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Knowledge and Awareness on Fumigation of Operation Theaters among Dental Undergraduates

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Disinfectants play a vital role in global infection control as a crucial weapon against the transmission of nosocomial pathogens/infections combating global disease outbreak. Because of the multifactor causation of infections the environment of operation theatre plays a great role in the onset and spread of infections. As in this advancing medical era, the microbial contamination of the hospital environment, especially the operating theatre, intensive care units had continued an increased prevalence of nosocomial infection. The people who are at risk do not only involve the patients but the health professions including the nurses as well. The aim of this study was to provide and assess knowledge on fumigation of operation theatres among the dental undergraduates. A cross-sectional study was conducted online with a pre-structured questionnaire containing 10 questions among the 100 undergraduates. Persistent data were extracted and analyzed using SPSS software by IBM. A total of 100 undergraduates attended the online survey among which 78.8% were interns followed by 12.12% and 9.1% of third years and final year dental undergraduates respectively. The most commonly used fumigants opted by the participants were predominantly of formaldehyde with 89% followed by phosphine 9%. Regarding the methods of

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fumigation, awareness on the electric boiler fumigation method and potassium permanganate method was predominantly high among the interns with 58.9% and 84.62% respectively. Within the limits of this study, formaldehyde was the predominantly opted type of fumigant. The potassium permanganate method of fumigation was predominantly known among the participants when compared to the electric boiler fumigation method. However, the majority of participants were unaware of the emerging compounds named Virkon and Bacillocid Rasant. These were assessed along with other factors like awareness of ammonia neutralization and also the risk involved in the fumigation process.

Keywords: Fumigation; formaldehyde; neutralisation; Virkon; Bacillocid Rasant.

1. INTRODUCTION

Disinfectants play a vital role in global infection control as a crucial weapon against the transmission of nosocomial pathogens/infections combating global disease outbreak. Because of the multifactor causation of infections the environment of operation theatre plays a great role in the onset and spread of infections. Wound infections are the second most prevalent cause of hospital-acquired infectious disease. Nosocomial infections are caused owing to the use of tainted antiseptic solutions capable of processing infectious microorganisms such as Pseudomonas aeruginosa as well as Klebsiella species [1]. These complications of surgical procedures cause considerable morbidity and it can also lead to mortality as high as 77% when it occurs deep at the site of the procedure [2]. As in this advancing medical era, the microbial contamination of the hospital environment, especially the operating theatre, intensive care units had continued an increased prevalence of nosocomial infection. The people who are at risk do not only involve the patients but the health professions including the nurses as well [3].

We can control a major part of exogenous infections by maintaining a sterile environment in the operation theater. Fumigation is an old age process of sterilization and has been an accepted method of sterilization for areas where microbiological cleanliness is required. Formaldehyde vapor fumigation is the most widely used process due to its cost-effective technique. The sanitizers used in hospitals ought to be newly prepared and of sufficient strength [4].

It has been indicated that formaldehyde should be handled only in the workplace as it is a potential carcinogen and an employee exposure standard for formaldehyde has to be set that limits an 8-hour time-weighted average exposure concentration of 0.75 ppm [5]. Formalin is commercially available as a 40% solution of formaldehyde in water. When formalin is heated, formaldehyde vapor is generated [6]. Formaldehyde fumigation has been accepted as a method of disinfection for operation theatres (OT) and critical care units in developing countries because of its cost-effective nature but due to their potential carcinogenic and irritant nature, we may opt for other agents such as hydrogen peroxide, hydrogen peroxide with silver nitrate, peracetic acid and other like quaternary ammonium compounds [7]. The most effective method to prevent exposure to formaldehyde is to substitute a safer, less toxic highly penetrating disinfectant. Many other compounds are emerging for safer use in the field. Another such emerging compound used for the sterilization of the operating theaters is Bacillocid and Virkon. Due to emerging new microbial trends and nosocomial infections, it is very essential for dental students to have a comprehensive understanding about fumigation processes of their clinical setups.

