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**Alagu Rathi Bharathi.A<sup>1</sup>**

**Rakshagan V<sup>2</sup>**

**Dhanraj M. Ganapathy<sup>3</sup>**

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<sup>1</sup>Graduate student, Department of Prosthodontics, Saveetha Dental college, Saveetha Institute of Medical and Technical Sciences, Saveetha university, Chennai, India.

<sup>2</sup>Reader, Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and technical Sciences, Saveetha University, Chennai- 600077.

<sup>3</sup>Professor and Head Department of Prosthodontics, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-77



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**Alagu Rathi Bharathi.A<sup>1</sup>, Rakshagan V<sup>2</sup>, Dhanraj M. Ganapathy<sup>3</sup>**

<sup>1</sup>Graduate student, Department of Prosthodontics, Saveetha Dental college, Saveetha Institute of Medical and Technical Sciences, Saveetha university, Chennai, India.

<sup>2</sup>Reader, Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and technical Sciences, Saveetha University, Chennai- 600077.

<sup>3</sup>Professor and Head Department of Prosthodontics, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-77

\*Corresponding author

Email: 151701043.sdc@saveetha.com<sup>1</sup>, rakshagan.sdc@saveetha.com<sup>2</sup>, dhanraj@saveetha.com<sup>3</sup>

### **ABSTRACT**

**Introduction:** General anesthesia is a state of medically induced coma or unconsciousness. General anaesthetics are drugs that render a patient unresponsive and unconscious, so that the patient is unaware of surgery and does not move or feel pain while it's being carried out. The anaesthetic agent is administered through an intravenous line or the anaesthetic agent may be inhaled through a breathing mask or tube. Inhalation anaesthetics are also known to be found in two forms, gaseous anaesthetics and the volatile anaesthetics. The volatile anaesthetics are liquids at room temperature and need vapourizers to make it suitable for the inhalation purposes.

**Aim:** The present study aimed to assess the knowledge and awareness on inhalation anaesthesia among dental students.

**Materials and Methods:** The present study is an online based survey conducted among the dental students. The participants were from 1st, 2nd, 3rd and 4th years of BDS. Questionnaires were prepared and distributed among dental students through an online link from the survey planet.

**Results and Discussion:** About 62% of the students were well aware of inhalation general anaesthesia. 55% of the students were aware of nitrous oxide as inhalation general anaesthetics. From the results of the survey it is clear that most of the dental students were well aware of inhalation general anaesthesia and also had proper knowledge about its complications.

**Keywords:** general anaesthesia, inhalation anaesthesia, nitrous oxide, innovative technique, innovative technology, dental students.

### **INTRODUCTION**

General anesthesia is a state of medically induced coma or unconsciousness. General anaesthetics are drugs that render a patient unresponsive and unconscious, so that the patient is unaware of surgery and does not move or feel pain while it's being carried out. The anaesthetic agent is administered through an intravenous line or the anaesthetic agent may be inhaled through a breathing mask or tube. As we know there are various classes of anaesthetic agents which include intravenous (IV) anaesthetics, inhalational anaesthetics, IV sedatives, synthetic opioids, and neuromuscular blocking drugs. (1,2)

Each of the anaesthetic classes has their own particular strengths and weaknesses in attaining the primary goal of general anesthesia. Inhalation anaesthetics are also known to be found in two forms, gaseous anaesthetics and the volatile anaesthetics. The volatile anaesthetics are liquids at room temperature and need vapourizers to make it suitable for the inhalation purposes. The most frequently used inhalation anaesthetic gases are halothane, nitrous oxide, isoflurane, sevoflurane, and desflurane. All inhalational anaesthetic agents provide loss of memory and immobility, whereas nitrous oxide provides amnesia, immobility and analgesia. Inhalation anaesthetics are commonly used in combination with intravenous anaesthetic agents. (3–5)

The gold standard method to measure potency is the minimum alveolar concentration (MAC), which can be defined as the minimum alveolar concentration of the inhaled anaesthetic agent, at which 50% of people under inhalation anaesthetic do not move in response to a noxious stimulus. (6). Each additional 0.1 above or below a MAC of 1.0 corresponds to a one standard deviation increase or decrease in dose. 50% of patients will not move at 1.0 MAC and 68% at 1.1 MAC, 95% at 1.2 MAC, and 99.7% at 1.3MAC. The higher the Minimum Alveolar Concentration, the lower the potency of gas is necessary for sedation. Induction speed is regulated by the alveolar concentration which is known as FA in conjunction with the inspired concentration known as FI. The rate at which this ratio approaches 1 is called the speed of induction. (7) Nitrous oxide, also called the "laughing

gas,". It is a non-flammable, odorless, and colorless gas.(3) It has a MAC value of 104%. Unlike other inhalation anesthetics, nitrous oxide has analgesic properties which makes it a more favourable anesthetic option for laboring patients. Postoperative nausea and vomiting are the most adverse effects of inhalation anaesthetics. There have been some studies that show intravenous anaesthesia reduces the risk of adverse effects compared to inhalation anesthesia.(8) .

