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Original Research Article

Rate of incense usage in the northern part of Nigeria and its adverse effects among users

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ABSTRACT

Background: Incense is an oleoresin that seeps from wounds in the trunks and leaves of Boswellia trees (*B. carterii* and *B. papyrifera*, endemic to Arabia, Africa, China, and India, respectively). Incense is traditionally burned for a variety of home functions in different cultures, and it has been linked to airborne pigmented and depigmented dermatitis.
Methods: Questionnaires were developed using SurveyHeart and administered to determine the rate of incense usage in some households in northern Nigeria. Responses were compiled, data collated and the findings showed that four hundred and sixty (460) people responded.
Results: The highest age range that responded was between thirty to thirty-nine (30-39) years with forty-eight (48%). Seventy-three (73%) were married and about 62% have one to five (1-5) children. Ninety-five percent (95%) of them use incense bakhour to neutralize odour. The survey showed that most people have been using it for more than ten (10) years. The research also tells that most respondents burn about ten (10) grams daily. Majority of the respondents displayed no respiratory conditions as well as their family members while thirty-two (32%) claimed they and their families suffer some of respiratory ailment.
Conclusions: In conclusion, the use of incense in the northern part of the country is on the high side (94.86% out of 460 respondents) both in frequency and dose-wise which poses as a serious health condition to its users due to the contents of the incense and approximately 68% of the respondents have no knowledge of its adverse effects.

Keywords: Aerodynamic particle sizer, Hygroscopic tandem differential mobility analyser, Incense bakhour, Incense smoke, Scanning mobility particle sizer

INTRODUCTION

Incense is an oleoresin that seeps from wounds in the trunks and leaves of Boswellia trees (*B. carterii* and *B. papyrifera*, endemic to Arabia, Africa, China, and India, respectively).[1] Incense is traditionally burned for a variety of home functions in different cultures, and it has been linked to airborne pigmented and depigmented dermatitis.[2] Several researchers in Asia and North America have looked into the possibility of a link between incense stick use and health issues.[3-5] In non-smoking Saudi women, extensive indoor incense exposure has been linked to obstructive lung disease.[6] A strong link has been found between incense stick exposure and lung cancer risk factors.[7,8] Furthermore, incense exposure was a significant precipitating factor in 18% of 414 asthmatic children in Qatar, ranging in age from 7 months to 12 years.[9] To the best of our knowledge, these are the only research on the influence of incense on lung shape. The relationship between

exposure to Arabian incense (bakhour) and human health has not been properly researched. The physical properties of indoor particles were examined with a scanning mobility particle sizer (SMPS) system (14.6-850 nm) in a study conducted by.[10] From August 15 to September 8, 2014, an aerodynamic particle sizer (APS, 0.54-18 m) and a hygroscopic tandem differential mobility analyzer (H-TDMA) were used in an apartment located in an urban background site in Prague (Czech Republic). For particles released from incense burning activities, the maximum number concentration was 2.25 105 particles cm^3. Incense burning primarily produced accumulation mode particles with a count median diameter of 90-150 nm. Incense-burning particles were found to be virtually hydrophobic, with a growth factor (Gf) of roughly 1.01-1.10. The total lung deposition fractions of these particles by number when they penetrated into the human lung were 0.03-0.32 from incense, according to an updated MPPD model that took into account the hygroscopic qualities of particles. The existence and thermal profile of volatile organic components in three different samples of bakhour smoke were investigated using thermo-gravimetric analysis. The volatile and semi-volatile chemicals found in the bakhour smoke samples were then isolated using thermal desorption-gas chromatography-mass spectrometry. All organic compounds found were examined for potential health hazards using a spectrum library and a thorough literature search.[10]

Objective of the study

To investigate the demographic data of users of incense bakhour. To discover the number of users that are having respiratory conditions. To estimate the extent of incense usage using questionnaire in the northern part of the country. To review the adverse effects of incense bakhour consumption using relevant literatures and experiments

Chemical components found in most incense

Aldehydes: these include acetaldehyde, acrolein, formaldehyde, furfural.

