http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

OPEN ACCESS Pakistan Journal of Biological Sciences

ISSN 1028-8880
DOI: 10.3923/pjbs.2023.510.515

Research Article
Assessment of Saudi Society's Awareness of the Hazards of Scented Candles and Air Fresheners

Leen Abdullah Alghariri, Renad Sultan Alanzi, Reem Oudah Albalwi, Lamees Fuad Garot, Hadeel Saud Alqbali and Mervat Sayed Mohamed

Department of Biochemistry, Faculty of Science, University of Tabuk, Kingdom of Saudi Arabia

Abstract

Background and Objective: Air fresheners and scented candles are dangerous for human health and the environment. They are associated with allergies and irritation for a weak respiratory system. This study was conducted to determine the extent of community awareness of the toxicity associated with scented candles and air fresheners. **Materials and Methods:** This study uses a questionnaire from March, 2023 to June, 2023. The study questionnaire, which was completed by 1667 participants, assesses the degree of knowledge, habits and diseases connected to scents and candles. Descriptive statistics, including percentages, were used. **Results:** It was discovered that, on average, 568 (34.1%) people are unaware that candles contain chemicals. As 1497 (89.8%) are prepared to replace them with natural and safer candles, while 163 (9.8%) consulted a doctor after exposure to candles because of respiratory allergies; 1093 (65.5%) do not care to check the ingredients before buying a candle and 854 (51.2%) are unaware that candles might cause long-term damage. **Conclusion:** A significant portion of participants were unaware of the dangers of scented candles and air fresheners. There is no link between respiratory allergies and the substances present in these candles, but it has been proven that most participants are ready to change and use natural alternatives.

Key words: Toxicity, indoor pollution, scented candles, volatile organic compounds, health questionnaire, community awareness

Citation: Alghariri, L.A., R.S. Alanzi, R.O. Albalwi, L.F. Garot, H.S. Alqbali and M.S. Mohamed, 2023. Assessment of Saudi society's awareness of the hazards of scented candles and air fresheners. Pak. J. Biol. Sci., 26: 510-515.

Corresponding Author: Mervat Sayed Mohamed, Department of Biochemistry, Faculty of Science, University of Tabuk, Kingdom of Saudi Arabia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Air pollution means pollution of the internal and external environment. There are many common sources of air pollution, such as car exhausts, nuclear tests, earthquakes and volcanoes[1] especially there are other sources of air pollution that are not known to many people, such as scented candles and air fresheners that contain chemicals such as paraffin, benzene and formaldehyde. The increasing attraction to candles nowadays due to their different shapes, colors, scents and the versatility of their uses. For example, many people use candles on occasions and others resort to candles as a therapeutic method to change the mood and give it a feeling of comfort and calm, as in the case of massage centers, hotels and health resorts, especially for people. Those who suffer from professional stress and some people consider candles to be the perfect solution to take care of the air, as they are used to remove unwanted odors. The use of scented candles has gained a great deal of attention in terms of room decoration and the energy of refreshing the air in closed places, such as by lighting candles in closed rooms (without an air source) when they practice yoga, read books and do many other activities. Under the light of these uses, it was determined that the sources contributing to indoor air pollution, including burning candles and the dissemination of air fresheners. It was known that the combustion process can produce gases and particles harmful to human health. In addition, when scented candles that contain paraffin (a product derived from petroleum waste) are burned in an indoor space, various toxic pollutants are released, including a large amount of volatile organic compounds such as benzene and toluene (both carcinogens) and they are also released. Polycyclic aromatic hydrocarbons are also known as carcinogens such as naphthalene and anthrancines[2-6] and emit distinctive odors due to the additives included, such as perfumes and essential oils[7]. In fact, petroleum soot (which is a black powder consisting of carbon particles) forms as a by-product during incomplete combustion; the emission of paraffin candles is the same as that of diesel fuel and vapors. Candles usually contain phthalates, which are located along the center of the candle and consist of heavy metals such as lead. Hence, candle wicks are also considered a source of toxins by themselves. When the candle is lit, the phthalates are released into the air and can be inhaled through the lungs or absorbed through the lungs. When phthalates enter the bloodstream, they lead to an increase in allergy and asthma symptoms and a change in the hormone level[8]. Studies have shown that most scented candle products and air fresheners are associated with general headaches, migraines, coughing, shortness of breath, asthma attacks, dermatitis and allergic rhinitis[9-12]. Some studies have indicated that exposure to the burning of scented candles on a regular basis in enclosed spaces can expose people to a harmful amount of chemicals, increase health risks and be considered as dangerous as indirect smoking. Also, people who are exposed to candles may experience irritation of the eyes, nose and throat, labored breathing, nausea, bladder cancer[13] and up to the point of damage to the central nervous system[14,15].