Previously our department has published extensive research on various aspects of prosthetic dentistry [8–18], this vast research experience has inspired us to research about the Awareness and knowledge on fumigation of operation theatres. The aim of this study was to provide and assess knowledge on fumigation of operation theatres among the dental undergraduates.

2. MATERIALS AND METHODS

The present study is an online survey conducted among dental undergraduates. The participants were 3rd, 4th, and internship dental undergraduate students. Questionnaires were prepared and distributed among the dental undergraduates through an online link. A total of 100 undergraduate students attended the survey. Participation in this survey was voluntary.

Its dependent variables include the compounds for fumigations, methods and risks whereas its independent variables include age and gender of the participants. The collected data included age, gender, year of study, and the questions.

The collected results were entered in Microsoft excel. Data analysis was done using SPSS software 20.0. Statistics used for analysis were descriptive statistics and comparison of variables was done using the chi-square test. The results were expressed in percentages.

3. RESULTS AND DISCUSSION

A total of 100 undergraduates attended the online survey among which 78.8% were interns followed by 12.12% and 9.1% of third years and final year dental undergraduates respectively (Fig. 1). The most commonly used fumigants opted by the participants were predominantly of formaldehyde with 89% followed by phosphine 9% (Fig. 2). Regarding the methods of fumigation, awareness on the electric boiler fumigation method was predominantly high among the interns (58.9%) followed by 3rd years (33.33%) (Fig. 3) and the awareness on the potassium permanganate method was also predominantly high among the interns (84.62%) followed by 3rd years (66.7%) and final years (60%) (Fig. 4). Only 13% of the participants were aware of the ammonia neutralization step in the fumigation process (Fig. 5). When questioned on the awareness of newly emerging fumigants, Virkon was predominantly known among the interns (30.7%) followed by 3rd years (8.3%) and it was found to be statistically significant with a P-value <0.05 (Fig. 6). Awareness of Bacillocid Rasant was also predominantly high among 39.7% of the interns followed by 33.3% of 3rd years and 30% of final yrs (Fig. 7). However, the majority of the participants were unaware of the emerging compounds named Virkon and Bacillocid Rasant. According to the year of study, 97.4% of the interns were aware of the risk involved in the fumigation process followed by 3rd years (75%) and final yrs (70%) (Fig. 8).

