

The relationship between use of aluminum-containing anti-perspirant and hair color with breast cancer

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ABSTRACT

Introduction: Breast cancer is one of the most important and common types of cancer in most countries of the world and its incidence are increasing in Iranian women. Understanding its contributing factors is important in planning for prevention. This study was conducted to investigate the association between aluminum-containing antiperspirant and hair color use with breast cancer. **Methods:** In this observational cross-sectional descriptive study, 384 patients with breast cancer referred to selected hospitals of Tehran University of Medical Sciences in 2017 and 384 person as control group were randomly selected. The anti-perspiration use of aluminum-containing and hair color was compared. In this study, data were collected and descriptive and inferential statistics were used to analyze them. Absolute and relative frequency distribute tables, mean, and standard deviation were used to descriptive statistics. Chi-square and independent t-tests were used for data analysis. **Results:** The use of antiperspirant was similar in this study, with 23.2% of breast cancer patients and 22.4% of control group using antiperspirant ($P = 0.796$). Frequency distribution of the use of hair color was similar among the studied subjects and 35.9% of breast cancer patients and 32% of control group consumed hair color ($P = 0.253$). **Conclusion:** Based on the results, it can be concluded that there is no significant relationship between the use of aluminum-containing anti-perspiration and hair color with breast cancer.

Keywords: Anti-perspiration, breast cancer, hair color

Introduction

Cancer is one of the diseases that, unfortunately, despite significant advances in various fields of medicine, has not yet been fully cured. Breast cancer is the leading cause of cancer deaths among women, with more than 2 million breast cancers reported each year and more than 600,000 deaths from this type of cancer.^[1] In Iran, breast cancer is the most common cancer in women with the incidence of crude and standardized age of 17.4 and 21.3 per 100000, respectively.^[2] The age of breast cancer in Iranian women is 10 years lower than in Western women, due

to the higher density of breast tissue in Iranian women than other races.^[3,4] Breast cancer has not a single, specific risk factor, and in fact a combination of hormonal, genetic, and possibly environmental factors can increase the risk of developing it. Breast cancer is diagnosed at a more advanced stage due to the lack of nationwide screening of breast cancer in Iran, while in countries where breast cancer screening is performed, 80% of patients are diagnosed in the early stages of the disease.

Many studies have been carried out to investigate the possible entry of environmental estrogens present in water, food, and air into the body. Environmental estrogens have a variety of types, including physiological and pharmaceutical estrogens or estrogenic metals such as iron found in water or diet, cadmium found in cigarettes, and aluminum used in cosmetics. But given that the risk of developing breast cancer is increased by

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the regular entry of these substances into the body, especially through areas close to the breast, the estrogen-active metals used in cosmetics are one of the most effective ways to penetrate. Aluminum is very common in healthcare. In creams for easier penetration, in lacquers are found as a hardening agent as well as a bleach and antiperspirant. In addition, in 90% of deodorants, there are mineral salts that are sometimes very high. Aluminum compounds that are often used in anti-perspiration stay on the skin near the breast, and because it has a 6-fold penetration into the affected skin, they may be absorbed by the skin and cause hormonal effects such as estrogen. In fact, since estrogen is capable of boosting the growth of breast cancer cells, aluminum compounds in anti-perspiration may aid in the development of breast cancer.^[5] These compounds form a temporary barrier in the sweat duct that stops the flow of sweating to the surface of the skin. Some breast cancers occur in areas near the armpit that contain high concentrations of anti-perspiration spray substances. 99% of these chemicals have been found in breast tissue and breast samples, especially in women with breast cancer.

Given the scarcity of information and research on the use of aluminum-containing anti-perspiration and hair color and their impact on breast cancer, as well as the lack of precise identification of potential breast cancer risk factors in Iran and the lack of a similar study in the country, in a study, we investigated the relationship between the use of aluminum-containing anti-perspiration and hair color and the incidence of breast cancer.

