

Bra wearing not associated with breast cancer risk: a population based case-control study

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Abstract

Despite the widespread use of bras among U.S. women and concerns in the lay media that bra wearing may increase breast cancer risk, there is a scarcity of credible scientific studies addressing this issue. The goal of the study was to evaluate the relationship between various bra wearing habits and breast cancer risk among postmenopausal women. We conducted a population-based case-control study of breast cancer in the Seattle-Puget Sound metropolitan area that compared 454 invasive ductal carcinoma (IDC) cases and 590 invasive lobular carcinoma (ILC) cases diagnosed between 2000 and 2004 to 469 control women between 55 to 74 years of age. Information on bra wearing habits and other breast cancer risk factors were collected from study participants through in-person interviews. Multivariate adjusted odds ratios (OR) and their associated 95% confidence intervals (CI) were estimated using polytomous logistic regression. No aspect of bra wearing including recency, average number of hours/day worn, wearing a bra with an underwire, or age first began regularly wearing a bra, was associated with risks of either IDC or ILC. Our results did not support an association between bra wearing and increased breast cancer risk among postmenopausal women.

Introduction

There has been some suggestion in the lay media that bra wearing may be a risk factor for breast cancer based on the potential for bras to impede lymph circulation and drainage and thus interfere with the process of waste and toxin removal (1). However there is a scarcity of credible scientific studies addressing this issue. To our knowledge, the only epidemiologic evidence on bra wearing and breast cancer risk comes from a case-control study published in 1991 which reported a nonstatistically significant two-fold higher risk among premenopausal women who wore a bra versus those who did not, but no elevation in risk was observed for postmenopausal women (2). Given that questions in the lay media have been raised regarding breast cancer risk and bra wearing, we evaluated relationships between various aspects of bra wearing and breast cancer risk among postmenopausal women enrolled in a population-based case-control study.

Materials and Methods

Study population

We used data from a population-based case-control study involving postmenopausal women living in the three-county Seattle-Puget Sound metropolitan area (King, Pierce and Snohomish Counties). The study was originally designed to evaluate differences in risk factors for the two most common histologic subtypes of breast cancer, invasive ductal carcinoma (IDC) and invasive lobular carcinoma (ILC). The details of subject recruitment and data collection have been published previously (3). Briefly, cases were women between 55 and 74 years of age first diagnosed with invasive breast cancer between January 1, 2000 and March 31, 2004 while residing in the Seattle-Puget Sound area. The Cancer Surveillance System, the region's population-based cancer registry also participating in the Surveillance, Epidemiology, and End Results program of the National Cancer Institute, was used to identify cases. All ILC cases (identified using ICD-O histology codes of 8520, 8522, and 8524) and a random sample of 25% of the IDC cases (identified using ICD-O histology code of 8500) were targeted for recruitment in order to enroll equal numbers of ILC and IDC cases. A total of 1044 out of 1251 eligible cases were interviewed (83%), consisting of 454 IDC and 590 ILC cases. A common control group, frequency

matched 1:1 to the ILC cases within 5-year age groups, was selected from the general population of women living in the three-county area by random-digit dialing. We called a total of 29,735 telephone numbers of which 9,876 were verified as residential. Of these residential numbers, 87% were successfully screened for study eligibility. Four hundred and sixty-nine out of 660 telephone-screened eligible controls (71%) completed the interview.

Data collection

The study protocol was approved by the Fred Hutchinson Cancer Research Center Institutional Review Board and written consent was obtained from all study participants. In-person interviews were conducted with both cases and controls to collect information on reproductive history, body size, medical history, family history of cancer, use of hormonal replacement therapy, other potential breast cancer risk factors and demographic characteristics. Women were asked a series of structured questions to assess lifetime patterns of bra wearing including age at which they started regularly wearing a bra, whether they wore a bra with an underwire, number of hours per day and number of days per week they wore a bra at different times in their life and if these patterns ever changed. Through these questions we quantified both lifetime and recent bra wearing habits. Data on bra wearing habits were limited to those practiced before each participant's reference date. Date of breast cancer diagnosis was the reference date used for cases, and for controls a reference date was assigned to reflect the distribution of reference dates among the cases.