In Saudi Arabia and other Arab nations, scented candles are frequently used in homes and during social gatherings[16]. The extensive usage of scented candles in this region is an indication that many people are unaware of the problems associated with Volatile Organic Compounds (VOCs) and particle emissions from burning candles. This study was conducted to determine the extent of community awareness of the toxicity and scented candles that have harmful effects, as well as the consumption of scented candles and air fresheners, because there is variation in the degree and effect of scented candles on human health and the environment.

MATERIALS AND METHODS

Study method: The study was conducted in Saudi Arabia between March, 2023 and June, 2023. This study is a descriptive research study, which means that it relies on data collection and analysis to reach its conclusions. The current study's survey and analytical approach, as well as its descriptive approach, were used to prepare it. This research methodology has been described as an organized scientific and research method to gather facts and data about social events and scientific phenomena related to a specific person or group of people within society. Qualitatively, then identify generalizable indicators and indications related to the study's topic[17].

Study population and sample: A group of people, organizations or key components involved in the research problem are referred to as the study population and the researcher uses them to gather the necessary data and to clarify the extent to which the characteristics of this group have an impact on the findings of the research problem[18]. In the current study, the study population consists of all citizens in the Kingdom of Saudi Arabia and a deliberate sample of 1667 citizens was chosen.

Questionnaire: The researcher's method for gathering data and information that enables him to respond to the study's questions and test its hypotheses is known as the study tool[19]. The questionnaire was used as the main tool in the current study to gather information from the study sample. The current study's questionnaire was created after a review of previous research on the topic, which dealt with knowledge, attitudes and behaviors related to the use of scented candles and air fresheners and the risks associated with them. A total of 22 questions were included in the questionnaire, including 19 questions about knowledge, attitudes, habits and practices related to the use of scented candles and air fresheners and the risks involved and 3 questions about the demographic characteristics of the study.

Ethical considerations: The participants received information and assurances of confidentiality and anonymity. It is impossible to identify the survey respondents using the information gathered, statistically analyzed and presented below.

Statistical analysis: Descriptive statistics were used for analysis of results. The percentage is calculated by taking the frequency in the category divided by the total number of participants and multiplying by 100%.

RESULTS

The general characteristics of participants with ages ranging from 18 to more than 45 years are shown in Table 1. In total, 1667 people participated in a questionnaire. The participants were all Saudi Arabian, with women representing approximately the majority (74.3%) and men (25.7%). More than half (42.4%) of participants aged 31 to 45 were male; sample distribution by regions in question. The North Region had the highest value (53.3%).

More than two-thirds of the participants used scented candles at home (84.8%); more than half of the participants used them from time to time (64.1%) and 40.5% of the participants used them for more than 5 years. More than half of the participants were very close when the scented candles were lit (54.9%) as indicates in Table 2.

Table 1: Distribution of general characteristics of participants

Item	N (%)
Gender	
Female	1239 (74.3)
Male	428 (25.7)
Age (years)	
From 18 to 25	409 (24.5)
From 26 to 30	305 (18.3)
From 31 to 45	706 (42.4)
Greater than 45	247 (14.8)
Region	
North Saudi Arabia	888 (53.3)
Southern Saudi Arabia	74 (4.4)
Eastern Saudi Arabia	29 (1.7)
Western Saudi Arabia	426 (25.6)
Central Saudi Arabia	250 (15.0)

Table 2: Usage of scented candles among participants

Item	N (%)
Do you use scented candles in your home?	
No	253 (15.2)
Yes	1414 (84.8)
How often do you use scented candles in your home?	
From time to time	1068 (64.1)
Use it frequently	362 (21.7)
I don't use it	237(14.2)
How long do use scented candles in your home?	
0 years	271 (16.3)
From 1 to 2 years	306 (18.4)
From 3 to 5 years	414 (24.8)
More than 5 years	676 (40.5)
How close are you usually to candles when lighting them?	
Very close (in the same place)	915 (54.9)
Far away (elsewhere)	752 (45.1)

