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Visualization, Research Trends, and hotspots evolution on Deodorants and/or Personal Hygiene Products and Cancer: A Scientometric Study

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Abstract

Deodorants and personal hygiene products are integral to our daily lives. However, scholarly interest is growing vis-à-vis the possible relationships between these products and the development of cancer. This scientometric analysis visualized research trends and traced the evolution of hot spots in the field of deodorants and/or personal hygiene products and cancer. This quantitative study employed a scientometric approach with a retrospective observational design. A comprehensive search of the Scopus database was conducted on January 23, 2024. The search strategy included terms related to “deodorants,” “personal hygiene products,” and “cancer.” A total of 65 manuscripts published during the evaluation period spanning from 2013 to 2022 were identified. The examination of the academic performance of several authors evidenced Philippa D. Darbre as a prolific scholar with four publications through 2019, which accumulated 149 citations. Milan J. Anadkat published one paper in 2020, which garnered 30 citations. The analysis of the academic output and research impact of ten institutions from varied sectors and countries revealed the predominance of the University of Reading in the UK, with the highest academic output, generating four publications. The University of Urbino in Italy and the University of Rochester in the United States obtained 113 and 59 citations, respectively. Ain Shams University in Egypt and Curtin University in Australia each published only one paper but displayed substantive per publication citations. This study comprehensively overviewed the extant research on deodorants and/or personal hygiene products and cancer, highlighting key authors and institutions as well as thematic trends.

Keywords:

Cancer, Deodorants, Hygiene Products, Scientometric Study.

INTRODUCTION

Over the past decade, the scientific community has expressed escalating curiosity about the potential links between the utilization of deodorants and antiperspirants and the likelihood of cancer onset [1,2]. Sweat gland secretion is odorless but the microbial transformation of this secretion produces volatile molecules that generate body odor [3]. Therefore, an effective deodorant can inhibit the growth and activity of bacteria such as Staphylococcus and Epidermidis that are secreted by apocrine glands. Currently, most deodorants are formulated using antibacterial

components such as quaternary ammonium compounds, triclosan, aluminum salts, and fragrant substances that conceal unpleasant smells [4].

Personal hygiene products such as deodorants are indispensable to our daily routines. They afford us cleanliness, freshness, and safety in our daily interactions. However, concern has grown in recent years about their possible connection with the development of certain types of cancer [5]. Many cosmetic products are applied daily on and around the human breast: deodorants as well as lotions, sprays, moisturizers, breast creams, and other similar

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products^[6]. Such products are not washed away. Rather, they persist on the skin, facilitating dermal exposure, absorption, and build-up in underlying tissues. This process may be intensified because of skin abrasions caused by shaving^[7].

The worry emanates from the hypothesis that certain components in these products could adversely affect our health, for instance, aluminum salts and quaternary ammonium compounds^[8]. These ingredients are utilized because of their ability to curb the growth of odor-causing bacteria; however, some studies have indicated that they could exert biological effects beyond their original functions^[9]. Human skin is the organ most exposed to the external environment. Therefore, it acts as the first barrier of defense against chemical and microbial threats^[10]. It harbors a microbial ecosystem unique to every individual and varies significantly in discrete areas of the body. Recent findings suggest a possible relationship between the use of antiperspirants or cosmetics and the composition of the skin microbiota^[11].

Research in this domain is still advancing, and thus far, the results are mixed. Some studies have identified a connection between the use of these items and increased cancer risk, whereas others have not confirmed such a relationship^[12]. Knowledge about the molecules on the skin's surface or how products impact this chemistry remains limited despite the skin microbiome's stability over time^[13]. Mass spectrometry can be utilized to detect host molecules and determine individual lifestyles vis-à-vis diets, medications, and personal care products^[14]. Regardless of the ambiguity, it is crucial to remain informed and conscious of the potential hazards associated with the use of these products. As consumers, we have the right to obtain information about substances we introduce to our bodies and to know how they could affect our future health^[15].

It is vital to grasp the temporal variations in the microbiome and skin chemistry to ascertain whether alterations in personal routines can impact the human skin ecosystem^[16]. Despite being highly individualized, our skin chemistry, which encompasses hormones and pheromones such as androstenedione and androsterone, undergoes significant changes akin to the microbiome^[17]. In a similar vein, experimental modifications to the personal care routines of participants in some studies resulted in changes in bacterial and molecular diversity and structure, particularly in the axillae and feet^[18].

Therefore, the present study aimed to evaluate the evolution of hotspots related to deodorants and/or personal hygiene products and cancer.