Statistical analysis

Various bra wearing characteristics were categorized based on their distributions in our study population, including current and lifetime average hours/day wore a bra (categorized into quartiles based on the control distribution), ever and current use of an underwire bra (yes/no), current average hours/day wore a bra with and without an underwire (categorized into quartiles based on the control distribution), and age first began regularly wearing a bra (12 years or younger, 13-14 years and 15 years or older). There was one participant who reported that she never wore a bra and she was excluded from the analysis. There were seven women who did not currently wear a bra and they were included in our lifetime bra wearing analyses but excluded from the analyses of current bra wearing habits.

We used polytomous logistic regression to estimate odds ratios (OR) and their associated 95% confidence intervals comparing IDC and ILC cases to controls (4). P-values for trend were computed across categories of bra wearing duration and age first began wearing a bra. All analyses were conducted using Stata/SE version 13.1 (StataCorp LP, TX). All models were adjusted for age at the reference date (5-year categories), reference year (continuous) and county since controls were frequency matched to cases on these three factors. Several covariates were evaluated as potential confounders including race/ethnicity, education, annual household income, body mass index (BMI) at age 30 and BMI one month prior to the reference date, bra cup size at age 18 and one year prior to the reference date, age at first full term pregnancy, use of hormone therapy, types of menopause, parity, family history of breast cancer, and mammogram screening in past two years. BMI at age 30 was used as a proxy for women's weight status at a young age due to the lack of weight and height information for women when they were adolescents. None of the above variables changed the ORs of interest by more than 10% and thus none were included in the final statistical models. In addition, none of the covariates were found to modify the relationships between various bra wearing characteristics and breast cancer risk based on likelihood ratio tests, including bra cup sizes, BMI, use of hormone therapy, and mammogram screening in past two years (all $P_{\text{interaction}} > 0.05$). A sensitivity analysis restricted to women who did not change bra wearing habit during their lifetime was performed and the results were similar to those based on the whole sample (data not shown).

Results

Compared to controls, IDC and ILC cases were somewhat more likely to have a current BMI $< 25 \text{ kg/m}^2$, to be current users of combined estrogen and progestin hormone therapy, to have a first-degree family history of breast cancer, to have had a mammogram in the past 2 years, to have experienced a natural menopause, and to be nulliparous (Table 1).

No aspect of bra wearing including recency, average number of hours/day worn, wearing a bra with an underwire, or age first began regularly wearing a bra was associated with risks of either IDC or ILC breast cancer (Table 2). For the continuous variables assessed all p-values for trend were > 0.05 .

Discussion

This population-based case-control study of postmenopausal women found no evidence that any aspect of bra wearing is associated with risk of either IDC or ILC breast cancer. In particular the risk did not vary by daily duration of wearing a bra, age when women started wearing a bra, or whether women wore a bra with an underwire. Our finding is consistent with the previous study that bra wearing was not associated with breast cancer risk among postmenopausal women (OR: 1.00, 95% CI: 0.79, 1.26) (2). However, in the earlier study participants were interviewed and simply classified as either bra users or non-users, with no further assessment on types of bra women wore and duration of bra use. Results from the current study strengthen the existing evidence by exploring various aspects of bra wearing habits and evaluating a number of potential confounders based on contemporary data.

It is important to acknowledge some of the limitations of this study. Data on bra wearing habits were all self-reported, which are subject to recall bias and/or non-differential misclassification. This said, there is no more reliable measure of this exposure other than self-report. We also observed bra wearing habits to be relatively stable over a woman's lifetime (e.g., 47.6% of women reported that their bra wearing habits never changed over their lifetime) which may make the recall task less complex and thus improve accuracy in self-reporting these data. Because bra wearing was ubiquitous among our participants, we were unable to compare risks among women who never wore a bra to those who regularly wore a bra, and instead our primary comparison was based on average number of hours per day women wore a bra.