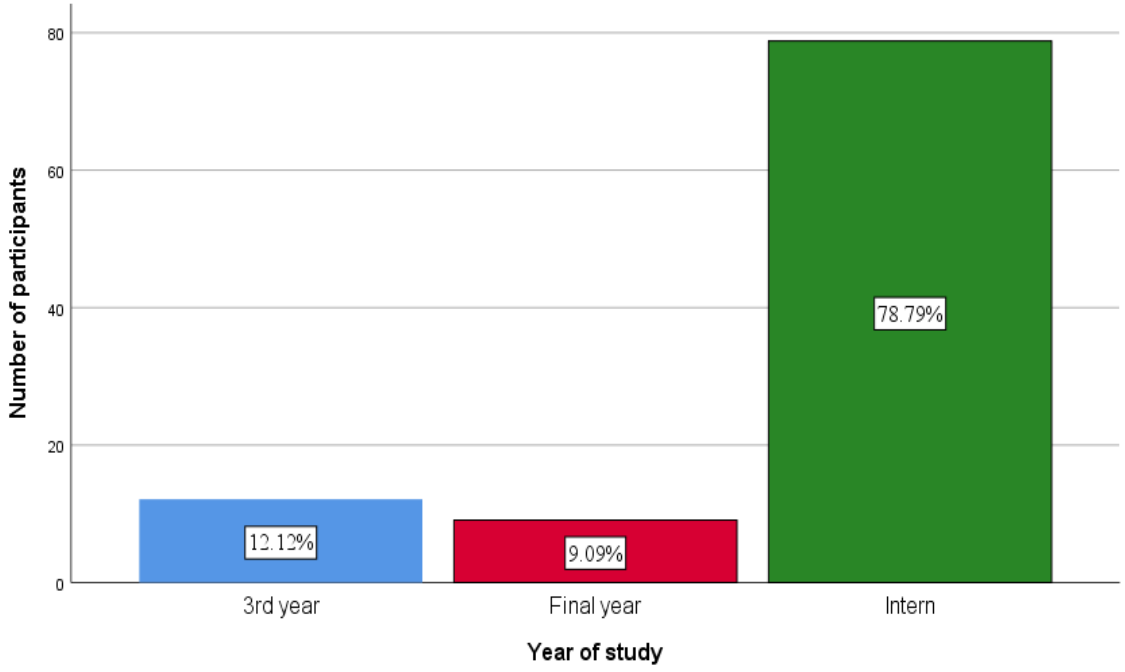

Fig. 1. Bar chart representing the distribution of survey participants based on the year of study. X axis represents the year of study and Y-axis represents the number of participants in terms of percentage. Predominantly noticed group of participants were interns followed by third years and then final years

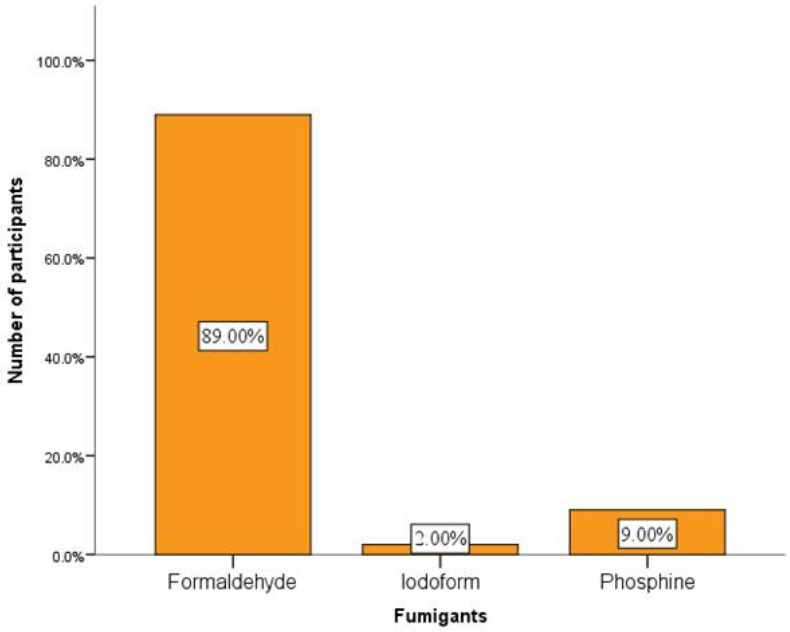

Fig. 2. Bar chart representing the distribution of commonly used types of fumigants. X axis represents the types of fumigants and Y axis represents the number of participants in terms of percentage. The prevalence of formaldehyde as the most common fumigant was predominantly opted by the participants followed by phosphine

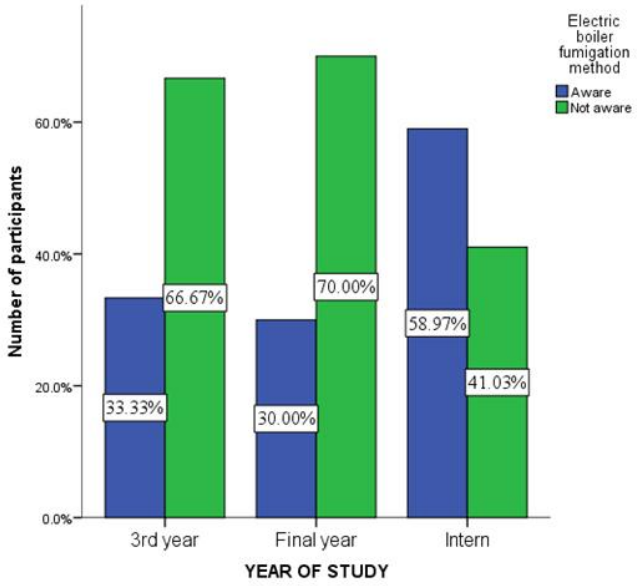

Fig. 3. Bar chart denotes the association of the awareness of the electric boiler fumigation method among the participants based on the year of study. X axis denotes the awareness of the electric boiler fumigation method among the participants based on the year of study and Y axis denotes the number of participants. The awareness of the electric boiler fumigation method was predominantly high among the interns followed by 3rd years. However, the association between the year of study and the awareness of the electric boiler fumigation method was found to be not statistically significant with a P-value >0.05. Pearson Chi Square= 1.105, df= 2, P value=0.078 (>0.05)