Methods

A descriptive-correlational study was conducted to investigate the relationship between the use of aluminum-containing anti-perspiration and hair color with breast cancer. The subjects in this study were patients with breast cancer referred to hospitals affiliated to Tehran University of Medical Sciences (Imam Khomeini and Sina Hospitals) who were randomly selected and met the criteria for the study units. Inclusion criteria for this study include: women who have been treated with chemotherapy for the first time for breast cancer, should have aluminum in their breast tissue pathology, with minimal literacy, no history of cancer in the patient's family, women at least 15 and up to 70 years of age, people willing to participate in this study. In this study, 384 specimens that aluminum was found in their breast tissue cytology and 100 of them were used of anti-perspiration products and 200 non-antiseria that use the anti-perspiration products were selected. Interviews, questionnaires and patient records were used for data collection. In this study, a questionnaire was designed to assess demographic characteristics and a questionnaire related to the status of known aluminum exposure in breast cancer. Interviewing is a method of gathering information that is conducted directly and face-to-face or by telephone. In this study, data was collected through a questionnaire that was completed during the interviews with the samples. The questionnaire consisted of two parts, the first part consisting of gathering information about demographic characteristics of the studied

units (age, sex, race, occupational status, education, etc.) and the second part consisting of collecting information on the use of anti-perspiration containing aluminum that the answer of the pathology of breast issue has been shown the presence of aluminum. Questions were asked and completed by the researcher by telephone or in the presence of the patient face to face and in the presence of mother, father, or guardian of the sample and who considered patient information from childhood.

Interview started with this explanation that researcher is a medical student and performs a dissertation on breast cancer risk factors in patients referring to Tehran University (Imam Khomeini and Sina) affiliated hospitals and the analysis will be done generally and their presence in the study is optional. Each question was followed by a full set of examples, and if needed, each question explained. Questions about anti-perspiration began by explaining whether these factors may be contributing to the disease. At the beginning of the interview, questions about anti-perspiration and how to use them were first asked. And at the end of the interview, demographic questions were asked so that the probability of patient fatigue at the end of the interview did not affect their response. The total time allotted for the interview was about 45–60 minutes depending on the patient's condition. During the patient interview, all interview conditions and guidelines were considered. At the end of the interview, the samples would be appreciated and reassured of the confidentiality of the information, due to the overwhelming tendency of the interviewee to disclose general information. In this study, data were collected and descriptive and inferential statistics were used to analyze them. Absolute and relative frequency distribute tables, mean, and standard deviation were used to descriptive statistics. Chi-square and independent t-tests were used for data analysis.

Findings

The results of this study are summarized in Table 1. As can be seen in this table, sex frequently distribution, age, marital status, paternal race, maternal race, education, occupation, disease duration, interval of Surgery, antiperspirant use, hair color, age of use antiperspirant, antiperspirant use Frequency, antiperspirant type of use, marked antiperspirant use, antiperspirant daily frequency, antiperspirant reaction, antiperspirant usage time, armpit shaving route, deodorant after armpit washing, deodorant after armpit washing interval and deodorant reuse after washing were similar in the subjects studied.

Discussion

Due to the lack of accurate knowledge of the potential risk factors of breast cancer in Iran and the lack of a similar study, the present study, was designed and conducted on the use of aluminum-containing anti-perspiration and hair color and its effect on the development of breast cancer. For the purpose of this research, 384 women with breast cancer referred to selected hospitals of Tehran University of Medical Sciences and a group of 384 healthy individuals (statistically matched