Material and Method

Study Design

This quantitative study adopted a scientometric approach and employed a retrospective observational design.

Search Strategy

A comprehensive search of the Scopus database was

conducted on January 23, 2024. The search strategy included terms related to "deodorants", "personal hygiene products" and "cancer" by applying Boolean operators "AND" and "OR" as evidenced by the following search formula: ("antiperspirant" OR "antiperspirant products" OR "antiperspirant agents" OR "sweat inhibitors" OR "antiperspirant spray" OR "antihidrotic" OR "antiperspirant product" OR "perspiration control" OR "sweat blocker" OR "perspiration management" OR "axillary hygiene" OR "sweat reduction" OR "underarm care" OR "perspiration control agent" OR "sweat prevention" OR "deodorant" OR "antibacterial deodorant" OR "body spray" OR "odor neutralizers") AND ("cancer" OR "carcinoma" OR "neoplasms" OR "malignancy" OR "tumor" OR "oncology" OR "malignant growth" OR "cancerous condition" OR "carcinogenesis" OR "oncogenesis" OR "cancer risk" OR "tumor development" OR "cancer biology" OR "cancer screening" OR "tumorigenesis" OR "neoplasms" OR "carcinoma" OR "tumor markers, biological" OR "oncology" OR "cancer genetics" OR "carcinogens" OR "cancer therapy")

Selection of Studies

A total of 65 manuscripts published during the evaluation period from 2013 to 2022 were identified. Of these, 29 were original articles, 18 were reviews, and 11 were book chapters, and 7 were excluded because they were in the other category.

Scientometric Analysis

SciVal software was used; for which first, access was obtained, and the scope of research was defined by selecting the most important researchers, research groups, institutions, or countries. A wide range of research metrics were analyzed, including number of publications, citations, collaborations, impact of publications. Visualizations of research trends and the evolution of hotspots were also generated using the analyzed data. The results are presented in the form of knowledge network maps.

Ethical Considerations

This study was conducted in conformity with the ethical principles of scientific research. All data were anonymously collected and analyzed and were aggregated to ensure privacy and confidentiality. There are no conflicts of interest because we worked with publicly available metadata.

Results

This bibliometric study examined the academic performance of several authors. With four publications as of 2019, Philippa D. Darbre was evidenced as a prolific scholar. Her papers accumulated 149 citations and the study revealed an impressive average rate of 37.3 citations per publication. Her h-index of 41 reflects the wide-ranging impact of her work. However, Milan J. Anadkat published one paper in 2020 that received 30 citations with an h-index of 26. These findings afford valuable insight into the influence these researchers exert in their respective disciplines. However, we must crucially note that these indicators merely measure impact and do not necessarily reflect the quality or significance of an individual's research (Table 1).











Table 1: Top-10 Most Productive Authors.

Name	Scholarly Output	Most Recent Publication	Citations	Citations Per Publication	Field-Weighted Citation Impact	h-index
Darbre, Philippa D.	4	2019	149	37.3	1.6	41
Ginex, Pamela K.	2	2020	46	23	1.93	15
Morgan, Rebecca L.	2	2020	46	23	1.93	44
Maloney, Christine	2	2020	46	23	1.93	6
Moriarty, Kerri A.	2	2020	46	23	1.93	6
Backler, Chelsea	2	2020	46	23	1.93	3
Sappino, André Pascal	2	2016	59	29.5	0.68	30
Mannello, Ferdinando	2	2013	113	56.5	1.97	38
Vrabel, Mark	2	2020	46	23	1.93	9
Anadkat, Milan J.	1	2020	30	30	0.97	26

Our bibliometric study scrutinized ten institutions working with varied sectors and countries to assess their academic output and research impact. The University of Reading in the United Kingdom notably yielded the highest academic output, generating four publications. In addition, the University of Urbino in Italy and the University of Rochester in the United States respectively obtained 113 and 59 citations. Ain Shams University in Egypt and Curtin University in Australia each published only a single work

during the study period but garnered sizable citations per publication (29 and 31, respectively). The University of Rochester led in the field-weighted impact index with a score of 2.17, indicating a strong impact on its research area, while Washington University St. Louis and the University of Basel evinced lower indexes (0.53 and 0.67, respectively). These results highlight the diversity of institutional performance and underscore the importance of considering both quantity and quality in research evaluations (Table 2).

Table 2: Top ten Institutions.