Aromatic hydrocarbons: benzene, styrene, toluene, xylene.

Other aromatics (and benzyl derivatives): benzofuran, 4,4-diamine-3,3-dimethyl-1,1-biphenyl (4,4'-bi-o-toluidine), 2-methoxy-4-vinylphenol and vanillin

Terpenoids: alpha-terpineol and 3,7-dimethyl-7-octen-2-ol.[10]

METHODS

Rate of incense consumption

This was an epidemiological study using a questionnaire that was designed using the SurveyHeart app and responses collated from the general public at a confidence interval of 95%.

This study started from 14th June, 2021 and responses gathered for a period of about 3 months up till August; 2021 in Kaduna State. However; as the responses were both physical and virtual; a copy was sent online via social media networks to Kano, Katsina, Abuja, Maiduguri, Niger, Yobe and Jigawa.

Inclusion and exclusion criteria

The inclusion criteria involved all respondents from the northern part of Nigeria that were upto 10 years and above while the exclusion criteria were people living in the southern part of Nigeria as was not their tradition.

The statistical software used to analyse the date was incorporated in the SurveyHeart app that applied simple descriptive statistics and percentages.

Sample size included 460 respondents using purposive sampling technique which is a very good representative for the population of people in the Northern part of the country. Ethical approval was not required as this was an epidemiological study involving cultural behavioural pattern.

RESULTS

In Table 1, results showed that out of the four hundred and sixty, 460 respondents three hundred and sixty, 360 (78%) were females while one hundred, 100 (21.79%) were males.

Table 1: Gender of respondents.

Gender	Number of respondents	Percentage
Male	100	21.79
Female	360	79

Table 2: Age range of respondents.

Age range	Number of respondents	Percentage
10-19	14	3.04
20-29	144	31.30
30-39	221	48.04
40-49	51	11.09
50-59	30	6.30

Table 2 displayed two hundred and twenty-one, 221 (48.04%) of the respondents were within the age range of thirty to thirty-nine (30-39); one hundred and forty-four; 144 (31.30%) were within twenty to twenty-nine (20-29), fourteen, 14 (3.044%) within ten and nineteen (10-19), fifty-one, 51 (11.09%) were within forty to forty-nine, 40-49 and thirty, 30 (6.30%) were above 50 years of age. Looking at Table 3; their marital status showed that three hundred and thirty-six, 336 (73.36%) were married, one

hundred and sixteen, 116 (25.33%) were single while only eight, 8 (1.31%) were divorced.

Table 3: Marital status of respondents.

Marital status	Number of respondents	Percentage
Married	116	25.33
Single	336	73.36
Divorced	8	1.31

Table 4: Number of children of respondents.

Number range	Number	Percentage
1-5	281	61.35
6-10	13	2.84
Above 10	6	1.31
Non	160	34.06

Table 4 indicated the respondents' number of kids, two hundred and eighty-one, 281 (61.35%) had one to five (1-5) kids, thirteen, 13 (2.84%) had about six to ten (6-10) kids, six, 6 that is one point three one percent (1.31%) had children above ten, 10 and one hundred and sixty, 160 (34.06%) have no children. Table 5 showed that out of the four hundred sixty (460) respondents only twenty-four, 24 (5.14%) never used incense bakhour whereas four hundred and thirty-six, 436 (94.86%) use it in the range of thirty-two, 32 (6.85%), one hundred and twenty, 120 (25.70%), one hundred and twenty-three, 123 (26.34%) and one hundred and sixty-one, 161 (35.97%) for rarely, sometimes, mostly and always respectively. On the other hand; only seventy-two, 70 (15.18%) never used it on body and clothes while eighty-seven, 87 (18.87%), seventy-six, 76 (16.49%), one hundred and fourty six, 146 (31.24%) and eighty-one, 81 (17.59%) use it on body and clothes for always, usually, sometimes and rarely respectively. One hundred and ninety-six, 196 (42.76%) do not react to the smoke whereas twenty-four, 24 (5.18%), twenty-two, 22 (4.75%), one hundred and two, 102 (22.03%), one hundred and sixteen, 116 (25.05%) making up fifty-seven point two four (57.24%) react to the smoke in the range always, usually, sometimes and rarely respectively.

