenting with breast cancer and 104 control subjects that did not have the pathology (BIRADS 1–2). An analysis of the main clinical characteristics and lifelong seed consumption was carried out. The association between the consumption of these foods and the risk for breast cancer was estimated by odds ratios and 95% confidence intervals, controlling other risk factors, using the Mantel-Haenszel analysis. ***Results:*** The high consumption of peanuts, walnuts, or almonds significantly reduced the risk for breast cancer by 2–3 times. This protective effect was not found with low or moderate seed consumption when compared with null consumption. ***Conclusions:*** High consumption of peanuts, walnuts, and almonds appears to be a protective factor for the development of breast cancer.

Introduction

Breast cancer is the most frequent gynecologic neoplasia observed worldwide [1]. It represents 16% of all cancers in women [2]. The risk for the development of

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breast cancer is the result of a combination of hereditary and environmental factors, the latter of which include aspects of lifestyle and diet [3–5]. The consumption of certain foods may modify the risk for the development of cancer. It has been suggested that walnuts and peanuts have anticarcinogenic effects [6].

However, there are very few studies that evaluate the effect of human consumption of peanuts and other seeds on cancer. A study conducted on a Taiwanese population demonstrated that peanut consumption had a protective effect against colon cancer in women [7], but there are also studies that contradict the benefits of this seed. Inadequate storage practices can favor its contamination with aflatoxins (secondary metabolites of the fungi Aspergillus flavus and Aspergillus parasiticus), a known risk factor for the development of different cancers. Peanut consumption has been associated with the development of primary liver cancer in certain populations in which there is low technological development, probably due to its contamination with these toxins [8].

With respect to breast cancer, no studies have been conducted to determine whether peanut consumption has a protective effect, which would be congruent with the antineoplastic activity reported for certain components of the peanut and other seeds in in vitro assays [9–11].

The peanut is an important food in the Mexican diet (consumed weekly by 2 out of every 5 persons) [12], and therefore it is of interest to evaluate the effect of its consumption on the development of breast cancer. However, the fact that the greater part of the peanuts consumed in Mexico are still processed in a traditional, not very technical manner, makes them susceptible to aflatoxin contamination. It is not known if the consumption of this food could also be a risk factor for cancer. Therefore, a case–control study was conducted whose aim was to evaluate the effect of peanut and other seed consumption on the development of breast cancer in a population in western Mexico (Colima).

Methods

Ninety-seven women patients presenting with breast cancer and 104 non-hospitalized women with normal mammograms (American College of Radiology Breast Imaging Reporting and Data System [BIRADS] 1 or 2) agreed to participate in the study. Within the time frame of 2012–2013, participants were recruited from a single public hospital center *(Instituto Estatal de Cancerología de Colima)* where patients received cancer treatment or follow-up and the control group received routine mammography. The study was approved by the institutional review board of the University of Colima School of Medicine and the ethics committee of the *Instituto Estatal de Cancerologia de Colima*. All participants included in the study signed a statement of informed consent.

Selection criteria for the control group individuals were: (1) that their routine mammograms were carried out at the same hospital in which the breast cancer (BC) patients were treated; (2) that they had a normal mammogram (BIRADS 1–2); (3) that they belonged to the same age group (less than a 5-year difference) as the patients of the BC group (individuals were paired by age group), and (4) that they had no personal history of cancer. Additionally, all study participants were non-blood-related Mexican mestizo subjects from the State of Colima, Mexico.

Definitions

A medical history was elaborated for each of the participants (including histopathologic and immunohistochemical reports on the tumors). Breast cancer patients were categorized into stages according to the TNM classification. The presence of metastasis was evaluated with a liver function test, chest X-ray, abdominal ultrasound scan, and bone scintigraphy. As part of the anamnesis, the consumption frequency of peanuts, walnut and almonds was asked. A portion of at least 1 oz (28 g), each ingestion, was the quantity taken into consideration for the study. The portions of other foods were considered as follows: (1) fruit: 1 medium-sized fruit (the size of a baseball) or half a cup of fresh fruit or juice; (2) vegetables: 1 cup of raw green leafy vegetables or half a cup of cooked vegetables or their juice; (3) Corn and beans: half a cup of cooked corn kernels or beans or one tortilla, or their equivalent in a food made mainly of corn or beans; (4) Meat: 85 g of cooked red meat; (5) soft drinks: 250 ml volume. Consumption was regarded as the habitual intake during the majority of the person's lifetime. In the BC group, it was emphasized that consumption did not refer to changes in seed consumption that were made after the cancer diagnosis. Consumption was categorized as: High (at least once a week); Moderate (at least once every 15 days); Low (at least once every 2 months); and Null (less than 5 times a year or never). Smoking was evaluated as 'lifetime cigarette use' in accordance with the definition taken from the U.S. National Survey on Drug Use and Health, and so positive for smoking was regarded as the smoking of 100 or more cigarettes during the individual's life time [13]. Alcoholism was regarded as the regular consumption of 20–40 g of alcohol daily; a standard drink contains approximately 12–14 g of alcohol [14]. Lactation was considered positive when the mother breastfed one or more children for 6 months [15]. Gestation was a pregnancy of 28 weeks or more. The use of hormonal contraceptives was regarded as positive when they were used for a period equal to or above 5 years [16].

Statistical Analysis

The Student's t test was used to compare the mean values of the measurement variables (normally distributed). The qualitative data comparison was done through the Chi-square test. The association between the food consumption and risk for breast cancer was estimated by odds ratios (OR) and 95% confidence intervals (CI) (Crosstabs procedure). They were calculated, controlling other risk factors, using the Mantel-Haenszel analysis. All statistical analyses were performed with the SPSS version 2.0 software (IBM, Armonk, New York, N.Y., USA).