Table 3: Participant's knowledge of scented candles and their side effects

Question	No (%)	Yes (%)	Sometimes (%)
Have you visited a physician recently because of a respiratory allergy after exposure to candles?	1504 (90.2)	163 (9.8)	
Do you feel discomfort or negative effects after using scents or candles for a long period of time? (nausea-shortness of breath-coughing)	1166 (69.9)	501 (30.1)	
Do you find it difficult to breathe when you are near scented candles?	842 (50.5)	214 (12.8)	611 (36.70)
Are there scented incense burners in your car?	1089 (65.3)	578 (34.7)	
Are you or any of your children allergic to scented candles?	1311 (78.6)	356 (21.4)	
Are you keen to read the components of the candles before buying them?	1093 (65.6)	574 (34.4)	
Do you light candles and scents in the rooms of children and the elderly?	1507 (90.4)	160 (9.6)	
Are there safety precautions to be taken when using scented candles?	613 (36.8)	1054 (63.2)	
Are scented candles suitable for indoor use? (without air supply)	1301 (78.0)	366 (22.0)	
Did you know that scented candles contain chemicals?	568 (34.1)	1099 (65.9)	
Do you feel any irritation in your eyes, throat or nose when exposed to scented fumes and candles?	1089 (65.3)	578 (34.7)	
Have you noticed any changes in your mood or energy levels after being exposed to the scented candle or scented candle?	972 (58.3)	695 (41.7)	
Did you know that excessive use of scented candles and scents has long-term harm?	854 (51.2)	813 (48.8)	
Are you ready to replace commercial scented candles with other natural ingredients?	171 (10.3)	1496 (89.7)	

Table 3 shown that, most of the participants weren't keen to read the components of the candles before buying them, which is 65.6%. The majority of the participants knew that scented candles contain chemicals (65.9%), but more than half of the participants didn't know that excessive use of scented candles and scents has long-term harm (51.2%). The majority of the participants took safety precautions when using scented candles (63.2%) when answering the question. Are scented candles suitable for indoor use? (without an air supply). The majority of the participants said no (78%) and 90.4% of the participants didn't light up the candles and scents in the elderly and children's rooms. While 65.3% of the participants don't have scented incense burners in their cars. Half of the participants complained of defalcate of breathing when they are near scented candles, two third of the participants didn't complain of discomfort or negative effects after using scents or candles for a long period of time (69.9%), the majority of the participants (78.6%) aren't or any of their children allergic to scented candles, (65.3%) didn't feel any irritation when they exposed to scented fumes and candles, only (9.8%) of the participants visited the doctor because of a respiratory allergy after exposure to candles, more than half of the participants (58.3%) didn't experience any change of mood levels when they lighted up the scented candle, the majority of the participants (89.7%) were ready to replace commercial scented candles with other natural ones.

DISCUSSION

Awareness of its harm and the materials that make it up and the correct habits in using scented candles and air fresheners, have a very important role in reducing air pollution and respiratory diseases that are caused by harmful substances that are emitted and accumulate in the long run and cause a polluted and disturbing environment that is not suitable for work and production in general. The information that is provided to the consumer is limited and not clear to those who are not specialists or familiar with the dangers of these materials. There is no law in any country that obligates or compels any consumer of a non-food product to disclose all of its ingredients. Alternatively, the product may be included in a generic term, such as perfume[20,21]. This supported what was founded in this study: That 65.5% of people do not care to read the components of the candle before purchasing it due to the lack of available information about the dangers of these materials and 34.1% do not know that there are chemicals in the composition of these materials in the first place. This data came despite the widespread use of scented candles and fresheners by 84.8% of those who use these products in their homes. The percentage of those who use it frequently, knowing the possibility of damage related to it, reached 21.7%, with a percentage of 14.3% that they never use. This widespread use of candles and scented materials, with a lack of awareness of the correct methods and damages, reflects negatively on health first, followed by the safety of the internal environment. There are those who visited the doctor recently because of respiratory allergies after exposure to scented candles by 9.8% and those who suffer from negative effects after using scents or candles for a long period of time (nausea, shortness of breath and coughing) and feel uncomfortable constitute 30.1% because of their repeated exposure to toxic substances emitted by these scented candles. When analyzing scented products using gas or mass chromatography Spectrometrically, the most commonly emitted compounds were terpenes (e.g., limonene)[22]. In addition to being primary pollutants for the environment in general, turbines interact with ozone in the air and generate hazardous secondary pollutants such as formaldehyde[23].