Table 5: Incense use of respondents and their reactions to it.

Use of Incense frequency	Number of respondents use at home	Percentage	Number of respondents use on body and clothes	Percentage	Number of respondents reactions	Percentage
Always	161	36	87	18.87	24	5.18
Usually	123	26.34	76	16.49	22	4.75
Sometimes	120	25.70	146	31.24	102	22
Rarely	32	6.85	81	17.57	116	25
Never	24	5.14	70	15.18	196	43

Table 6: Frequency of incense burning by respondents.

Frequency	Number	Percentage
Once	218	46.8
Twice	139	30
Thrice	20	4.3
More than thrice	18	3.9
Nil	65	13.8

Table 7: Duration of usage of incense by respondents.

Duration of usage	Number	Percentage
6 months	2.8	13
1 year	3.5	16
3 years	6.0	28
5 years	7.1	33
More than 5 years	71.7	333
Nil	8	35

Consequently; in Table 6; two hundred and eighteen, 218 (46.78%) burnt it once a day, one hundred and thirty-nine, 139 (29.83%) twice a day; twenty, 20 (4.29%) thrice a day, eighteen, 18 (3.86%) more than thrice a day, sixty-five, 65 (13.8%) for nil while others once or twice in two, 2 weeks, some once a week, some not all day and some rarely; make up seven, 7 (1.50%). Furthermore;

Table 8: Amount in grams of incense burnt in a day.

Weight burnt in grams	Number	Percentage
Less than 10	206	44.9
11-20	108	23.5
21-30	34	7.41
Above 30	26	5.6
Nil	86	17.43

Table 7 displayed the duration of usage of respondents as follows; 6 months-thirteen, 13 (2.81%), 1 year-sixteen, 16 (3.46%), 3 years-twenty eight, 28 (6.05%), 5 years-thirty three, 33 (7.13%), more than 5 years-three hundred and thirty three, 333 (71.71%) and others that form thirty five, 35 (8%) out of the total noted that they used it all their life, some as long as they can remember, some more than twenty, 20 years, someone responded she used it for

more than ten, 10 years, another eighteen, 18 years and is now their culture and some respondents went into business. Table 8 showed that the rate of consumption in grams daily include two hundred and six, 206 (44.88%) less than ten grams (10 gm), one hundred and eight, 108 (23.53%) 11-20 gm, thirty-four, 34 (7.41%) burn up to 100 gm, while others eighty-six, 86 (17.43%) were not sure and twenty-six, 26 (5.66%) burn more than 30 gm.

Table 9: Respondents respiratory conditions and their family members.

Respiratory conditions	Number of respondents	Percentage	Number of respondents family	Percentage
Asthma	40	8.47	126	25.3
Bronchitis	11	2.33	22	4.4
Allergic Rhinitis	70	14.8	86	17.3
Others	26	5.5	22	4.4
Nil	315	68	202	48.6

Meanwhile Table 9 indicated that forty, 40 (8.47%) suffer from asthma, eleven, 11 (2.33%) has bronchitis, seventy, 70 (14.9%) have allergic rhinitis, others including headache twenty-six, 26 (5.51%) and three hundred and fifteen, 315 (68.01%) had no respiratory conditions. In a similar vein, one hundred and twenty-six, 126 (25.30%) of the respondent's family members have asthma, twenty-two, 22 (4.42%) have bronchitis, eighty-six, 86 (17.27%) have allergic rhinitis, twenty-two, 22 (4.42%) unspecified and two hundred and two, 202 (48.59%) had no respiratory conditions. Lastly Table 10 displayed three hundred and twelve, 312 (67.97%) were not aware about its adverse effect where as one hundred and fourty five, 145 (31.59%) claim to know some of its adverse effects.

Table 10: Respondents awareness on incense adverse effects.