Institution	Country/Region	Scholarly Output	Citations	Citations per Publication	Field-Weighted Citation Impact
University of Reading	 United Kingdom	4	149	37.3	1.6
Chungbuk National University	 South Korea	2	62	31	1.26
University of Basel	 Switzerland	2	24	12	0.67
University of Urbino	 Italy	2	113	56.5	1.97
McMaster University	 Canada	2	46	23	1.93
University of Rochester	 United States	2	59	29.5	2.17
Washington University St. Louis	 United States	2	32	16	0.53
Oncology Nursing Society	 United States	2	46	23	1.93
Ain Shams University	 Egypt	1	29	29	0.35
Curtin University	 Australia	1	31	31	1.31

This investigation of academic performance indicators appraised institutional performance according to CiteScore quartiles for the period ranging from 2013 to 2022. The consistent presence of 25 institutions in the Q1 quartile (top 25%) is noteworthy and the University of Reading ranked first in six of the ten assessed years. Ten institutions held firm during the Q2 quartile (top 26%–50%) with the University of Reading leading in five years. However, the Q3 quartile (top 51%–75%) registered

four institutions, and the Q4 quartile (top 76%–100%) grouped twelve institutions. Overall, we observed that the University of Reading maintained its prominence throughout the studied period, evidencing continual academic impact via research, while the performance of other institutions evinced variations over the years. This analysis offers a comprehensive overview of the distribution of institutions in the CiteScore quartiles and their evolution over the last decade (Figure 1).

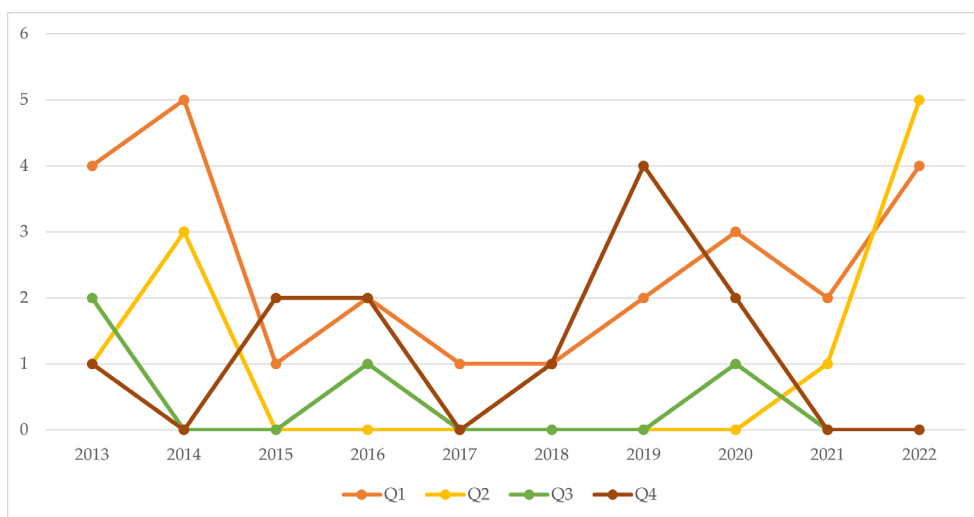


Figure 1: Publications by CiteScore.

Our analysis of thematic evolution revealed significant transitions in keywords and topics of interest over time. Research published in 2013–2014 focused on breast cancer but the attention shifted toward antiperspirants in 2015–2016 with a weighted inclusion rate of 1.00, which indicated a complete transition. The relevance of antiperspirants continued to be subsequently highlighted and remained the central theme between 2017 and 2019. The emergence of antiperspirants was also identified as a thematic variant during this period even as breast

cancer persisted as a theme, albeit with a lower inclusion rate. Antiperspirants continued as a key theme during the transition 2020–2021 but breast cancer regained prominence with a weighted inclusion index of 1.00. Finally, breast cancer remained the dominant theme in 2020–2021 and 2022–2022. These results reflect thematic shifts over the years and display the evolution of the relevance of breast cancer and antiperspirants. Thus, our findings offer a dynamic perspective on research conducted in these domains (Figure 2).