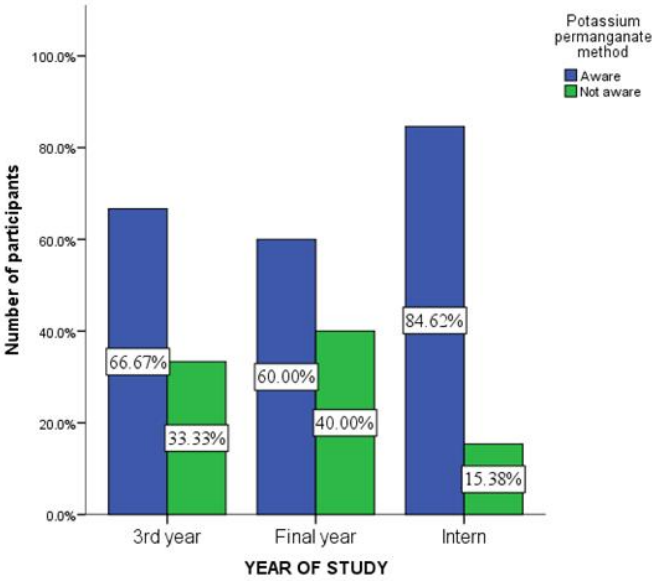

Fig. 4. Bar chart denotes the association of the awareness of the potassium permanganate method among the participants based on the year of study. X axis denotes the awareness of the potassium permanganate method among the participants based on the year of study and Y axis denotes the number of participants. The awareness of the potassium permanganate method was predominantly high among the interns followed by 3rd years and final years. However, the association between the year of study and the awareness of potassium permanganate method was found to be not statistically significant with a P-value >0.05. Pearson Chi Square= 4.872, df= 2, P value=0.088 (>0.05)

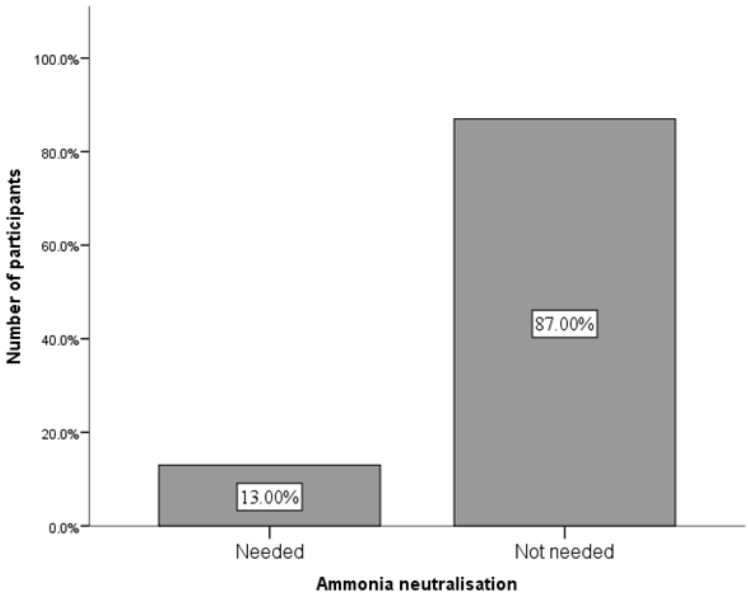

Fig. 5. Bar chart representing the distribution of awareness on the need for ammonia neutralization step in the fumigation process. X axis represents the need for the ammonia neutralization step and Y axis represents the number of participants in terms of percentage. Only 13% of the participants were aware of the ammonia neutralization step in the fumigation process