Most commonly antiemetic agents such as metoclopramide or dexamethasone may be administered to decrease the incidence of nausea and vomiting.(9). Another adverse effect that may occur in the administration of inhaled anesthetic agents is the malignant hyperthermia and it is most commonly seen in the administration of inhaled gas halothane. Patients with heritable alterations between muscular cytosolic concentrations of calcium ions and their proteins, (9,10) may exhibit excessive release of  $Ca^{2+}$  in the skeletal muscles that cause the patients to exhibit symptoms like the hyperthermia, tachycardia, muscle rigidity, hyperkalemia, and metabolic imbalances while being exposed to inhalation anaesthetic agents. (11)

Patients with a known history or family history of MH should avoid volatile inhalation agents and other precipitating agents such as succinylcholine. A few inhalation agents are known to irritate the airways of patients with severe asthma and induce bronchospasm due to the pungent smell on induction, primarily with desflurane and isoflurane. Other agents like sevoflurane can be used in asthmatic patients to help relax the airways on induction as they do not have such pungent smells. (12) Nitrous oxide can cause diffusion hypoxia quickly following discontinuation of the agent. It is recommended that 100%  $FiO_2$  be used to counteract the rapid dilution of  $O_2$  in the alveoli. (13) Nitrous oxide is contraindicated in patients undergoing craniotomies, bowel surgery, intraocular and middle ear surgeries. Nitrous oxide is thirty times more soluble than nitrogen. This leads to the rapid removal of nitrogen in these closed spaces. Nitrous oxide will quickly diffuse into these closed spaces leading to increased pressure/volume in the brain, bowel, eye, and middle ear. In addition, patients with pneumothorax or pulmonary hypertension can have worsening of the pneumothorax and increases in pulmonary hypertension related to the use of nitrous oxide.(14)Our team has extensive knowledge and research experience that has translate into high quality publications (15–30)

The aim of this study is to create awareness about inhalation general anaesthetics among the dental students.

## MATERIALS AND METHODS

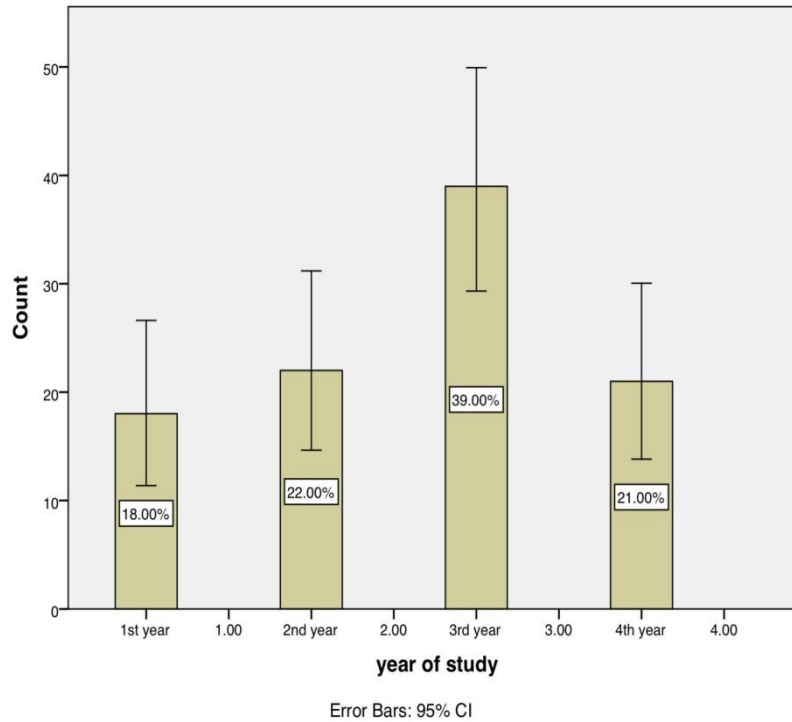
The present study is an online based survey conducted among the dental students. The participants were from 1st, 2nd, 3rd, 4th and Intern years of BDS. Questionnaires were prepared and distributed among dental students through an online link from the survey planet. The total number of participants was 100 dental students. Participation in this study was voluntary. The questionnaire contained 15 questions. Independent variables were demographics such as year of study of participants. Dependent variables were inhalation general anaesthesia, dental students . Only the completed surveys were included for analysis. The collected results were entered in Microsoft excel. Data analysis was done using SPSS software 20.0. Statistics used for analysis was Descriptive statistics and comparison of variables were done using chi square test where  $p < 0.05$ , statistically significant .