Options	Number	Percentage
Yes	145	32
No	312	68
Others	2	0.44

DISCUSSION

Taking Table 1 into consideration; a different study explained the frequency of current incense use was similar in men seventy-seven point five percent (77.5%) and women seventy-six point five percent (76.5%).[11] probably because in our community, the women use it traditionally at home to secure the envisaged scent not for religious purposes in the temple. In Table 2; similar reports from people at different ages reported frequencies of current incense use; but use was more frequent among Hokkien eighty percent (80%) than Cantonese seventy-three point four percent (73.4%) of the study subjects.[11] Most of the respondents are at their marital stage and so 30-39 years became the highest frequency as most of them use it at home. From Table 4, another study of brain tumour in children showed an increased risk to children whose parents burned incense in the home was observed and another on four hundred and fourteen, 414 children aged zero point seven to thirteen (0.7-13) years in Qatar, the burning of incense was found to be a contributing factor in astigmatic incidences.[12,13]

Consequently; Table 5 displayed a contrast from incense use was associated with an increased risk of carcinoma of the upper respiratory track other than the nasopharynx. The increase risk association was dose-dependent, with high risk for long-term.[11] However; exposure to incense burning for only twice monthly was not associated with a decline of forced vital capacity and forced expiratory volume (FVC and FEV). The multivariable linear regression analysis showed that the association with the incense smoke exposure was independent of other tested parameters and exposure indications in over 70% of participants reported exposure to incense burning at home and those with daily exposure had however FVC and FEV in a study conducted by Chen et al in 2016. Table 6 compared to non-users, daily users with more than 40 years of incense exposure had a statistically significant seventy percent (70%) increase in risk of non-NPC upper respiratory tract carcinoma (95% CI) which concludes individuals who used incense during the day or 'at all times' had a relative risk of 2.1.[11] Furthermore; Table 8 explained a report that correlated with a study conducted in Geneva, Switzerland, a church was insulated to reduce the heating cost and after 3 years the church room was more discoloured than previously after 10-12 years. It was found to be soot from the burning of candles and incense and the annual consumption of incense used during the high mass was one kilogram (1 kg). The smoke emitted from the incense calculated on basis of laboratory simulations to one hundred and ninety-two 192 gm/year corresponding to 192 mg/gm of incense which points that the examination of the soot and estimations of the smoke formation showed the soot was mainly caused by the incense.[14]

Consequently; Table 9 stipulated a similar study of reported by Omar et al, 2441 surveyed children in Oman (2 regions); about fifteen percent (15.4%) had current asthma.[15] Bakhour exposure more than twice a week was three times more likely to affect child breathing compared to non bakhour use and this effect was two point five five times (2.55X) higher in asthmatics than

non-asthmatics; another epidemiological study, a correlation between the use of incense and leukaemia in children was found and an increased risk of leukaemia was observed in children whose parents burned incense during pregnancy and while attending the newly born.[16,17] Unfortunately; it was indicated in Table 10 that in a similar vein, authors argued that coughing may be related to formaldehyde which is measured in Chinese incense and also refer to studies that show connection between formaldehyde and coughing.[18-20] Finally; in a study on the influence of several factors on respiratory illnesses and symptoms, 4000 children from Taiwan, coughing was found to be associated with burning of incense.[21]

The limitations of this study include problems of diagnostic accuracy, its only observational epidemiologic and does not cover follow up on diseased conditions records and death certificates. It also involves no records of migration and travel of immigrants from areas of study and ecological fallacy. There is another limitation of not venturing into cohort study and whether or not the respondents are inhaling the same type of bakhour burnt with different or same release of contents. Furthermore, this study compiled responses after the act of using the incense has already and still been done by different categories of people across different locations, they are not enough to match to experimental studies for preventing and predicting adverse health effects alongside bias.

