

# Relationship between the use of antiperspirants containing aluminum with breast cancer in patients referred to selected hospitals of Tehran University of Medical Sciences in 2013

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## ABSTRACT

**Background:** Breast cancer is the second most common type of cancer after lung cancer among women. The individual cause of the disease is not known, but various hormonal, environmental and genetic factors can increase the risk of developing the disease.

**Aim:** To investigate the relationship between the use of antiperspirants containing aluminum and breast cancer in patients referred to the selected hospitals of Tehran University of Medical Sciences in 2013.

**Methods:** This study was a descriptive correlational study and in order to achieve the goal of the study, 274 women with cancer referred to selected hospitals of Tehran University of Medical Sciences were selected along with a group of 200 healthy individuals (as control group). Data collection tools, a questionnaire prepared by the researcher had two parts: the first part of the questionnaire, demographic information and the second part related to antiperspirants and how to use them, and all participants completed the two sections. SPSS 23 software was used for statistical analysis.

**Results:** There was no relationship between the age of people using antiperspirants and the prevalence of breast cancer ( $P = 0.467$ ). Also there was no relationship between the use of antiperspirants ( $P = 0.433$ ), the type of antiperspirant used ( $P = 0.966$ ), the use of specific antiperspirants ( $P = 0.361$ ), the duration of use of specific antiperspirants ( $P = 0.427$ ), the place of use of antiperspirants ( $P = 0.768$ ), the use of antiperspirants after underarm hair removal ( $P = 0.287$ ) and the prevalence of breast cancer.

**Conclusion:** There is no significant statistical difference between the use of antiperspirants containing aluminum in women in the control and the experimental group ( $P = 0/823$ ). Therefore, there is no relationship between the use of antiperspirants containing aluminum and breast cancer.

**Keywords:** Antiperspirants, Aluminum, Breast cancer.

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## INTRODUCTION

Despite human advances in medicine, but still there is no definitive cure for cancer, and even if patients survive, who will suffer severe psychological and physical damage. Among women, the second most common cancer after lung cancer is breast cancer, and due to the uncertainty of its cause, it has long been considered by surgeons and is one of the most dreaded human diseases<sup>1</sup>. Most cases (80%) are sporadic and there is no definitive evidence of cancer incidence in smokers, people who had silicone breast implants, or use of antiperspirants and metal covers, or miscarriages (spontaneous). Breast cancer is a health problem in the United States, which 212,000 people are affected and 41,000 people die a year. Between 1920 and 2002, early diagnosis and effective treatment leading to survival, so that mortality rates fell by 2.4%<sup>2</sup>.

The incidence of this disease is higher in white women, but the mortality rate is higher in black women. The mortality rate increases with age. The mortality rate among women 65 and older is reported to be 54%. Other risk factors, such as low menses age, menopause after the age of 55 and higher social and economic status, increases the incidence risk. The disease rarely occurs in men and misconceptions that men are not affected lead to delayed diagnosis<sup>3</sup>. Breast cancer mortality rates are highest in

North America and Northern Europe, averaging in Southern Europe and Latin America, and low in Asia and Africa<sup>4</sup>. The lowest incidence of mortality among Japanese women is due to low animal fat intake, and African blacks are less likely to get the disease than blacks in the United States, and the overall incidence of the disease is very low in Asian countries<sup>3</sup>.

In Iran, according to the Cancer Research Center of Shahid Beheshti University of Medical Sciences, the highest incidence of breast cancer in the Middle East is in Iran, and every year 10,000 new cases are identified and 1,400 deaths are reported. The incidence of breast cancer among Iranian men is 2.8%, which is 1.8% higher than the global statistics. Iranian women get this disease 5 to 10 years earlier (between the ages of 40 and 45). The disease is more dangerous in the postmenopausal age, because this disease progresses is faster under the influence of estrogen<sup>5</sup>. In developed countries, 80% of cases are detected and treated in the early stages, but in Iran, 65% of cases are diagnosed in the advanced stage due to lack of screening. Most cases of breast cancer in Iran are in Mazandaran and Golestan provinces<sup>6</sup>.