Table 1: Frequency distribution of the parameters studied in the subjects

Item	Parameter	Case Cunt-%	Control Cunt-%	Total Cunt-%	P		
Sex	Male	2-0.5	1-0.3	3-0.4	1		
	Female	382-99.5	383-99.7	765-99.6			
	Total	384-100	384-100	768-100			
Age	<40	105-27.3	99-25.8	204-26.6	0.624		
	40<	279-72.7	285-74.2	564-73.4			
	Total	384-100	384-100	768-100			
Marital	Single	66-17.2	68-17.7	134-17.4	0.849		
	Married	318-82.8	316-82.3	634-82.6			
	Total	384-100	384-100	768-100			
Paternal Race	Fars	285-74.2	283-73.7	568-74	0.869		
	Non-Fars	99-25.8	101-26.3	200-26			
	Total	384-100	384-100	768-100			
Maternal Race	Fars	280-72.9	283-73.7	563-73.3	0.807		
	Non-Fars	104-27.1	101-26.3	205-26.7			
	Total	384-100	384-100	768-100			
Literacy	<Diploma	86-22.4	80-20.8	166-21.6	0.867		
	Diploma	243-63.3	247-64.3	490-63.8			
	Diploma<	55-14.3	57-14.8	112-14.6			
	Total	384-100	384-100	768-100			
Job	Housewife	257-66.9	261-68	518-67.4	0.758		
	Out of Home	127-33.1	123-32	250-32.6			
	Total	384-100	384-100	768-100			
Disease Duration (Yrs)	<1	125-32.6	-	125-32.6	-		
	1-3	205-53.4	-	205-53.4			
	3<	54-14.1	-	54-14.1			
	Total	384-100	-	384-100			
Surgery Interval (Mo)	<6	123-32	-	123-32	-		
	6-12	214-55.7	-	214-55.7			
	12<	47-12.2	-	47-12.2			
	Total	384-100	-	384-100			
Anti-Perspirant Use	Pos.	89-23.2	86-22.4	175-22.8	0.796		
	Neg.	295-76.8	298-77.6	593-77.2			
	Total	384-100	384-100	768-100			
Hair Color Use	Pos.	138-35.9	123-32	261-34	0.253		
	Neg.	246-64.1	261-68	507-66			
	Total	384-100	384-100	768-100			
Anti-Perspirant Use Age	<15	8-9	4-4.7	12-6.9	0.870		
	15-18	24-27	21-24.4	45-25.7			
	19-21	22-24.7	22-25.6	44-25.1			
	22-25	16-18	21-24.4	37-21.1			
	26-30	11-12.4	12-14	23-13.1			
	31-35	4-4.5	3-3.5	7-4			
	35<	4-4.5	3-3.5	7-4			
	Total	89-100	86-100	175-100			
	Anti-Perspirant Use Frequency	Daily	46-51.7	45-52.3		91-52	0.624
		Twice-Weekly	32-36	35-40.7		67-38.3	
1-3 Per Month		8-9	6-7	14-8			
Occasionally		1-1.1	0-0	1-6			
Rarely		1-1.1	0-0	1-6			
Others		1-1.1	0-0	1-6			
Total		89-100	86-100	175-100			
Anti-Perspirant Use Type	Spray	11-12.4	7-8.1	18-10.3	0.742		
	Gel	19-21.3	22-25.6	41-23.4			
	Mam	44-49.4	46-53.5	90-51.4			
	After-Shave	11-12.4	9-10.5	20-11.4			
	Others	4-4.5	2-2.3	6-3.4			
	Total	89-100	86-100	175-100			

Contd...

Table 1: Contd....

Item	Parameter	Case Cunt-%	Control Cunt-%	Total Cunt-%	P
Brand Anti-Perspirant Use	Total	89-100	86-100	175-100	0.835
	Pos.	65-73	64-74.4	129-73.7	
	Neg.	24-27	22-25.6	46-26.3	
Anti-Perspirant Use Times Daily	Total	89-100	86-100	175-100	0.443
	1	48-53.9	37-43	85-48.6	
	2	37-41.6	46-53.5	83-47.4	
	3	2-2.2	2-2.3	4-2.3	
	4 and More	2-2.2	1-1.2	3-1.7	
Skin Reaction to Anti-Perspirant Use	Total	89-100	86-100	175-100	0.250
	Erythema	3-3.4	1-1.2	4-2.3	
	Itchin	2-2.2	1-1.2	3-1.7	
	Burning	4-4.5	0-0	4-2.3	
	No Thing	79-88.8	83-96.5	162-92.6	
	Others	1-1.1	1-1.2	2-1.1	
Anti-Perspirant Use Activity	Total	89-100	86-100	175-100	0.711
	After Shower	9-10.1	7-8.1	16-9.1	
	After Exercise	13-14.6	7-8.1	20-11.4	
	Before Sleep	10-11.2	8-9.3	18-10.3	
	Before Acting out	7-7.9	6-7.0	13-7.4	
	Mornings	47-52.8	55-64	102-58.3	
	Others	3-3.4	3-3.5	6-3.4	
Armpit Shaving Route	Total	89-100	86-100	175-100	0.778
	Blade	36-40.4	34-39.5	70-40	
	Hair Removal Cream	29-32.6	32-37.2	61-34.9	
	Cutter	4-4.5	2-2.3	6-3.4	
	Wax	10-11.2	9-10.5	19-10.9	
	Epilator	5-5.6	7-8.1	12-6.9	
	Others	5-5.6	2-2.3	7-4	
	Total	89-100	86-100	175-100	
Deodoran After Armpit Washing	Pos.	5-5.6	7-8.1	12-6.9	0.509
	Neg.	84-94.4	79-91.9	163-93.1	
	Total	89-100	86-100	175-100	
Deodorant After Armpit Washing Interval	Immediately	3-60	3-50	6-54.5	0.885
	1-2 H	1-20	2-33.3	3-27.3	
	After Sweat Smell	1-20	1-16.7	2-18.2	
	Total	5-100	6-100	11-100	
Repeat Deodorant Use After Washing	Pos.	2-40	4-66.7	6-54.5	0.567
	Neg.	3-60	2-33.3	5-45.5	
	Total	5-100	6-100	11-100	