## RESULTS AND DISCUSSION

Students from different years participated in the survey. The participants were from the first years (18%) , second years(22%) , third years(39%) and fourth year(21%) dental students (Figure 1). Only About 50% of students were aware that general anaesthesia is a separate medical discipline.(Figure 2). About 71% of students were aware of the differences between the general and the local anaesthesia.(Figure 3). About 70% of the students were well aware of the types of general anaesthesia available and about 30% of the students were not aware of the types of general anaesthesia available. (Figure 4). About 62% of students were aware of the inhalation general anaesthesia, among them 22% of students were from second year and 28% of students were from third year (Figure 13), and about 38% of students were not aware of the inhalation general anaesthesia. (Figure 5). About 55% of students were aware that nitrous oxide is the most commonly used general anaesthetics and about 25% of students consider halothane is the most commonly used general anaesthetics while 20% of students consider isoflurane as the most commonly used general anaesthetics ( Figure 6). About 63% of students were aware of the side effects that may be induced by inhalation anesthetics, among them 22% of students were from second year and 29% of students were from third year (Figure 14), and about 37% of students were not aware of the side effects that may be induced by inhalation anesthetics (Figure 7). About 63% of the students were aware of the complications that may take place due to the usage of nitrous oxide as general anaesthetic and about 37% of the students were not aware of the complications that may take place due to the usage of nitrous oxide as general anaesthetic (Figure 8). About 62% of the students were aware that isoflurane could cause severe asthma and induce bronchospasm and 38% of the students were not aware that isoflurane could cause severe asthma and induce bronchospasm (Figure 9).About 38% of the students prefer intravenous general anaesthetics over inhalation general anaesthetics and about 62% of the students prefer inhalational general anaesthetics over intravenous general anaesthetics (Figure 10). About 71% of the students are aware of conscious sedation and about 29% of the students are not aware of the conscious sedation (Figure 11). About

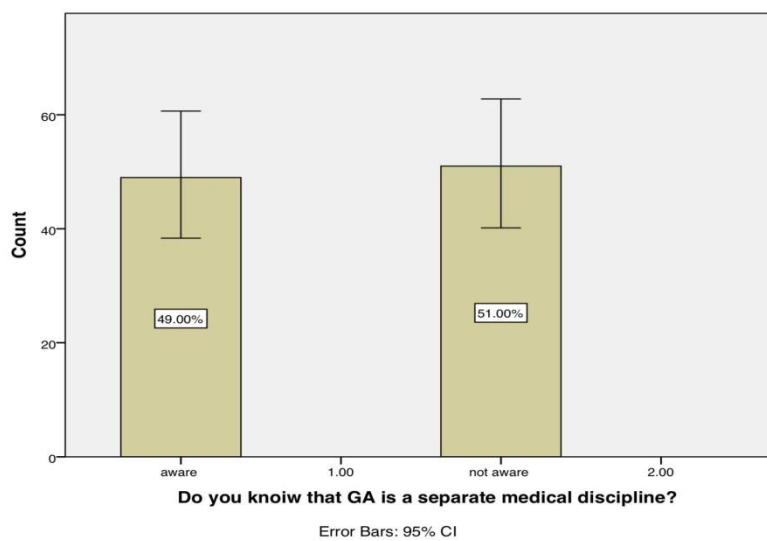
37% of the students prefer conscious sedation over general anaesthesia and about 63% of the students prefer general anaesthetics over conscious sedation (Figure 12).

Our study was carried out with the aim of appraising the attitude and awareness of dentists toward the knowledge on inhalation general anaesthesia and suggest alternative measures to overcome side effects. We can observe that the students were aware of inhalation general anaesthesia . And the students also had proper knowledge about the inhalation general anaesthetics and its complications.



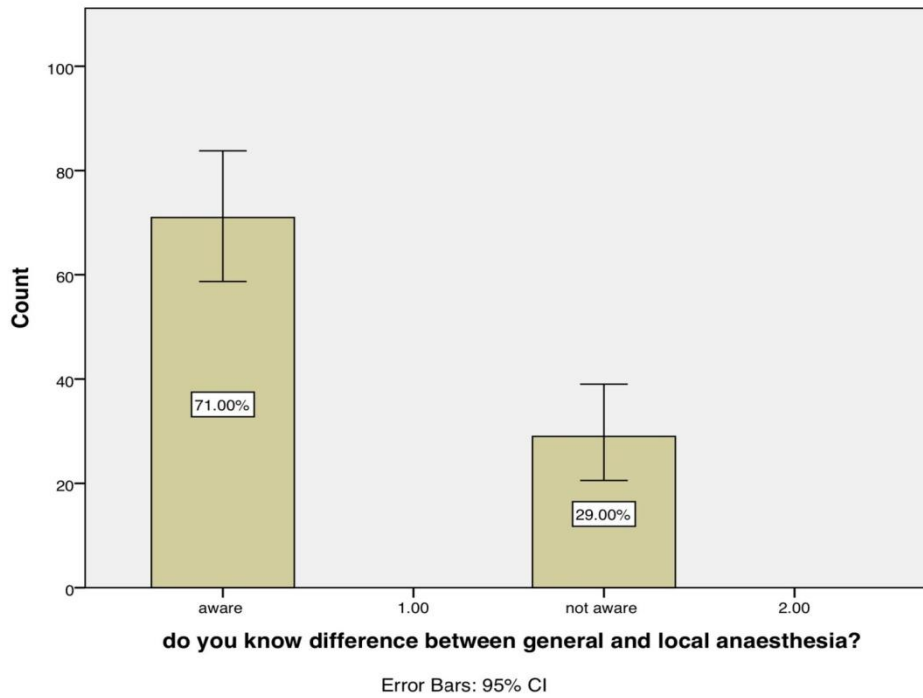
**Figure 1: Bar chart depicting the year of study of the participants of our study**