Table 1. Main clinical characteristic distribution of the study subjects

Variables	Case (n = 97)	Control (n = 104)	p
Smoking, %	7.2	8.6	0.495
Alcoholism, %	4.1	4.8	0.153
Diabetes, %	12.4	14.4	0.427
Hypertension, %	23.7	22.1	0.833
BMI, kg/m^2	27.1±4.0	27.8±4.5	0.222
Age of first coitus	21.6±6.8	20.1±5.0	0.083
Number of pregnancies	3.4±2.8	4.3±2.5	0.044*
Pregnancies (yes/no), %	63.9	78.8	0.022*
Lactation (yes/no), %	55.7	72.1	0.013*
Hormonal contraceptive, %	17.5	11.5	0.228
Menarche-menopause, years	31.2±8.2	32.4±6.1	0.283
High consumption of soft drinks, %	70	55	0.197
Fruit, %	85	93	0.310
Vegetables, %	82	91	0.224
Red meat, %	86	90	0.478
Beans, %	99	94	0.118
Corn, %	100	99	1.000

BMI = Body mass index. * Statistically significant results.

Table 2. Seed consumption frequency and its association with breast cancer

Consumption frequency	Controls, %	Cases, %	Adjusted* OR (95% CI)	p
Peanut				
High	43.3	19.6	0.33 (0.17–0.63)	0.001
Moderate	15.4	22.7		
Low	18.2	20.6		
Null	23.1	37.1		
Walnut				
High	25.0	13.4	0.45 (0.22–0.93)	0.033
Moderate	5.8	20.6		
Low	20.2	21.7		
Null	49.0	44.3		
Almond				
High	25.0	15.5	0.44 (0.21–0.89)	0.024
Moderate	8.7	20.6		
Low	29.8	24.7		
Null	36.5	39.2		

* Adjusting the gestation and lactation variables, OR high vs. others.

Results

The mean age was 50.7 (SD 7.5) and 51.3 (SD 13.6) in the controls and cases, respectively. There was no significant difference in this variable (p = 0.69). Other characteristics of the study population are summarized in table 1. This table shows that there were significant differences only in the variables of gestation and lactation, which were lower in the case group. There were no significant differences between the cases and controls in relation to the high consumption of soft drinks, fruit, vegetables, red meat, corn, and beans (table 1). With respect to tumor histology in the case group, ductal cancer predominated in 87.6%, followed by the lobular, papillary, and mucinous types at 6.5, 3.1 and 3.1%, respectively. Receptor overexpression for HER2, progesterone, and estrogens was positive in 16.5, 72.2, and 77.3%, respectively. The clinical stage of cancer was 0 in 14.4% of the cancer patients, IA in 11.3%, IB in 3.1%, IIA in 33.0%, IIB in 25.7%, IIIA in 8.2%, IIIB in 4.1%, and IV in 0%.

As can be seen in table 2, high peanut, walnut, and almond consumption reduced the risk for breast cancer by 2 to 3 times. This protective effect was not found with low or moderate seed consumption, when compared with null consumption (data not shown). It should be mentioned that these analyses were done, adjusting the gestation and lactation variables. The main form of preparation of the consumed seeds was reported as follows: 77.1% of the study subjects consumed toasted unshelled peanuts, 11.9% fried, 5.5% covered in sugar or flour and fried, and 5.5% in a powder or butter. Walnuts and almonds were consumed raw by 100%. There were no differences in the type of preparation of the seeds consumed by the case group and control group.

Discussion

High peanut, walnut, and almond consumption was shown to reduce the risk for breast cancer by 2–3 times in the population studied. These results are in accordance with the recent report by Bao et al., but the effect of nut consumption was not evaluated for the specific development of breast cancer [17]. The protective effect for breast cancer could be generated by some components of these seeds, such as phytic acid, phytosterols, and resveratrol that have previously shown antineoplastic effects in vitro in the cells of liver, colon, prostate, and breast cancers [6–11].

On the other hand, it was previously reported that high peanut consumption increased the incidence of primary liver cancer in Cameroon; this was related to the presence of certain fungal varieties that contaminate food with

aflatoxins when they are inadequately stored or processed [6]. More than half the population of the present study consumed peanuts on a weekly basis, mainly toasted and unshelled. This presentation is susceptible to fungal contamination. Nevertheless, the peanut was a significant protective factor in our sample. This could be an indication that the seeds consumed in our population are generally not contaminated with carcinogenic levels of aflatoxins, but this is something that needs to be verified in future studies.

It is important to point out that the peanut was the most frequently consumed seed, probably due to its price; it costs 4–5 times less than the other seeds studied. This becomes relevant for peanut-producing regions with low-income populations because they could reduce the risk for breast cancer through high peanut consumption and at reduced costs.

High consumption of fruit, vegetables, soft drinks, red meat, beans, and corn was not associated with the development of breast cancer; this finding concurs with that of the previous studies [18]. Of the seeds analyzed, the peanut had the greatest protective effect for breast cancer. However, the fact that the peanut afforded a higher degree of protection than almond or walnut should be interpreted with caution. Peanut consumption is much more frequent than that of the almond or walnut in the population studied, producing a more precise statistical result for the peanut (narrower confidence intervals) [19]. Further studies on populations that consume greater amounts of almonds and walnuts are required in order to more precisely evaluate their protective effect, or studies on larger samples are required so that this aspect, as well as possible biases undetected in the present study, can be analyzed.

In conclusion, high peanut, walnut, and almond consumption appears to be a protective factor for the development of breast cancer. More studies on other populations are necessary, given that there can be a very wide variety of consumption levels, forms of preparation, and potential contaminants.

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