Formaldehyde is a dangerous substance that can cause severe allergic reactions and diseases and has been classified as a carcinogen by the International Agency for Research on Cancer[24]. Due to the accumulation of these pollutants in the indoor air without any external natural air sources, 36.6% suffer from breathing difficulty when using scented candles or near them, while 12.9% confirm that they do not tolerate the presence of candles in their environment and suffer from breathing problems. In addition, it was found that 21.3% of their children are allergic to scented candles because they contain substances that could be considered irritating to the respiratory system and 34.7% are already suffering from irritations due to constant exposure to scented candles and air fresheners in homes and workplaces in the eyes, throat and nose. Also, despite these numbers and the fact that people already suffer from respiratory problems, allergies and irritations due to the chemicals emitted from scented candles, 54.9% would be too close and in the same place to light candles. And also, these substances emitted in scented candles form aromas that have a strong and pleasant smell that can cause an improvement in mood and psychological state, as 41.7% confirmed that they actually found changes in mood and energy levels when exposed to scented candles. But on the positive side, there are some data points that show that there is little awareness at some points related to indoor air pollution due to scented candles and air fresheners. Whereas, 90.4% know that candles should not be lit in the rooms of children and the elderly due to the weakness of their respiratory systems, the presence of chronic diseases, or the fear of developing an allergy of some kind and 63.2% are aware that safety precautions should be taken in the use of candles to prevent their dangers. Such as making sure of clean air sources to reduce the concentration of pollutants and their damage and of course, the potential fire hazard. This is supported by the fact that 78.1% know that scented candles should not be used in enclosed spaces without air sources and 48.8% know that the use of scented candles causes long-term harm such as allergies, shortness of breath and indoor air pollution. A good sign of awareness and reduction of this type of pollution is that 89.8% are willing to replace scented candles that contain chemicals with natural alternatives such as soy candles, which are a renewable, biodegradable alternative to the harmful paraffin wax used in scented candles. It was found that the harmful substances that result from candles made of soy are few or almost nonexistent compared to those that contain chemical substances[25]. Among the proposed solutions, in addition to using scented candles from natural sources to reduce air pollution, is the application of a policy that is less or at least free of scents in public places and airports to reduce indoor air pollution, which is often voluntary for people to choose to reduce the use of scented materials for the public interest and reduce allergies and diseases[26].

In the end, the researchers' recommendation was to reduce the use of scented candles and air fresheners and replace them with healthy alternatives. But there is still a need to spread awareness fully and extensively about this matter, with certain difficulties, such as that the frequent use of scented candles has become part of society's habits, which they find difficult to replace and there are no clear laws that prevent and control the presence of chemicals in scented candles and air fresheners.

CONCLUSION

The results of the current study show that the use of scented candles and air fresheners is common, especially among females in the Kingdom of Saudi Arabia. Health problems were present in 9.8% of the respondents after they were exposed to scented candles, which made them visit the doctor. As 30.1% of the respondents felt negative symptoms after using scented candles. For long-term conditions such as nausea, shortness of breath and coughing, there is a need for awareness campaigns about the danger and toxicity of candles and air fresheners on human health and the environment. According to the current study, 89% of those who participated in the questionnaire are willing to replace scented candles and scents with natural products.

SIGNIFICANCE STATEMENT

According to researchers' knowledge, this is the first Saudi research that talks about the dangers of scented candles and air fresheners. This topic was chosen due to the danger of continuous exposure to these substances. The researchers have tried to shed light on the dangers of substances that society does not realize have a negative impact in the long term. This hypothesis of lack of awareness was proven through the results of the questionnaire, which showed that most participants do not know about the existence of dangerous chemicals that are involved in the composition of these materials. On the plus side, they are willing to substitute it with natural alternatives in order to foster a healthy and secure community.

ACKNOWLEDGMENT

This work was supported by the Department of Biochemistry, Faculty of Science, University of Tabuk, Saudi Arabia.