18% of the students were from the first year of BDS, 22% of the students were from second year of BDS, 39 % of the students were from third year of BDS and 21% of the students were from fourth year of BDS.



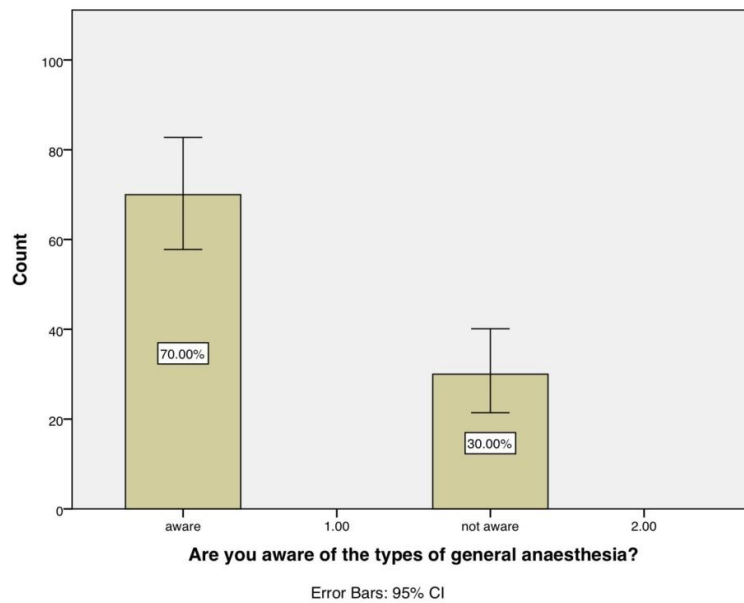
**Figure 2: Bar chart depicting the awareness of the students about general anaesthetics as a separate medical discipline.**

49% of the students were aware that GA is a separate medical discipline and 51% of the students were not aware that GA was a separate medical discipline.



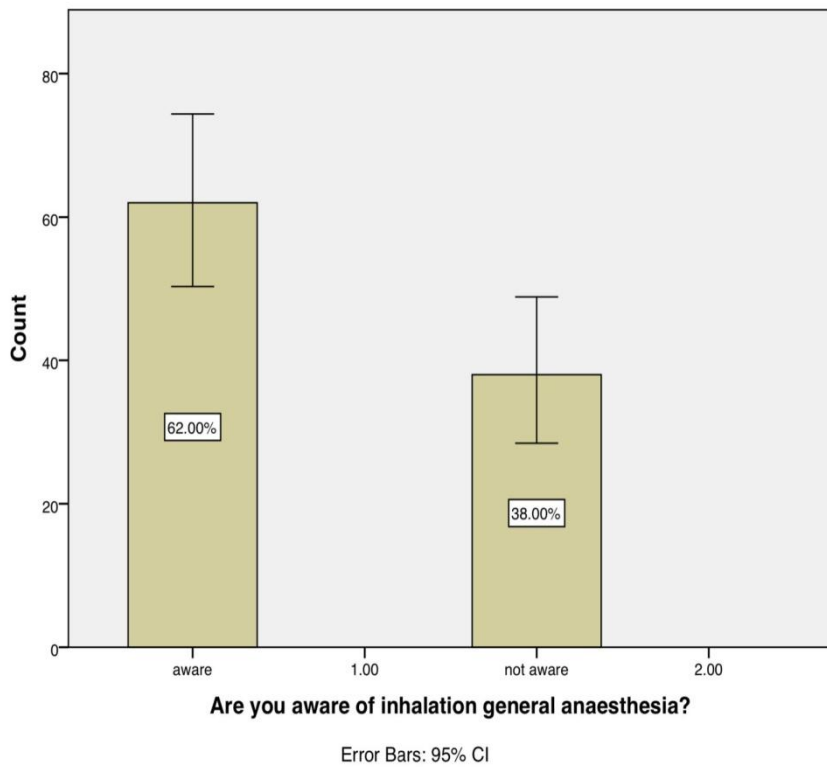
**Figure 3: Pie chart depicting the awareness of the students about the differences between the general anaesthesia and local anaesthesia.**

71 % of the students are aware of the differences between general anaesthesia and local anaesthesia and 29% of the students are not aware of the differences between general anaesthesia and local anaesthesia.