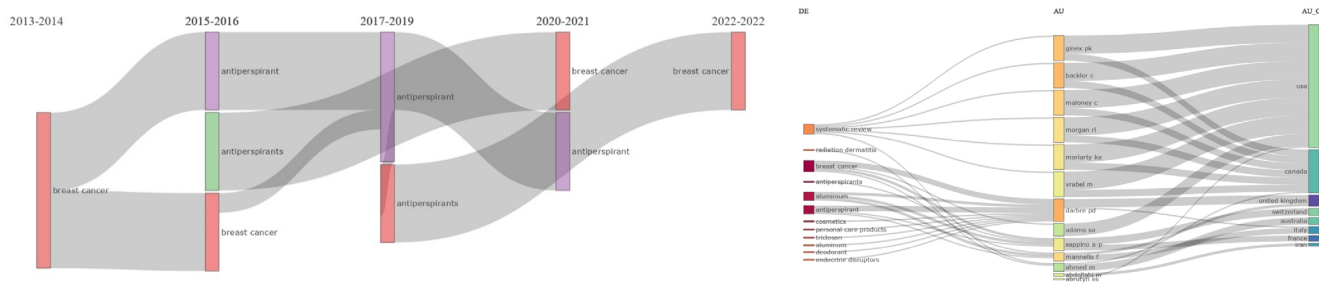


Figure 2: Thematic Evolution.

The cross-country collaboration analysis pinpointed several outstanding connections in the collaboration network. Australia entered into a distinctive collaboration with Canada, while Canada also established cooperative

connections with Israel, Italy, and the Netherlands. India collaborated with Ecuador and Korea, expanding its network of international partnerships. Israel supplemented its collaboration with Italy and the

Netherlands by partnering with Canada. Italy engaged in collaborations with Israel, the Netherlands, and the United Kingdom. Switzerland and France collaborated to strengthen their international relations in research. The United States predominated by spearheading most collaborations, displaying four connections

with Canada and establishing links with Colombia, Germany, Israel, Italy, and the Netherlands. These findings delineate a diverse and global network of collaborations between countries and highlight the international interconnectedness of the relevant research initiatives (Figure 3).

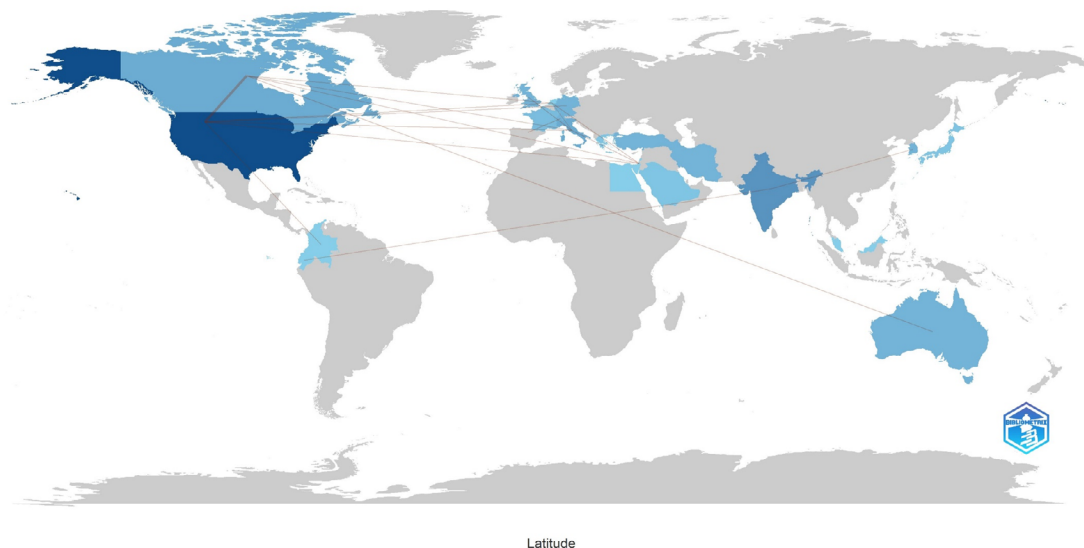


Figure 3: Country Collaboration Map.

The investigation of the visual representation of cooccurrences per keyword demonstrated the relationships and frequencies of keywords found in a dataset. In this context, we discovered that all the 229 keywords satisfied the threshold, with a minimum number of one cooccurrence. We found different nodes of which the light blue cluster represented by the keyword “breast cancer” emerged as the most

representative, followed by the orange cluster with the keyword “aluminum.” Both clusters were primarily interrelated with the keyword “antiperspirant.” This cooccurrence graph provides a quick and visual overview of the relationships between keywords found in a specific dataset and facilitates the identification of the emerging thematic patterns related to the given topic (Figure 4).