CONCLUSION

It can therefore be concluded that the use of incense in the northern part of the country is on the high side (94.86% out of 460 respondents) both in frequency and dose-wise which poses as a serious health condition to its users due to the contents of the incense like aldehyde, styrene, xylene, benzofuran among others. The mutagenic activity is believed to be caused by the combustion products from the included materials in incense. This study showed that the aerosol emission from one piece of incense was comparable to the aerosol emission from 0.5 to 4 cigarettes. This causes emission of volatile compounds that may reach uncovered skin and cause contact dermatitis especially for those that use it on their body. Majority of the users are not aware of its adverse effects and some even argue that it has absolutely no effect. As children are at higher risk due to the young age and early prolonged exposure; most users do not take any precautions to the presence of their kids and burn it as they please; even though the incense is not reported to cause any respiratory ailment but may trigger the development of several ailments on the long run.

Recommendations

It is strongly recommended that the incense users burn a maximum of 1g daily and in an empty area where it can be occupied after the smoke has dissipated and users should also use it not more than once a day followed by proper ventilation as the experience is that sufficient amounts of the fragrances containing the envisaged odorous effects still remain in the air. It is also recommended to study further like post mortem of people that have been known to be chronically exposed for a very long time or cohort studies of users in the country to discover more facts about its health risk assessment. There should be the necessity for public policies to be put in place to raise awareness on the health risks implicated with this traditional practice and taking of foods high in anti-oxidants to counteract the effect of the reactive oxygen species.

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REFERENCES

1. Sousa Basto A, Azenha A. Contact dermatitis due to incense. Cont Dermat. 1991;24(4):312-3.
2. Hayakawa R, Matsunaga K, Arima Y. Depigmented contact dermatitis due to incense. Cont Dermat. 1987;16(5):272-4.
3. Liou SH, Cheng SY, Lai FM, Yang JL. Respiratory symptoms and pulmonary function in mill workers exposed to wood dust. Am J Industr Med. 1996;30(3):293-9.
4. McBride SJ, Ferro AR, Ott WR, Switzer PA, Hildemann LM. Investigations of the proximity effect for pollutants in the indoor environment. J Expos Sci Environ Epidemiol. 1999;9(6):602-21.
5. Jetter JJ, Guo Z, McBrian JA, Flynn MR. Characterization of emissions from burning incense. Sci Tot Environ. 2002;295:51-67.
6. Dossing M, Khan J, Al-Rabiah F. Risk factors for chronic obstructive lung disease in Saudi Arabia. Respir Med. 1994;88:519-522.
7. Koo LC, Ho JH. Diet as a confounder of the association between air pollution and female lung cancer: Hong Kong studies on exposures to environmental tobacco smoke, incense, and cooking fumes as examples. Lung Cancer. 1996;14:S47-61.
8. Lo HW, Hsu SC, Hung MC. EGFR signalling pathway in breast cancers: from traditional signal transduction to direct nuclear translocalization. Breast Cancer Res Treat. 2006;95(3):211-8.
9. Ger LP, Liou SH, Shen CY, Kao SJ, Chen KT. Risk factors of lung cancer. J Formos Med Assoc. 1992;91:S222-31.
10. Dawod ST, Hussain AA. Childhood asthma in Qatar. Ann Allerg Asthma Immunol. 1995;75(4):360-4.