Breast cancer is the abnormal and malignant proliferation of tissue cells of the mammary glands and mammary ducts, which is generally divided into two main groups: local (non-invasive) carcinoma and invasive

cancer<sup>2</sup>. The disease is most common in the external upper quadrant of the breast, and the symptoms are as follows: a lump or thickening in the breast or armpit, bloody or clear discharge from the nipple, redness or swelling of the breast, sagging of the skin, and its deformation in the form of orange peel, the deformation and appearance of the breast so that it is different from the other breast, and finally the wound in the skin of the breast that does not heal<sup>7</sup>. Various factors have been implicated in the development of breast cancer. Hormonal, genetic, and environmental factors increase the risk of breast cancer. In more than 80% of cases, the disease is sporadic and there is no family history. In cases where there is a family history, the disease has not been inherited. Risk factors for cancer include gender (99%), aging, a positive family history (first-degree relatives), and a fivefold increase in risk if two family members are infected. Gene mutations: BRCA-1 and BRCA-2 have been reported in most cases of breast cancer. The first menstrual period before the age of 12, menopause after the age of 55, the first pregnancy after the age of 30, postmenopausal hormone therapy, long-term use of the hormone are hormonal factors. The physical factors such as ionizing radiation in early puberty and women, who had radiation therapy for breast lymphoma, as well as a history of atypical ductal or lobular hyperplasia or lobular carcinoma, increase the risk of benign cancer. Drinking alcohol 3 to 5 times a day increases the risk of cancer by 1.5 times. Obesity, weight gain in adulthood increases the risk of postmenopausal cancer due to increased estrogen in adipose tissue. The use of antiperspirants is discussed<sup>2</sup>.

Various treatments for breast cancer have been introduced, based on the patient's age, stage of disease progression, and the patient's desire, and in some cases a combination of treatments are used. Surgical procedures include: radical mastectomy, modified radical mastectomy, complete mastectomy, and non-surgical methods include: radiotherapy and systemic adjuvant therapy with tamoxifen or chemotherapy<sup>7</sup>.

Due to the high risk of estrogen in breast cancer incidence, many studies have been conducted on the possibility of environmental estrogens entering of water, food and air into the human body. Types of environmental estrogens are including: physiological and pharmaceutical estrogens and metals with estrogenic activity, such as: iron found in water or food, cadmium found in cigarettes, and aluminum used in cosmetics. The risk of breast cancer increases dramatically with regular intake of these substances from areas close to the breast, and one of the ways to penetrate these substances into breast is through cosmetics. Numerous studies have been conducted to investigate the effect of carcinogenic chemicals on the prevalence of breast cancer, but unfortunately relatively little research has been done on the effect of metal contact on breast cancer.

Aluminum is used in half of cosmetics due to its various effects. It is used in creams as a penetrating agent and in varnish as a hardening agent and in antiperspirants as a bleach and antiperspirant agent. The concentration of aluminum in some antiperspirants is up to 20%<sup>9</sup>. Aluminum compounds temporarily block the sweat ducts, therefore reduces the sweat flow to the skin. The sprays contain a

high concentration of these compounds that remain on the skin near the breast, and since the passage of substances in the damaged skin is 6 times, it is quickly absorbed by the skin and has similar effects to estrogen. Since estrogen has the ability to increase the growth of breast cancer cells, aluminum compounds may also help to the progression of breast cancer. Some breast cancers are formed in the underarms, and 99% of the chemicals are found in breast tissue samples in women with cancer. Even high absorption occurs in milk-producing tissue, milk transfer ducts, and non-glandular tissue<sup>10</sup>.

Due to the lack of a study on the use of antiperspirants containing aluminum and its effect on breast cancer, as well as the lack of accurate knowledge of the potential causes of breast cancer and the lack of similar studies in Iran, the researcher was forced to investigate the relationship between use of antiperspirants containing aluminum and breast cancer.

Environmental and lifestyle conditions of a woman clearly play an important role in the development of breast cancer. Environmental factors and lifestyle, including diet (containing fat, alcohol, processed meat and low fiber), lack of exercise, poor health habits, hormones, smoking and other factors have increased cancer among women<sup>11</sup>. The use of deodorants and antiperspirants has been common since 1903, and aluminum salts have been used as the main ingredient in antiperspirants<sup>12</sup>. 90% of the US population uses antiperspirants and deodorants, and in women this use is often associated with underarm hair remove (13). Some of side effects of these products are including skin damage in the form of inflammation and burning, contact dermatitis and granuloma<sup>14</sup>. The semi-experimental study was conducted in 2013 by Iskakova et al., Entitled "The effect of aluminum on displacement and invasive features (MCF-7) in human breast cancer cells in the United Kingdom". In this study, aluminum was injected into culture medium (MCF-7) cells, and the results showed that aluminum could damage DNA and stop the growth of membrane cells, and also increase the invasiveness of breast cancer cells<sup>15</sup>. Another study on the effect of aluminum metal on breast tissue was conducted in 2012 in Manchester, England. Twenty-two people with breast cancer and breast surgery were included in the study, and the amount of aluminum using the graphite atomic spectroscopy was measured in breast tissue, and a significant amount of aluminum was identified in breast tissue<sup>16</sup>. A semi-experimental study was performed in 2003 at Mostafa Khomeini Hospital in Tehran to determine the role of age in the prognosis of breast cancer. In this study, the biological characteristics (tumor size, number of lymph nodes involved in the tumor and the degree of tumor progression) in 103 patients referred to Mostafa Khomeini Hospital in Tehran were examined. According to the results of this study, the prognosis of the disease and its biological characteristics are worse in young patients rather than in the middle-aged and elderly<sup>17</sup>. Another study was conducted by Dr. Holakouee et al in 2004 with the aim of investigating the risk factors for breast cancer in Babol city of Mazandaran province. The subjects studied in two control groups (500) and experimental (250 people with cancer with biopsy) on risk factors including academic level, menopause, history of miscarriage, high BMI and