This is the first study to characterize various bra wearing habits in relation to breast cancer risk using a rigorous epidemiological study design. The findings provided reassurance to women that wearing a bra does not increase the risk of the most common histological types of postmenopausal breast cancer.

References:

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Table 1 Distribution of selected characteristics among controls, ductal cases, and lobular cases

Characteristic	Controls		Ductal cases		Lobular cases	
	(n=469)		(n=454)		(n=590)	
	n	%	n	%	n	%
Age						
55-59	137	(29.2)	126	(27.8)	178	(30.2)
60-64	121	(25.8)	109	(24.0)	155	(26.3)
65-69	113	(24.1)	117	(25.8)	141	(23.9)
70-74	98	(20.9)	102	(22.5)	116	(19.7)
Race/ethnicity						
Non-Hispanic White	423	(90.2)	406	(89.6)	546	(92.5)
African American	8	(1.7)	10	(2.2)	9	(1.5)
Asian /Pacific Islander	9	(1.9)	16	(3.5)	11	(1.9)
Native American	10	(2.1)	11	(2.4)	11	(1.9)
Hispanic White	19	(4.1)	10	(2.2)	13	(2.2)
Missing	0		1		0	
Education						
High school or less	150	(32.0)	154	(33.9)	188	(31.9)
Some college	182	(38.8)	163	(35.9)	198	(33.6)
College graduates	87	(18.6)	88	(19.4)	124	(21.0)
Post graduates	50	(10.7)	49	(10.8)	80	(13.6)
Annual income						
<\$20,000	38	(9.6)	54	(14.1)	62	(12.5)
\$20,000-34,999	76	(19.3)	72	(18.8)	106	(21.4)
\$35,000-69,999	159	(40.4)	136	(35.5)	160	(32.3)
\$70,000-89,999	47	(11.9)	44	(11.5)	78	(15.7)
≥\$90,000	74	(18.8)	77	(20.1)	90	(18.1)
Missing	75		71		94	
BMI at 30 years of age (kg/m²)						
<25.0	378	(82.0)	369	(81.8)	504	(86.7)
25.0-29.9	66	(14.3)	68	(15.1)	58	(10.0)
≥30.0	17	(3.7)	14	(3.1)	19	(3.3)
Missing	8		3		9	
BMI one month prior to reference date (kg/m²)						
<25.0	146	(31.2)	158	(34.8)	212	(36.1)
25.0-29.9	163	(34.8)	144	(31.7)	195	(33.2)
≥30	159	(34.0)	152	(33.5)	180	(30.7)
Missing	1		0		3	
Menopausal hormone therapy use						
Never	118	(25.3)	141	(31.2)	125	(21.2)
Former	107	(23.0)	70	(15.5)	81	(13.8)
Current estrogen only	146	(31.3)	110	(24.3)	142	(24.1)
Current estrogen + progestin	95	(20.4)	131	(29.0)	241	(40.9)

Missing	3	2	1
First degree family history of breast cancer			
No	380 (84.3)	334 (77.9)	440 (76.5)
Yes	71 (15.7)	95 (22.1)	135 (23.5)
Missing	18	25	15
Had a mammogram within the past 2 years			
No	51 (10.9)	37 (8.1)	44 (7.5)
Yes	418 (89.1)	417 (91.9)	546 (92.5)
Menopausal status			
Natural	266 (58.0)	302 (67.7)	391 (68.2)
Induced ^a	68 (14.8)	49 (11.0)	71 (12.4)
Simple hysterectomy	125 (27.2)	95 (21.3)	111 (19.4)
Missing	10	8	17
Parous			
No	36 (7.7)	60 (13.2)	81 (13.7)
Yes	433 (92.3)	394 (86.8)	509 (86.3)

^a Women who had bilateral oophorectomy were classified as having an induced menopause.