11. Tuan YF. Topophilia: A study of environmental perception, attitudes, and values. Columbia University Press; 1990.
12. Friborg JT, Yuan JM, Wang R, Koh WP, Lee HP, Yu MC. Incense use and respiratory tract carcinomas: a prospective cohort study. Cancer Interdiscipl Int J Am Cancer Soc. 2008;113(7):1676-84.
13. Preston-Martin S, Yu MC, Benton B, Henderson BE: N-nitroso compounds and childhood brain tumours: a case control study. Cancer Res. 1982;42(12):5240-5.
14. Chen Y, Ji S, Chen C, Peng Q, Wang D, Li Y. Single-atom catalysts: synthetic strategies and electrochemical applications. Joule. 2018;2(7):1242-64.
15. Huynh CK, Sarolainen H, Vu-Duc T, Guillemin M, Iselin F. impact of thermal proofing of a church on its indoor air quality. The combustion of candles and incense as source of pollution. Scientific Total Environment 102: 241-251 in the toxicity of airborne fine particulate matter. Chem Res Toxicol. 1991;14:1371-7.
16. Omar AA, Abdullah AA, Bazdawi MA. Home of exposure to Arabian incense (bakhour) and asthma symptoms in children: a community survey in 2 regions in Oman. BMC Pulmon Med. 2009;9:23.
17. Lowengart RA, Peters JM, Cicioni C, Buckley J, Bernstein L, Preston-Martin S, et al. Childhood leukaemia and parents occupational and home exposures. J Nat Cancer Inst. 1987;79:39-46.
18. Van Steensel-Moll HA, Valkenberg HA, Van Zanen GE. Childhood leukaemia and parental occupation. Am J Epidemiol. 1985;121:216-24.
19. Way TD, Kao MC, Lin JK. Degradation of HER2/neu by apigenin induces apoptosis through cytochrome c release and caspase-3 activation in HER2/neu-overexpressing breast cancer cells. Febs Letters. 2005;579(1):145-52.
20. Danghbjerg P. Is a particle board in the home detrimental to health? Environ Res. 1989;48:154-63.
21. Sischo L, Broder H. Oral health-related quality of life: what, why, how, and future implications. J Den Res. 2011;90(11):1264-70.
22. Yang CY, Chiu JF, Cheng MF, Lin MC. Effects of Indoor environmental factors on respiratory health of children in a subtropical climate. Environ Res. 1997;75:49-55.

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APPENDIX

Questionnaire design using SurveyHeart:

Most houses in the northern part of the country burn incense bakhour (Arabic name given to incense) and has now become cultural practice on clothes and even bodies. However, its health risk assessment has rarely been studied. This study aims to review the rate of incense consumption in the northern part of Nigeria and some of its adverse effects on the histology of alveolar cells. This survey is being conducted by a researcher at Kaduna State University Nigeria, it will help her assess the rate of consumption of Bakhour and its association with respiratory problems like asthma, bronchitis and allergic rhinitis aside other findings. As with all knowledge networks surveys, your response to this survey is completely voluntary and you will not be individually identified and your response will be used for statistical purposes only. If you have questions about your right as a participant in this survey or are dissatisfied at any time with any aspect of the survey you may contact the Human Research Committee of Kaduna State. Thank you very much as you attempt to support this research and respond to the Questions that follow:

Please tick the suitable answer

1. What is your age range
    - 10-19
    - 20-29
    - 30-39
    - 40-49
    - Above 50
2. What is your gender
    - Male
    - Female
3. What is your marital status?
    - Single
    - Married
    - Divorced
4. How many kids do you have?
    - 1-5
    - 6-10
    - Above 10
    - Non
5. Do your house hold use incense?
    - Rarely
    - Sometimes
    - Mostly
    - Always
    - Never

6. Is the incense used on clothes and body in your house hold?
    - Always
    - Usually
    - Sometimes
    - Rarely
    - Never
7. If yes to any or both of the above 2 questions? How often do you burn in a typical day
    - Once
    - Twice
    - Thrice
    - More than thrice
    - Nil
8. How long have you been using the incense bakhour?
    - 6 months
    - 1 year
    - 3 years
    - 5 years
    - More than 5 years
    - Nil
9. Can you estimate in grams the amount you burn in a typical day
    - Less than 10grams
    - 11-20grams
    - 21-30grams
    - Above 30grams
    - Nil
10. Do you suffer from any respiratory conditions like
    - Asthma
    - Bronchitis
    - Allergic rhinitis
    - Others
    - Nil
11. Does any of your family member suffer from any respiratory conditions like
    - Asthma
    - Bronchitis
    - Allergic rhinitis
    - Others
    - Nil
12. Are you aware about its adverse effects on the lungs and/or body system?
    - Yes
    - No

13. Do you react to the smoke of the incense after inhalation?
    - Always
    - Usually
    - Sometimes
    - Rarely
    - Never