duration of breastfeeding. The results showed that the factors that could be changed should be considered in the breast cancer prevention program, and in this regard, people were informed about the role of high BMI in the incidence of breast cancer<sup>18</sup>. A study by McGrath (2008) in Chicago, USA, entitled "Diagnosis of breast cancer at an early age and its association with deodorants and antiperspirants" aimed at the effect of deodorants and antiperspirants and cosmetics on cancer. The study included 437 women who survived breast cancer and were evaluated for their use of deodorants and antiperspirants and underarm haircut. The results showed that the use of deodorants, antiperspirants and cosmetics had no effect on breast cancer (18). Another study by Darbre in 2009 on the effects of deodorants and antiperspirants on breast cancer in the UK and Wales focused on how deodorants and antiperspirants work in breast cancer. Women with breast cancer were examined in this study, and the results showed that cosmetics are a factor in the development of breast cancer and therefore an important decision must be made to prevent this factor<sup>19</sup>.

**MATERIALS AND METHODS**

The present study is descriptive-correlational and aims to investigate the relationship between the use of antiperspirants containing aluminum and breast cancer in people with breast cancer. The research environment in this study was Imam Khomeini and Sinai hospitals. Research community was women with cancer. Random sampling method was selected from patients in hospitals affiliated to Tehran University of Medical Sciences within 3 months. The study included 274 women who had been diagnosed with breast cancer by a physician and had been nominated for chemotherapy for the first time, and a breast pathologist confirmed the presence of aluminum. These people had no family history of breast cancer and were between the ages of 15 to 70, literate, and wanted to participate in the study, and 100 cases of them used antiperspirants. The control group included 200 women

who had not cancer, used antiperspirant products, and were identified with the experimental group in terms of all of the above characteristics. The total number of samples was 474. The data collection tool was a questionnaire that had two sections of demographic characteristics (age, sex, job status, race and level of education) and information on the use of antiperspirants containing aluminum. The questionnaire was prepared by the researcher and during the interview with the participants and after ensuring their satisfaction to participate in this research, they were asked. People were assured that their information would be kept confidential. The questionnaire was prepared by the researcher and to determine its validity, it was given to 10 faculty members of the faculty of Nursing and Midwifery of Tehran Islamic Azad University of Medical Sciences and was used after the necessary corrections and final review. To ensure the reliability, the questionnaire was given to 10 people with breast cancer and its reliability coefficient was determined by 0.82 alpha-carbon test. After collecting the data, SPSS 23 software was used for statistical analysis. In the data analysis, the chi-square and independent t-test method and in descriptive statistics, the absolute and relative frequency distribution table, mean and standard deviation were used.

**RESULTS**

Regarding the first part of the questionnaire, demographic characteristics (age, sex, job status, race and level of education) the similarity of control and experimental groups were examined using chi-square test and no significant statistical difference was observed between the two groups. 80% of people were married, 27% have a degree diploma, 23% elementary, 87% housewife, minimum age 24 and maximum 82 years and 18% were between 26 and 30 years old. The second part of the questionnaire was about the use of antiperspirants containing aluminum, and their types included: spray, gel and deodorant.