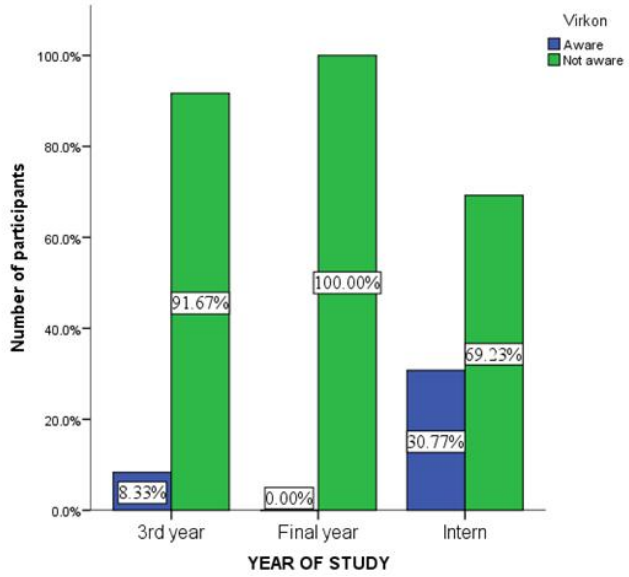

Fig. 6. Bar chart denotes the association of the awareness of Virkon among the participants based on the year of study. X axis denotes the awareness of Virkon among the participants based on the year of study and Y axis denotes the number of participants. The awareness of Virkon was predominantly high among the interns followed by 3rd years whereas the majority of the participants were unaware of Virkon. However, the association between the year of study and the awareness of Virkon was found to be statistically significant with a P-value <0.05. Pearson Chi Square= 6.496, df= 2, P value=0.039 (<0.05)

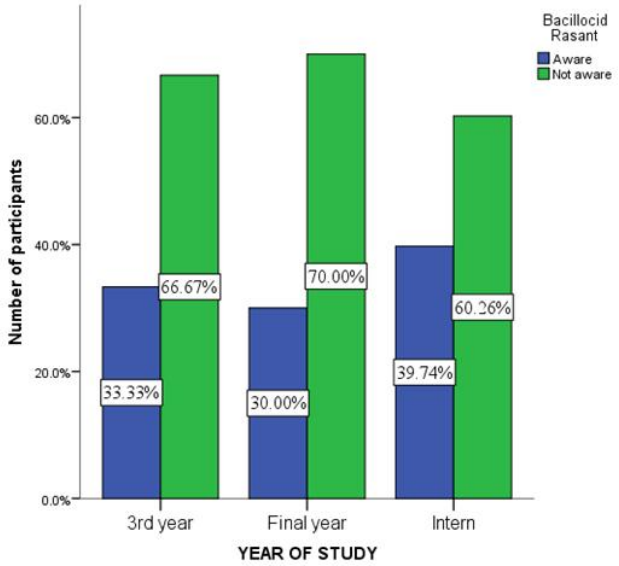

Fig. 7. Bar chart denotes the association of the awareness of Bacillocid Rasant Among the participants based on the year of study. X axis denotes the awareness of Bacillocid Rasant among the participants based on the year of study and Y axis denotes the number of participants. The awareness of Bacillocid Rasant was predominantly high among the interns followed by 3rd years and final yrs. Whereas the majority of the participants were unaware of Bacillocid Rasant. However, the association between the year of study and the awareness of potassium permanganate method was found to be not statistically significant with a P-value >0.05. Pearson Chi Square= 0.483, df= 2, P value=0.785 (>0.05)