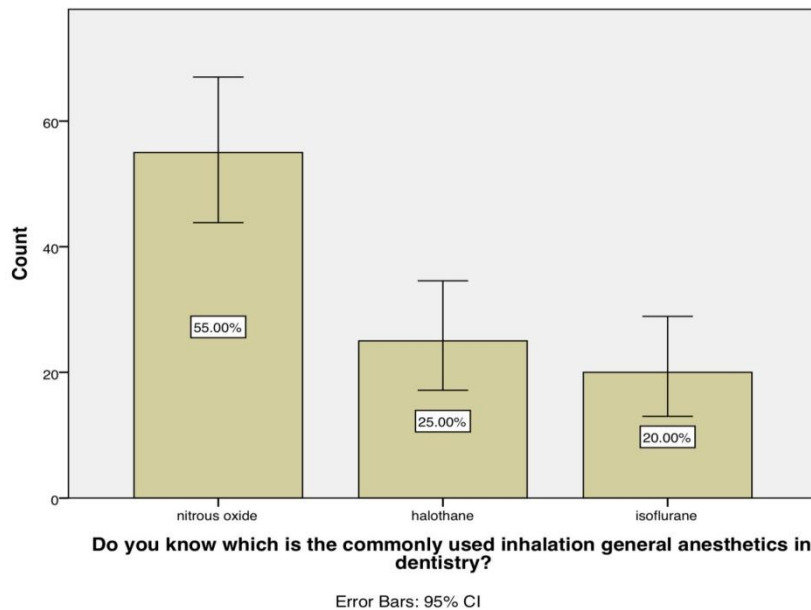
**Figure 4: Bar chart depicting the awareness of students regarding the types of general anaesthesia available.**

70 % of the students are aware of the types of general anaesthesia available and 30 % of the students are not aware of the types of general anaesthesia available.



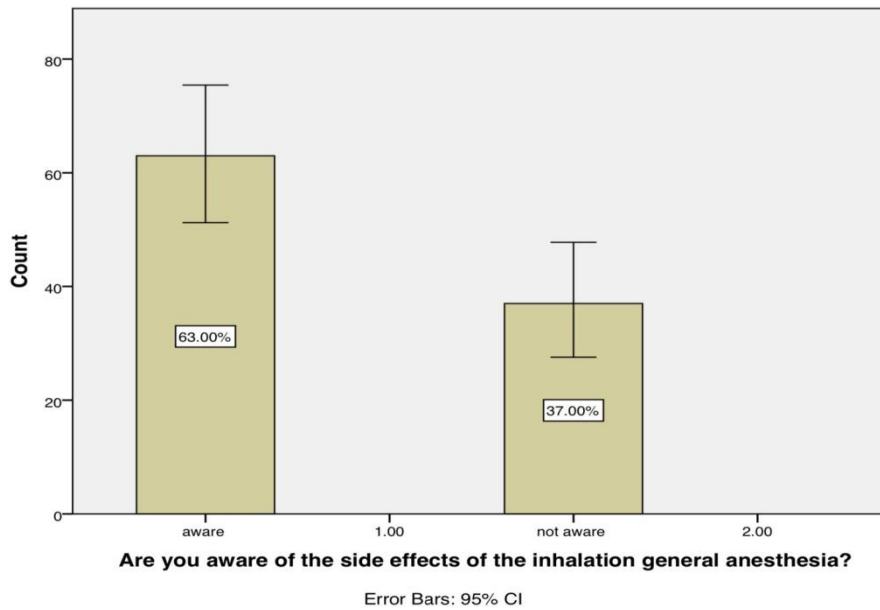
**Figure 5: Bar chart depicting the awareness of the students regarding the inhalation general anaesthesia**

62% of the students are aware of the inhalation general anaesthesia and 38% of the students were not aware of the inhalation general anaesthesia



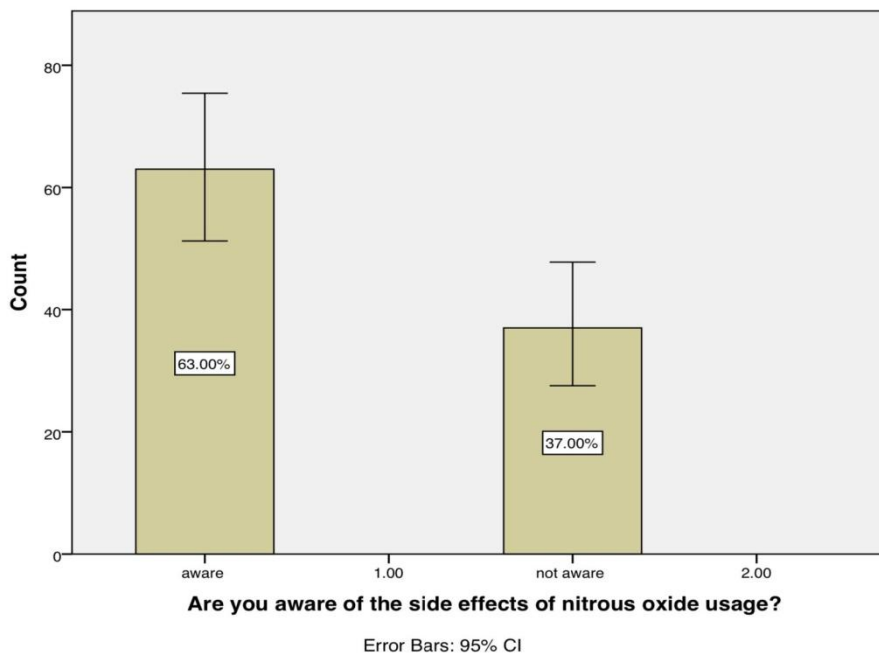
**Figure 6: Bar chart depicting the awareness of students regarding the most commonly used inhalation general anaesthetic.**