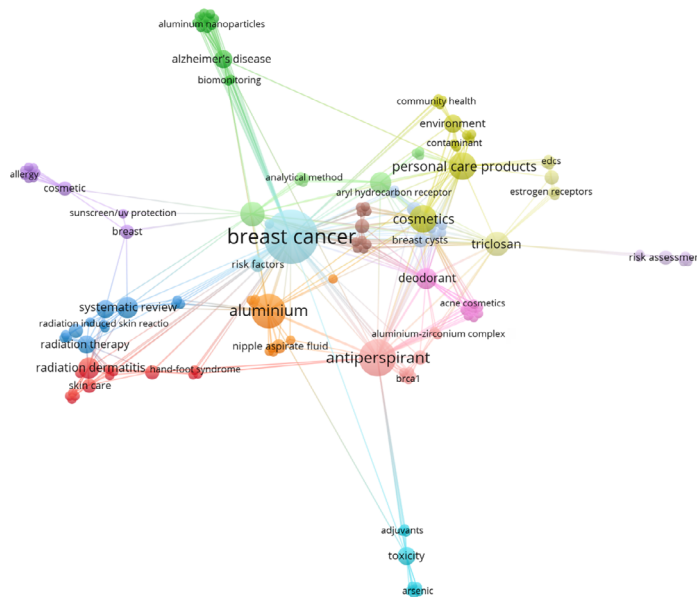


Figure 4: Co Occurrence by Keyword.

Discussion

Personal care products are extensively utilized but their impact on the molecular and microbial makeup of our skin has not yet been comprehensively investigated. Some procedures allow us to examine individuals systematically to understand the impact of certain lifestyle aspects on the skin^[19]. This procedure entails an exhaustive examination of the molecular and bacterial inventories of the skin and requires researchers to probe the relationships of these inventories to the use of personal care products^[20]. More than half of 108 batches of antiperspirants and deodorant body sprays of 30 different brands have been found to contain benzene, a chemical compound whose carcinogenic potential has been recognized^[21].

Recent research initiatives have indicated that personal hygiene habits can modify the metabolome as well as the microbiome of the skin. This modification appears to be influenced by both the type of product that is used and the area of the body on which it is applied^[22, 23]. Personal care products appear capable of affecting the skin microbiome just as diet can influence the gut microbiome^[24]. Therefore, a single application of these products could alter the skin microbiome and potentially influence cancer cell production over long period^[25]. Continuous reexposure to the chemicals present in our personal care products could also contribute to such resistance^[26].

Numerous specialists have indicated the potential association between the application of deodorants and antiperspirants and breast cancer because these products are used near the breast region and incorporate ingredients that could be detrimental. Nevertheless, no direct scientific proof yet exists to link the usage of these items to the incidence of breast cancer^[27]. Propylene glycol is a component that lingers on the skin and is frequently found in substantial amounts in deodorants and antiperspirants as a humectant that helps such products attain a uniform and silky texture. Studies have demonstrated that the daily application of personal care items can cause elevated exposure to these polymers, which could induce contact dermatitis in certain individuals^[28].

This review summarizes the current findings and overviews the available literature on the relationships between antiperspirants and deodorants and cancer. No direct relationship has yet been confirmed; however, it is crucial to continue researching and monitoring the ingredients of these products. The current study acknowledges certain notable limitations. First, notwithstanding the articulated concerns, no evidence yet exists that aluminum can modify the effects of this hormone in people or that the presence of aluminum in antiperspirants is associated with breast cancer. Scant extant studies have explored the potential connections between cancer and underarm antiperspirants or deodorants.

The present study also admits to the possibility of certain drawbacks commonly observed in bibliometric studies. First, the span of the study was limited because only Scopus was utilized to collect publications for the analysis. Also, this study evaluated only articles published in English. Thus, relevant research published in other languages or available on other academic databases could have been overlooked. Finally, the interpretation of knowledge maps generated through the bibliometric analysis could be subjective and dependent on the experience and knowledge of the researchers.

Conclusions

This scientometric study offers valuable insights into the field of deodorants and/or personal hygiene products and cancer despite its admitted limitations. Philippa D. Darbre and Milan J. Anadkat were evidenced as the most influential scholars of the relevant research in their respective fields. The University of Reading in the United Kingdom stood out as an institution because of its substantial academic output; other institutions such as the University of Urbino in Italy and the University of Rochester in the United States also demonstrated a robust research impact. Finally, this study delivered a comprehensive view of the distribution and evolution of institutions in the CiteScore quartiles, highlighting consistencies as well as variabilities in academic performance. These findings offer referential value for future research projects and prospective evaluations of academic performance.

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Competing Interests

The authors declare that they have no competing interest.

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