Table 1- Absolute and relative frequency distribution of use of antiperspirants containing aluminum in two experimental and control groups

Use of antiperspirants containing aluminum	Experimental group (breast cancer)		Control group (healthy people)		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	100	36.5	75	37.5	175	36.9
No	174	63.5	125	62.5	299	63.1
Total	274	100	200	100	474	100

Table 2 - The relationship between the use of antiperspirants containing aluminum in two experimental and control groups

Use of antiperspirants containing aluminum	Experimental group (breast cancer)		Control group (healthy people)		Chi-squared test	
	Number	Percentage	Number	Percentage	Statistics	Probability
Yes	100	36.5	75	37.5	0.05	0.82
No	174	63.5	125	62.5		
Total	274	100	200	100		

Table 3 - The relationship between the type of antiperspirant used with breast cancer in people with breast cancer and the healthy group

Type of antiperspirant used	Experimental group		Control group		Chi-squared test	
	Abundance	Frequency	Abundance	Frequency	Statistics	Probability
Spray	10	10	6	9.2	0.65	0.97
Gel	5	5	5	7.7		
Deodorant	57	57	37	56.9		
Spray+ Deodorant	21	21	12	18.5		
Gel+ Deodorant	7	7	5	7.7		
Total	100	100	65	100		

Table 4 - The relationship between the use of antiperspirant containing aluminum after underarm hair remove with breast cancer in people with breast cancer and the healthy group

Use of antiperspirant containing aluminum after underarm hair remove	Experimental group		Control group		Chi-squared test	
	Abundance	Frequency	Abundance	Frequency	Statistics	Probability
Yes	71	71	41	63.1	1.13	0.29
No	29	29	24	36.9		
Total	100	100	65	100		

According to the table above, there is no statistically significant difference between the use of antiperspirants containing aluminum in the two groups of breast cancer and healthy ( $P= 0.82$ ). Therefore, there is no relationship between the use of antiperspirants containing aluminum and the prevalence of cancer.

According to the table above, there is no statistically significant difference between the type of antiperspirant used with breast cancer in people with breast cancer and the healthy group ( $P= 0.97$ ). Therefore, the type of antiperspirant used and the prevalence of breast cancer are not related.

According to the table above, there is no statistically significant difference between the use of antiperspirant containing aluminum after hair removal under the armpit in the two groups of breast cancer and healthy individuals ( $P= 0.29$ ). Therefore, there is no relationship between the use of antiperspirant containing aluminum after hair removal under the armpit and the prevalence of breast cancer.

## DISCUSSION

Despite the knowledge on the presence of aluminum-containing materials in antiperspirants, and the evidence about of presence of aluminum in breast cancer tissue, there is no still a good evidence that aluminum in breast tissue has penetrated this area through the use of deodorant<sup>14,20</sup>. Researchers at the US National Cancer Institute, despite numerous studies, did not provide conclusive evidence of antiperspirant use and cancer incidence. The US Food and Drug Administration, which is responsible for confirming the safety of food, cosmetics and medicines, has not yet found evidence of antiperspirant effects in breast cancer. In 2002, the American Cancer Society conducted an experimental study in the United States to investigate the relationship between the use of antiperspirants and breast cancer among 813 women with breast cancer and 793 healthy women. It was found that there was no association between the use of antiperspirants and the incidence of breast cancer<sup>21</sup>. The British Cancer Research Center also conducted a study in the UK to investigate the relationship between the use of antiperspirants and breast cancer. According to this study, aluminum is present in the breast tissue of women with cancer, but it cannot be boldly acknowledged that this substance has caused breast cancer<sup>22</sup>.

In this study, the final conclusion is set based on the information obtained from the findings and in relation to the research hypothesis. According to Table 2, there is no a statistically significant difference between the use of antiperspirants containing aluminum in the two groups of breast cancer and the healthy group ( $P= 0.82$ ), so there is no a relationship between the use of antiperspirants containing aluminum and the prevalence of cancer.

According to Table 3, there is no statistically significant difference between the type of antiperspirant used with breast cancer in people with breast cancer and the healthy group ( $P= 0.97$ ). As a result, there is no relationship between the type of antiperspirant used and the prevalence of breast cancer. According to Table 4, there is no statistically significant difference between the use of aluminum-containing antiperspirants after hair removal under the armpit in two groups of breast cancer and healthy individuals ( $P= 0.29$ ).

## CONCLUSION

The results of this study indicated that, there is no a relationship between the use of aluminum-containing antiperspirants and the prevalence of breast cancer. Based on the present study, it is recommended:

1. Examination of the relationship between the start of use of antiperspirants and breast cancer in future studies
2. In future studies, examine the relationship between the use of antiperspirants and breast cancer (qualitatively)
3. This research should be done in a larger and wider society
4. Given that the awareness of cancer and the quality of life of people with this disease are low, a similar study should be done on other cosmetics such as hair color and its effect on breast cancer.

**Acknowledgments:** The authors express their gratitude to all the colleagues in the faculty of Nursing and Midwifery who helped us in this research.

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