55% of the students are aware that nitrous oxide is the most commonly used inhalation general anaesthetics, 25% of the students were aware that halothane is the most commonly used inhalation general anaesthetics and 20 % of the students were aware that isoflurane is the most commonly used inhalation general anaesthetics.



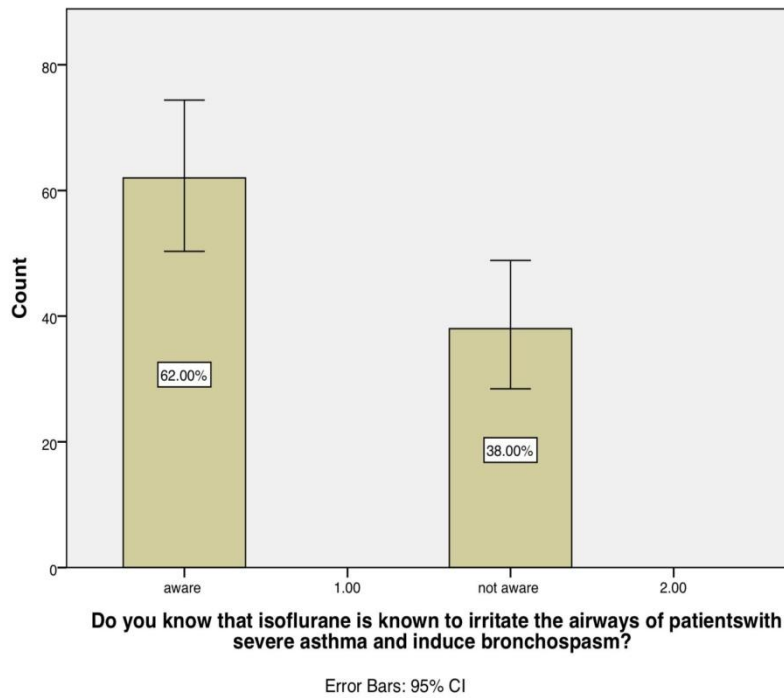
**Figure 7 : Bar chart depicting the awareness of the students regarding the side effects that may be induced by inhalation general anaesthetics.**

63 % of the students were aware of the side effects of the inhalation general anaesthesia and 37% of the students are not aware of the side effects of the inhalation general anaesthesia



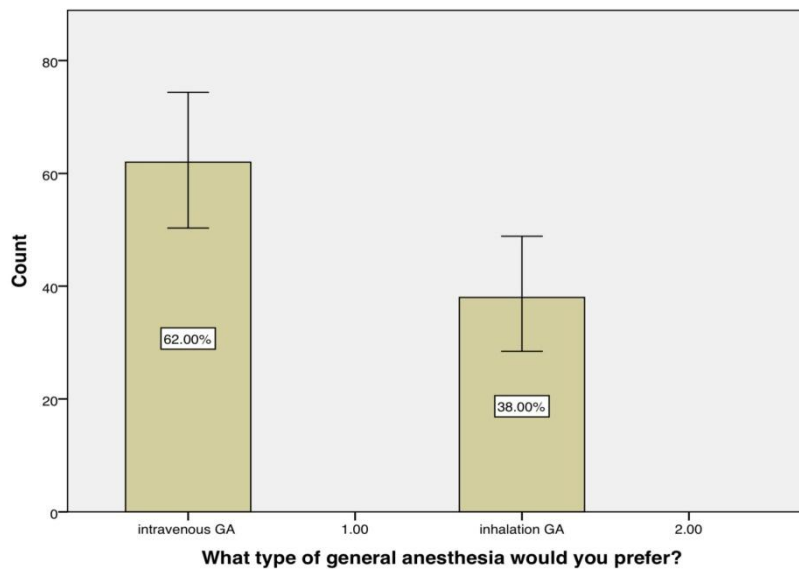
**Figure 8: Bar chart depicting the awareness of the students regarding the complications that may take place due to the usage of nitrous oxide as inhalation general anaesthesia.**

63% of the students are aware of the side effects of nitrous oxide and 37 % of the students are not aware of the side effects of nitrous oxide.