Table 2. Associations between bra wearing characteristics and breast cancer risk

Bra wearing characteristic	Controls (n=469)		Ductal cases (n=454)		Lobular cases (n=590)		
	n	(%)	n	(%)	OR (95% CI)	n (%)	OR (95% CI)
Lifetime average hours/day wore a bra, quartiles							
≤10.0	112	(25.1)	117	(27.1)	Ref	152 (27.3)	Ref
10.1-11.5	113	(25.3)	99	(22.9)	0.9 (0.6, 1.3)	115 (20.6)	0.7 (0.5, 1.0)
11.6-13.9	107	(24.0)	117	(27.1)	1.1 (0.7, 1.6)	151 (27.1)	0.9 (0.7, 1.4)
≥14	114	(25.6)	99	(22.9)	0.9 (0.6, 1.3)	139 (25.0)	0.8 (0.6, 1.2)
P-value for trend					0.801	0.609	
Current average hours/day wore a bra, quartiles							
≤10.0	131	(29.5)	116	(26.9)	Ref	165 (29.6)	Ref
10.1-12.0	123	(27.5)	113	(26.2)	1.1 (0.8,1.6)	136 (24.4)	0.8 (0.6,1.2)
12.1-15.9	79	(17.7)	99	(22.9)	1.6 (1.0,2.3)	118 (21.2)	1.1 (0.7,1.6)
≥16	113	(25.3)	104	(24.1)	1.2 (0.8,1.8)	138 (24.8)	0.9 (0.6,1.3)
P-value for trend					0.207	0.855	
Ever regularly wore a bra with an underwire							
No	251	(56.4)	233	(54.1)	Ref	331 (59.6)	Ref
Yes	194	(43.6)	198	(45.9)	1.2 (0.9,1.6)	224 (40.4)	0.8 (0.6,1.1)
Currently wore a bra with an underwire							
No	283	(63.6)	273	(63.3)	Ref	365 (65.8)	Ref
Yes	162	(36.4)	158	(36.7)	1.0 (0.8,1.4)	190 (34.2)	0.9 (0.7,1.1)
Current average hours/day wore a bra without underwire, quartiles							
≤10.0	96	(33.9)	87	(31.9)	Ref	128 (35.1)	Ref
10.1-12.0	87	(30.7)	80	(29.3)	1.1 (0.7,1.7)	97 (26.6)	0.8 (0.5,1.2)
12.1-15.9	41	(14.5)	51	(18.7)	1.6 (0.9,2.7)	70 (19.2)	1.1 (0.7,1.9)
≥16	59	(20.8)	55	(20.1)	1.2 (0.7,2.1)	70 (19.2)	0.8 (0.5,1.3)
P-value for trend					0.281	0.713	
Current average hours/day wore a bra with an underwire, quartiles							
<9.5	40	(24.7)	40	(25.3)	Ref	48 (25.3)	Ref
9.5-12.0	50	(30.9)	37	(23.4)	0.8 (0.4,1.5)	48 (25.3)	0.9 (0.5,1.6)
12.1-15.0	33	(20.4)	41	(25.9)	1.3 (0.7,2.4)	40 (21.1)	1.0 (0.5,1.8)
≥15.1	39	(24.1)	40	(25.3)	1.2 (0.6,2.2)	54 (28.4)	1.2 (0.6,2.2)
P-value for trend					0.389	0.541	
Age first began wearing a bra, years							
≤ 12	162	(34.5)	145	(31.9)	Ref	185 (31.4)	Ref
13-14	217	(46.3)	213	(46.9)	1.1 (0.8, 1.4)	303 (51.4)	1.2 (0.9, 1.6)
≥ 15	90	(19.2)	96	(21.1)	1.2 (0.8, 1.7)	102 (17.3)	1.0 (0.7, 1.4)
P-value for trend					0.426	0.903	

All analysis adjusted for age at the reference date, reference year and county. The numbers in the column may not add up to the total case/control numbers due to missing in some of the bra wearing variables.