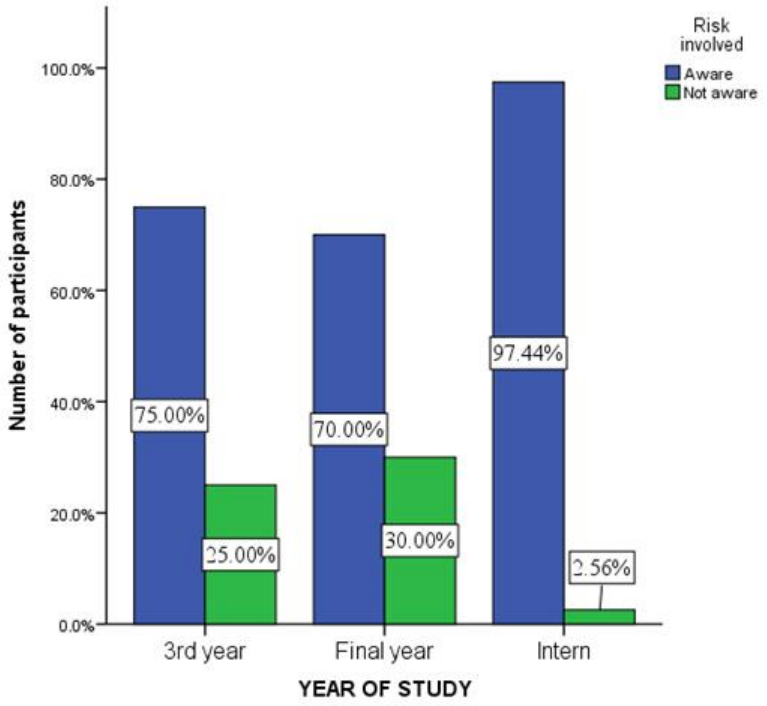

Fig. 8. Bar chart denotes the association of the awareness of the risk involved in the fumigation process based on the year of study. X axis denotes the awareness of the risk involved in the fumigation process based on the year of study and Y axis denotes the number of participants. The awareness of risk involved in the fumigation process was predominantly high among the interns followed by 3rd years and final yrs. However, the association between the year of study and the awareness of the risk involved in the fumigation process was found to be not statistically significant with a P-value >0.05. Pearson Chi Square= 1.909, df= 1, P value=0.167 (>0.05)

A variety of studies have been performed to examine the nature of hospital disinfection and sterilization procedures [19] to tackle particular issues, such as endoscopes, [20] the implementation of standard universal precautions [21,22] or the awareness and attitudes relevant to disinfection/ sterilization and infection control [23–25]. This survey yielded interesting findings regarding knowledge and awareness on fumigation procedure and material used among dental undergraduates.

In the current study formaldehyde was the most commonly opted fumigant by 89% of the participants. Similarly majorly used fumigant was formaldehyde according to a study by Patwardhan et al. [26] and by Fredrick et al. [27].

Stringent asepsis in OTs and ICUs is important to reduce the risk of nosocomial infections, thus reducing their strain. Infectious agents may be spread due to insufficient sterilization of equipment, the existence of pathogenic organisms shedding among hospital workers, the infected atmosphere via air and surfaces. In the current study, 84% of the participants agreed that healthcare providers were at increased risk of nosocomial infections. A similar study by Akhter et al. [28] showed that 72.3% of the respondents agreed that healthcare providers are at risk of getting nosocomial infection.

In the present study majority of the participants were partially unaware of the knowledge on fumigation of the operation theatres. In contradiction to a study by Akhter et al. [28] about 71.0% of the respondents had a good level of knowledge regarding infection control and the rest (29.0%) of them had poor levels of knowledge regarding infection control. Our overall level of knowledge was low compared to the findings of a similar study (>80.0%) [29]. A study reported that there is a need to educate healthcare providers on infection control and prevention measures [30]. Nevertheless, this can only be achieved by understanding the gaps in

knowledge and practice of infection control among healthcare providers.

4. CONCLUSION

Within the limits of this study, formaldehyde was the predominantly opted type of fumigant. Potassium permanganate method of fumigation was predominantly known among the participants when compared to the electric boiler fumigation method. However, the majority of participants were unaware of the emerging compounds named Virkon and Bacillocid Rasant. These were assessed along with other factors like awareness of ammonia neutralization and also the risk involved in the fumigation process. Our data support the need to urge further educational efforts to improve the knowledge and awareness among the students.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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