**Figure 9: Bar chart depicting the awareness of the students regarding the complications of isoflurane.**

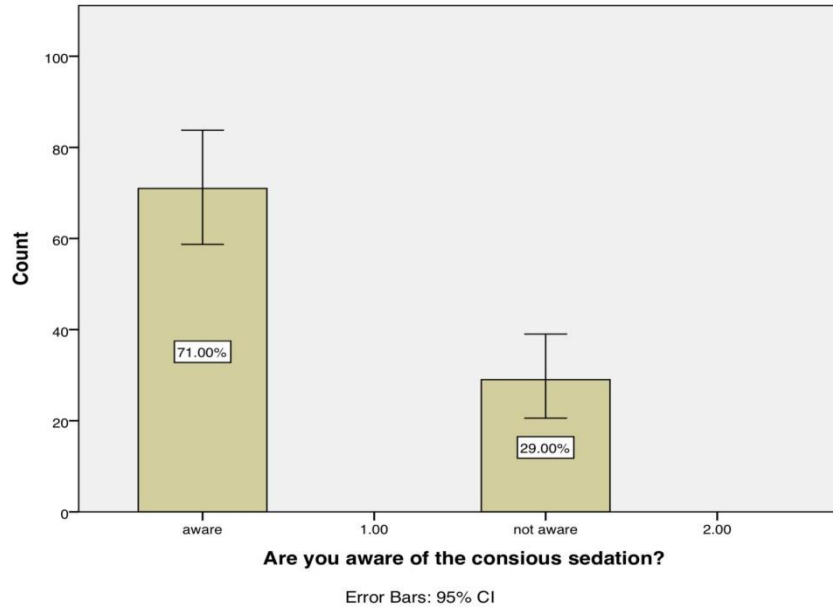
62% of the students were aware of the side effects of isoflurane and 38% of the students were not aware of the side effects of the isoflurane.



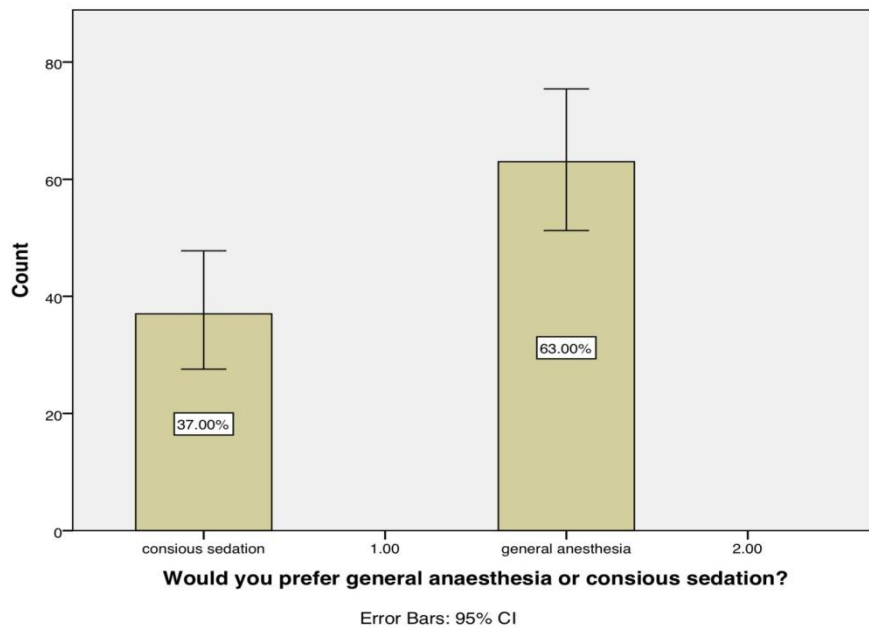
**Figure 10: Bar chart depicting the preferences of the students regarding inhalation general anaesthesia and intravenous general anaesthesia.**

62% of the students prefer intravenous general anaesthesia and 38% of the students prefer inhalation general anaesthesia.





**Figure 11: Bar chart depicting the awareness of the students regarding the conscious sedation.** 71% of the students are aware of the conscious sedation and 29 % of the students are not aware of the conscious sedation.



**Figure 12: Bar chart depicting the preferences of the students regarding the general anaesthetics and conscious sedation.** 37% of the students prefer conscious sedation over general anaesthesia and 63% of the students prefer general anaesthesia over conscious sedation.