with the cancer group) were included and analyzed in the present study. The prevalence of antiperspirant use was similar in the study population, with 23.2% of the patients suffering from breast cancer and 22.4% of the control group used antiperspirant (P = 0.796). Frequency distribution of hair color use was similar in the studied subjects, with 35.9% of breast cancer patients and 32% of the control group using hair color (P = 0.253). In other studies, the prevalence of use of antiperspirants and hair color in people with breast cancer is higher than the prevalence in this study. A study by McGrath (2003) found that 40% of women with breast cancer used antiperspirant and hair color.^[6] In the study by Fakri *et al.*, (2006), it was found that 51% of patients with breast cancer used antiperspirant and hair color, while in the healthy group 54% used antiperspirant and hair color.^[7]

A study by Davis and Thomas (2002) reported that 50% of women with breast cancer used antiperspirant and hair color, while 56% of the control group (healthy people) used antiperspirant and hair color.^[8] In line with the present study, it was found that the incidence of breast cancer did not increase following the use of antiperspirant and hair color (Above study). Therefore, there is no relationship between the use of antiperspirant and the prevalence of breast cancer. In a study using axillary deodorant and its effect on acute skin toxicity during radiation therapy for breast cancer, on 84 patients reported that there was no evidence to prohibit the use of deodorant (despite the use of an aluminum-containing antiperspirant).^[9] Similar to the results of the present study, Davis *et al.* (2002) also reported that the use of antiperspirants and hair color did not increase the risk of breast cancer.^[8] Even in the Fakri *et al.*, study (2006) showed a

negative relationship between the use of antiperspirant and hair color with breast cancer.^[7]

In a wide-ranging review, it was reported that there was no relationship between antiperspirant and hair color use with breast cancer.^[10] Darbre *et al.* (2013) investigated the effect of aluminum on the invasive properties of breast cancer cells.^[11] They measured the aluminum in the breast tissue. This study showed that aluminum can damage DNA and inhibit the growth of human breast membrane cells. Mannello (2011) in a study showed that the cause of high levels of aluminum in the NAF remains unknown, but may be due to exposure to antiperspirants in the armpit area or the gradual absorption of aluminum by the breast tissue can lead to cancer progression.^[12] Although we know that antiperspirants contain aluminum, some studies have shown that aluminum is present in breast cancer tissues and that aluminum can lead to the development and spread of cancer cells, and others have suggested that the skin is more permeable to aluminum. However, there is no evidence that show aluminum in the breast tissue has penetrated through the use of antiperspirants and hair color.^[13] Statistical analysis showed no significant difference in skin reactions between the two groups at the two measurement times. They concluded that the use of antiperspirants could not cause skin reactions in women with radiation-treated cancer.^[14] The US Food and Drug Administration (FDA) found no evidence with research data indicating a link between antiperspirants use and breast cancer.^[15] British Cancer Research (2014) has also rejected claims of a link between the use of antiperspirants and hair color with breast cancer.^[16] They have reported that aluminum is present in breast tissue of women with breast cancer, but the study's design was not designed to show that the use of antiperspirants and hair color caused breast cancer.

Conclusion

Overall, based on the results of this study and comparing them with other studies, it is concluded that there is no significant relationship between the use of aluminum-containing antiperspirants and hair color with breast cancer. The findings of this study can be made available to community health clinical nurses in order to increase their awareness and be effective in providing care and guidance to patients and families.

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Conflicts of interest

There are no conflicts of interest.

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