

# BREAST CANCER AND DEODORANTS/ ANTIPERSPIRANTS: A SYSTEMATIC REVIEW

Mohamed Farouk Allam<sup>1, 2</sup>

<sup>1</sup>Department of Preventive Medicine and Public Health, Faculty of Medicine, University of Cordoba, Cordoba, Spain

<sup>2</sup>Department of Community, Environmental and Occupational Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt

## SUMMARY

**Background:** Over the last decade, the possible association between underarm deodorants/antiperspirants use and breast cancer risk has raised important interest in the scientific community. The objective of our systematic review is to estimate the pooled risk of deodorants/antiperspirants use for breast cancer.

**Methods:** All observational studies that evaluated the association between breast cancer risk and deodorants/antiperspirants use were reviewed. We have only identified two case-control studies, carried out between 2002 and 2006.

**Results:** The first study was conducted in the USA and investigated the possible relationship between the use of products applied for underarm perspiration and the risk for breast cancer in women aged 20–74 years. This population-based case-control study gathered information by in-person interview. The second study was conducted in Iraq and investigated the possible relationship between the use of antiperspirants and the risk for breast cancer in women attending a teaching hospital. This study also gathered information by in-person interview. There was no risk of antiperspirants use in the pooled risk (odds ratio 0.40, 95% confidence interval 0.35–0.46).

**Conclusion:** Our comprehensive search has identified an insufficient number of studies to conduct a quantitative review and obtain reliable results. Further prospective studies are strongly needed.

**Key words:** cancer, antiperspirants, deodorants, breast, case-control, cohort, systematic review, meta-analysis

**Address for correspondence:** M. F. Allam, Department of Preventive Medicine and Public Health, Faculty of Medicine, University of Cordoba, Avda. Menéndez Pidal, s/n Cordoba 14004, Spain. E-mail: fm2faahm@uco.es

<http://dx.doi.org/10.21101/cejph.a4475>

## INTRODUCTION

Over the last decade, the possible association between underarm deodorants/antiperspirants use and breast cancer risk has raised important interest in the scientific community. Many narrative reviews and original studies were published about that possible association without definite conclusions (1–7). Darbre found traces of parabens, preservatives used in cosmetics, food and pharmaceutical products, in breast tumors. Although there is no proof that parabens cause cancer and most deodorants no longer contains these compounds, the authors reported that the detection of parabens in human breast tumors is of concern since they have been shown to mimic the action of the female hormone estrogen, which can drive the growth of human breast tumors (6). The study of McGrath surveyed the underarm-hygiene habits of 437 women with breast cancer. Women who shaved their underarms more than twice a week and applied deodorant more than once a week were almost 15 years younger when they were diagnosed with breast cancer than those who used neither regimen. The study found no link with breast cancer diagnosis in younger age when either shaving or deodorant was used alone (7). Another study investigated why carcinoma of the breast is more frequent in the upper outer quadrant. The examined hypothesis of this study was that underarm cosmetics cause breast cancer. The result of the study rejected this hypothesis and showed clearly that the high proportion of upper outer quadrant carcinomas of

the breasts is rather a reflection of the greater amount of breast tissue in this quadrant (5).

We present a quantitative review based on published studies that investigated the association between breast cancer and deodorants/antiperspirants use. The aim of the review was to estimate the combined weight of deodorants/antiperspirants use in breast cancer.

## MATERIAL AND METHODS

### Literature Review

Published observational studies on breast cancer risk and deodorants use were identified through a comprehensive MEDLINE/PubMed search (from 1966 to August 2016) and PsycLIT (from 1887 to August 2016) using a variety of Medical Subjects Headings and free text words (Deodorants or Parabens or Antiperspirants) and (Breast) and (Case-Control or Case-Referent or Retrospective or Cohort or Follow-up or Incident or Prospective or Epidemiology). We conducted additional searches of Current Contents, Best Evidence, previous reviews, examination of cited reference sources, and personal contact and discussion with several experts in the field. Published case reports or studies evaluating deodorants use but not stratified as exposed and no exposed women were excluded. When two or more papers were

based on an identical study, the paper that principally investigated the relationship between breast cancer and deodorants use was employed. We considered studies in English, French and Spanish and no attempts were made to locate any unpublished studies.

### Data Extraction

We identified two case-control studies on the basis of our inclusion criteria. A copy of each paper identified was obtained and relevant data were abstracted by the first author (M.F.A.) for a quantitative overview. The odds ratio and the country where the study was carried out were also ascertained. In case of discrepancies or when the information presented in a study was unclear, abstraction by a second reviewer (R.F-C.S.) was sought to resolve the discrepancy.

### Statistical Methods for Meta-Analysis

Data were abstracted from every study in the form of a risk estimate and its 95% confidence interval. Pooled risk estimate was obtained by weighing each study by the inverse variance of the effect measure on a logarithmic scale. This approach to pool the results assumes that the study populations being compared are similar and hence correspond to a fixed effect analysis (8).

All statistical analyses for pooling the studies were performed on the STATA Statistical Software, release 7.0 (StataCorp. 2001).