REFERENCES

1. Al-Taai, S.H.H., 2022. Environmental pollution "causes-types-effects". AIP Conf. Proc., Vol. 2398. 10.1063/5.0093364.
2. Orecchio, S., 2011. Polycyclic aromatic hydrocarbons (PAHs) in indoor emission from decorative candles. Atmos. Environ., 45: 1888-1895.
3. Derudi, M., S. Gelosa, A. Sliepcevich, A. Cattaneo, R. Rota, D. Cavallo and G. Nano, 2012. Emissions of air pollutants from scented candles burning in a test chamber. Atmos. Environ., 55: 257-262.
4. Manoukian, A., E. Quivet, B. Temime-Roussel, M. Nicolas, F. Maupetit and H. Wortham, 2013. Emission characteristics of air pollutants from incense and candle burning in indoor atmospheres. Environ. Sci. Pollut. Res., 20: 4659-4670.
5. Petry, T., E. Cazelle, P. Lloyd, R. Mascarenhas and G. Stijntjes, 2013. A standard method for measuring benzene and formaldehyde emissions from candles in emission test chambers for human health risk assessment purposes. Environ. Sci.: Processes Impacts, 15: 1369-1382.
6. Petry, T., D. Vitale, F.J. Joachim, B. Smith and L. Cruse *et al*., 2014. Human health risk evaluation of selected VOC, SVOC and particulate emissions from scented candles. Regul. Toxicol. Pharmacol., 69: 55-70.
7. Huang, H.Y., H.H. Ko, Y.J. Jin, S.Z. Yang, Y.A. Shih and I.S. Chen, 2012. Dihydrochalcone glucosides and antioxidant activity from the roots of *Anneslea fragrans* var. *lanceolata*. Phytochemistry, 78: 120-125.
8. Robinson, L. and R. Miller, 2015. The impact of bisphenol a and phthalates on allergy, asthma, and immune function: A review of latest findings. Curr. Environ. Health Rep., 2: 379-387.
9. Kim, S., S.H. Hong, C.K. Bong and M.H. Cho, 2015. Characterization of air freshener emission: The potential health effects. J. Toxicol. Sci., 40: 535-550.
10. Sealey, L.A., B.W. Hughes, J.P. Pestaner, A. Steinemann, D.G. Pace and O. Bagasra, 2015. Environmental factors may contribute to autism development and male bias: Effects of fragrances on developing neurons. Environ. Res., 142: 731-738.
11. Caress, S.M. and A.C. Steinemann, 2005. National prevalence of asthma and chemical hypersensitivity: An examination of potential overlap. J. Occup. Environ. Med., 47: 518-522.
12. Caress, S.M. and A.C. Steinemann, 2009. Prevalence of fragrance sensitivity in the American population. J. Environ. Health, 71: 46-50.
13. Adamowicz, J., K. Juszczak, S. Poletajew, S.V. van Breda, M. Pokrywczynska and T. Drewa, 2019. Scented candles as an unrecognized factor that increases the risk of bladder cancer; is there enough evidence to raise a red flag? Cancer Prev. Res., 12: 645-652.
14. Norbäck, D., J.H. Hashim, Z. Hashim and F. Ali, 2017. Volatile organic compounds (VOC), formaldehyde and nitrogen dioxide (NO_2) in schools in Johor Bahru, Malaysia: Associations with rhinitis, ocular, throat and dermal symptoms, headache and fatigue. Sci. Total Environ., 592: 153-160.
15. Al Khathlan, N., M. Basuwaidan, S. Al Yami, F. Al-Saif, S. Al-Fareed and K. Ansari, 2023. Extent of exposure to scented candles and prevalence of respiratory and non-respiratory symptoms amongst young university students. BMC Public Health, Vol. 23. 10.1186/s12889-023-15001-6.
16. Elsayed, Y., S. Dalibalta, I. Gomes, N. Fernandes and F. Alqtaishat, 2016. Chemical composition and potential health risks of raw Arabian incense (Bakhour). J. Saudi Chem. Soc., 20: 465-473.
17. Nassaji, H., 2015. Qualitative and descriptive research: Data type versus data analysis. Lang. Teach. Res., 19: 129-132.
18. Tenny, S., J.M. Brannan and G.D. Brannan, 2020. Qualitative Study. StatPearls Publishing, Treasure Island.
19. Story, D.A. and A.R. Tait, 2019. Survey research. Anesthesiology, 130: 192-202.
20. Lunny, S., R. Nelson and A. Steinemann, 2017. Something in the air but not on the label: A call for increased regulatory ingredient disclosure for fragranced consumer products. UNSW Law J., 40: 1366-1391.
21. Steinemann, A.C., 2009. Fragranced consumer products and undisclosed ingredients. Environ. Impact Assess. Rev., 29: 32-38.
22. Steinemann, A., 2015. Volatile emissions from common consumer products. Air Qual. Atmos. Health, 8: 273-281.
23. Nazaroff, W.W. and C.J. Weschler, 2004. Cleaning products and air fresheners: Exposure to primary and secondary air pollutants. Atmos. Environ., 38: 2841-2865.
24. La Torre, G., T. Vitello, R.A. Cocchiara and C.D. Rocca, 2023. Relationship between formaldehyde exposure, respiratory irritant effects and cancers: A review of reviews. Public Health, 218: 186-196.
25. Rezaei, K., T. Wang and L.A. Johnson, 2006. Combustion characteristics of candles made from hydrogenated soybean oil. J. Am. Oil Chem. Soc., 79: 803-808.
26. Steinemann, A., 2019. Ten questions concerning fragrance-free policies and indoor environments. Build. Environ., Vol. 159. 10.1016/j.buildenv.2019.03.052.