### RESULTS

The two case-control studies, which have been identified, were carried out between 2002 and 2006.

The first study was conducted in the USA and investigated the possible relationship between the use of products applied for underarm perspiration and the risk for breast cancer in women aged 20–74 years. This population-based case-control study gathered information by in-person interview. The authors asked whether the respondent regularly shaved under her arms suggesting that deodorants and/or antiperspirants might contain harmful substances that could be absorbed via small nicks or abrasions caused by hair removal. The odds ratios for those women who used antiperspirants exclusively, ever regularly and regularly within 1 hour of shaving were 0.8 (95% CI: 0.6–1.0), 0.9 (95% CI: 0.7–1.1) and 0.9 (95% CI: 0.7–1.1), respectively. Meanwhile, the odds ratios for those women who used deodorants exclusively, ever regularly and regularly within 1 hour of shaving were 1.1 (95% CI: 0.9–1.4), 1.2 (95% CI: 0.9–1.5) and 1.2 (95% CI: 0.9–1.5), respectively (9).

The second study was conducted in Iraq and investigated the possible relationship between the use of antiperspirants and the

risk for breast cancer in women attending Al-Kadhmia Teaching Hospital. The cases were women attending the oncology clinic that were diagnosed histopathologically by excisional biopsy, meanwhile controls were attending the general medicine clinic for various other complaints, not including breast problems. This hospital-based case-control study gathered information by in-person interview. The study did not specify whether the women were asked about the use of antiperspirants and/or deodorants. We contacted the authors of the study and they informed us that they asked in Arabic about the antiperspirant use of the “speed stick” type. The unadjusted odds ratio for those women who used antiperspirants was 0.24 (95% CI: 0.09–0.63), indicating protective effect (10).

We pooled OR of women who used antiperspirants regularly in the study of Mirick et al. (9) with un-adjusted OR of the study by Fakri et al. (10). Table 1 summarizes the characteristics and results of the pooled studies. The risk of the antiperspirants applying the fixed effect model was 0.40 (95% CI: 0.35–0.46).

### DISCUSSION

Our quantitative review aimed at evaluating the risk of deodorants/antiperspirants use for breast cancer. Although many reviews were published about this possible risk only two case-control studies with original data were conducted and published over the last 12 years (1–4, 9, 10).

Before reaching conclusions based on the present results, it is necessary to consider several potential objections to our procedures. Methodological concerns include limitations in the quality of the primary data, as the usefulness of a quantitative review largely depends on the quality of the studies used. Combining randomized controlled trials provides more evidence, but combining data from observational studies is sometimes desirable (11), especially in studying the aetiology of a chronic disease as in our case.

Our comprehensive search has identified two case-control studies with substantially different numbers of cases (683 vs. 54), an insufficient number to conduct a quantitative review and obtain reliable results. Since there are possible biases in the retrospective case-control studies, the studies can be, at their best, only indicative (12). Recall bias could alter the results especially that patients may consider deodorants use trivial. Another potential bias is to what extent further follow-up would alter the estimates of the association between deodorants use and breast cancer?

Another possible limitation in the Iraq study is that the controls were derived from patients of an oncological department. It could be hypothesized that in these controls deodorants might have caused cancers other than breast cancer; in this case it would not be logic to speak of a protective effect. Moreover, the

**Table 1.** Case-control studies evaluating the risk of breast cancer for use of antiperspirants

Author	Year	Type of study	Number of cases	Number of controls	Odds ratio	95% Confidence interval	Adjusted
Mirick	2002	Population-based	683	679	0.90	0.70–1.10	Yes
Fakri	2006	Hospital-based	54	50	0.24	0.09–0.63	No
Pooled risk					0.40	0.35–0.46	

numbers in the Iraq study are simply too small to come up with any meaningful result.

Our systematic review shows that antiperspirants use could be a protective factor against breast cancer. Our results agree with previous narrative reviews that rejected the possible association between deodorants/antiperspirants use and breast cancer risk (2, 3). One possible explanation for the protective effect of antiperspirants use in our systematic review is that educational level and/or socioeconomic class of participating women could act as a confounding factor. It is expected that women with higher educational level and/or socioeconomic status use deodorants/antiperspirants more frequently. High educational level and socioeconomic status are well known protective factors against breast cancer, after adjustment for number of children and age of mother at birth of the first child (13–15).

The study of McGrath (2003) investigated the intensity of underarm exposure in a cohort of 437 breast cancer survivors. The study showed that frequency and earlier onset of antiperspirant/deodorant usage with underarm shaving were associated with breast cancer diagnosis at younger age. Although this study was not technically a case-control study, its results cannot be ignored. The author recommended realizing new case-control studies to investigate the association between breast cancer and deodorants use (7). However, since then only one case-control study was conducted by Fakri et al. 2006 (10).

Aluminum-based compounds are the active ingredients in antiperspirants. It has been suggested that these aluminum compounds may be absorbed by the skin and cause changes in the estrogen receptors of breast cells. Recent work on cells in culture has lent credence to the hypothesis that this metal could accumulate in the mammary gland and selectively interfere with the biological properties of breast epithelial cells, thereby promoting a cascade of alterations reminiscent of the early phases of malignant transformation (16).

Recent study investigated whether different kinds of underarm deodorants commercially available in Germany might contain substances with estrogenic potential. Twenty five deodorants produced by ten different manufacturers in the form of sprays, roll-ons and sticks were investigated using in vitro-test (E-Screen assay) for the determination of estrogenic activity based on the human breast cancer cell line MCF-7. Seven out of ten spray deodorant samples showed a quantifiable estrogenic activity. In case of the sticks and roll-ons it was only one out of six and one out of nine, respectively (17).

Recently, Darbre and Harvey reported that parabens possess oestrogenic activity and can stimulate sustained proliferation of human breast cancer cells at concentrations measurable in the breast. Parabens also can inhibit the suppression of breast cancer cell growth by hydroxytamoxifen, and through binding to the oestrogen-related receptor gamma may prevent its deactivation by growth inhibitors. The authors concluded that there is evidence that parabens could have alleged responsibility in the occurrence of breast cancer (18).

In conclusion, our systematic review did not reveal any possible association between deodorants/antiperspirants use and breast cancer risk and calls for conducting new studies about this controversial association. Future studies should be performed on large prospective cohorts to increase their internal validity.

## Acknowledgement

I extend my sincere thanks to Prof. Dr. Rafael Fernández-Crehuet Navajas for his willing co-operation in the study.

## Conflicts of Interests

None declared

## REFERENCES

1. Gikas PD, Mansfield L, Mokbel K. Do underarm cosmetics cause breast cancer? *Int J Fertil Womens Med.* 2004 Sep-Oct;49(5):212-4.
2. Ragoth CJ. One step forward in proving, that underarm cosmetics do not cause breast cancer. *Breast.* 2005 Apr;14(2):85-6.
3. Namer M, Luporsi E, Gligorov J, Lokiec F, Spielmann M. The use of deodorants/antiperspirants does not constitute a risk factor for breast cancer. *Bull Cancer.* 2008 Sep;95(9):871-80. (In French.)
4. Hardefeldt PJ, Edirimanne S, Eslick GD. Deodorant use and breast cancer risk. *Epidemiology.* 2013 Jan;24(1):172. doi: 10.1097/EDE.0b013e3182781684.
5. Lee AH. Why is carcinoma of the breast more frequent in the upper outer quadrant? A case series based on needle core biopsy diagnoses. *Breast.* 2005 Apr;14(2):151-2.
6. Darbre PD. Underarm cosmetics are a cause of breast cancer. *Eur J Cancer Prev.* 2001 Oct;10(5):389-93.
7. McGrath KG. An earlier age of breast cancer diagnosis related to more frequent use of antiperspirants/deodorants and underarm shaving. *Eur J Cancer Prev.* 2003 Dec;12(6):479-85.
8. Fleiss JL. The statistical basis of meta-analysis. *Stat Methods Med Res.* 1993;2(2):121-45.
9. Mirick DK, Davis S, Thomas DB. Antiperspirant use and the risk of breast cancer. *J Natl Cancer Inst.* 2002 Oct 16;94(20):1578-80.
10. Fakri S, Al-Azzawi A, Al-Tawil N. Antiperspirant use as a risk factor for breast cancer in Iraq. *East Mediterr Health J.* 2006 May-Jul;12(3-4):478-82.
11. Greenland S. Quantitative methods in the review of epidemiologic literature. *Epidemiol Rev.* 1987;9:1-30.
12. Knapp RG, Clinton M. Risk and causality. In: Knapp Miller MC, editors. *Clinical epidemiology and biostatistics.* Baltimore: Williams & Wilkins; 1992. p. 109-30.
13. Pöhls UG, Renner SP, Fasching PA, Lux MP, Kreis H, Ackermann S, et al. Awareness of breast cancer incidence and risk factors among healthy women. *Eur J Cancer Prev.* 2004 Aug;13(4):249-56.
14. Coleman EA, O'Sullivan P. Racial differences in breast cancer screening among women from 65 to 74 years of age: trends from 1987-1993 and barriers to screening. *J Women Aging.* 2001;13(3):23-39.
15. Mobarakeh ZS, Mirzaei K, Hatmi N, Ebrahimi M, Dabiran S, et al. Dietary habits contributing to breast cancer risk among Iranian women. *Asian Pac J Cancer Prev.* 2014;15(21):9543-7.
16. Pineau A, Fauconneau B, Sappino AP, Deloncle R, Guillard O. If exposure to aluminium in antiperspirants presents health risks, its content should be reduced. *J Trace Elem Med Biol.* 2014 Apr;28(2):147-50.
17. Lange C, Kuch B, Metzger JW. Estrogenic activity of constituents of underarm deodorants determined by E-Screen assay. *Chemosphere.* 2014 Aug;108:101-6.
18. Darbre PD, Harvey PW. Parabens can enable hallmarks and characteristics of cancer in human breast epithelial cells: a review of the literature with reference to new exposure data and regulatory status. *J Appl Toxicol.* 2014 Sep;34(9):925-38.

Received June 23, 2015

Accepted in revised form August 7, 2016