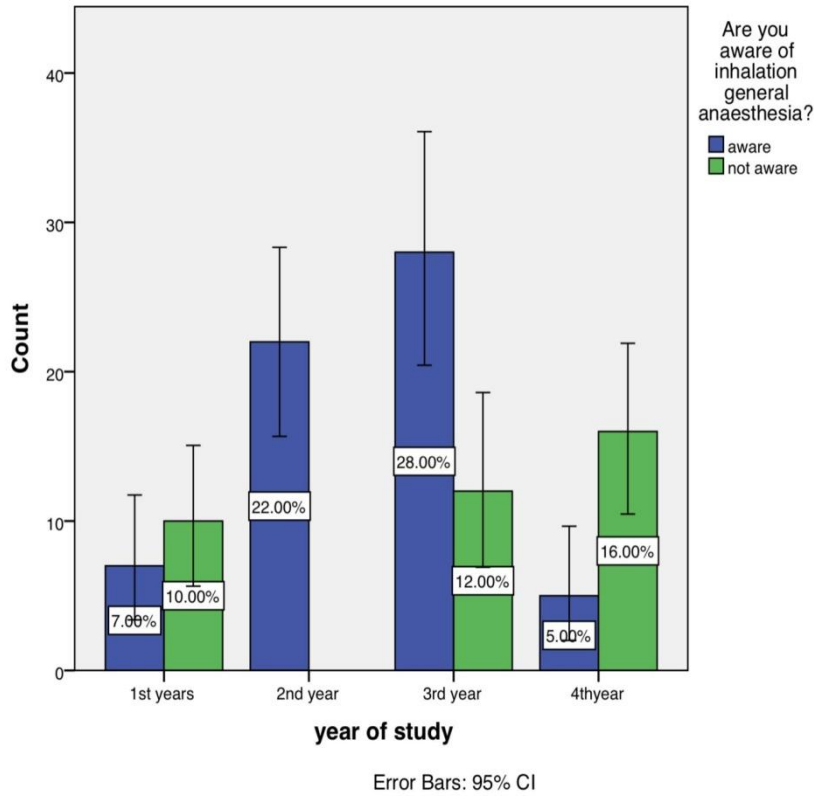


Figure 13: Bar chart depicting the awareness of inhalation anaesthesia.

7% of the first year students were aware of inhalation general anaesthesia, 22% of the second year students were aware of inhalation general anaesthesia, 28% of the third year students were aware of inhalation general anaesthesia and 5% of the fourth students were aware of inhalation general anaesthesia. Chi square test was done, p value found to be statistically significant ( $p < 0.05$ ).

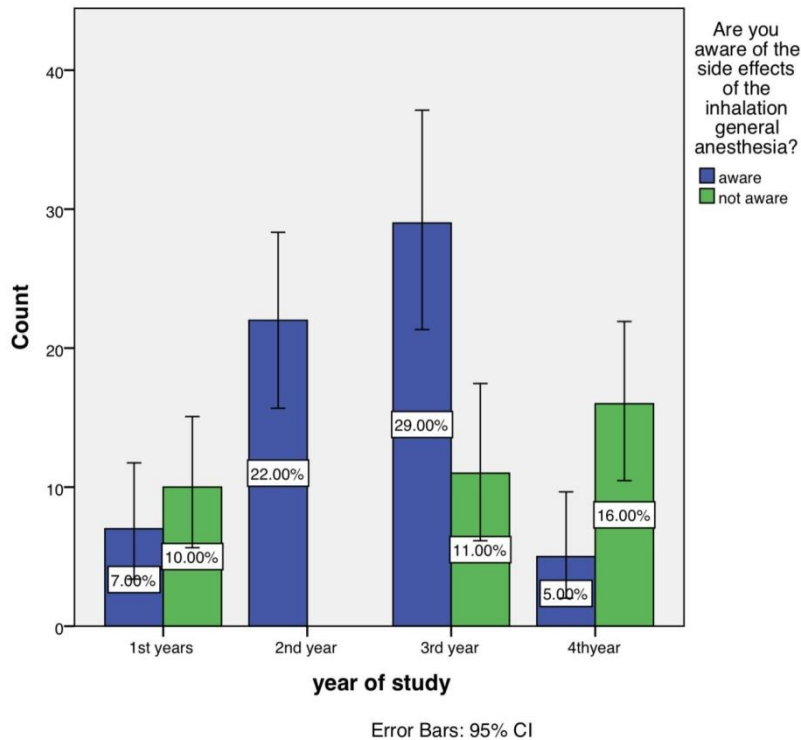


Figure 14: Bar chart depicting the awareness of side effects of inhalation general anaesthesia.

7% of the first year students were aware of side effects of inhalation general anaesthesia, 22% of the second year students were aware of side effects of inhalation general anaesthesia, 29% of the third year students were aware of side effects of inhalation general anaesthesia and 5% of the fourth students were aware of side effects of inhalation general anaesthesia. Chi square test was done, p value found to be statistically significant ( $p < 0.05$ ).

## CONCLUSION

This survey aims to create awareness among dental students about inhalation general anaesthesia. It also creates awareness about Complications of inhalation general anaesthetics. From the results of the survey it is clear that most of the dental students were well aware of inhalation general anaesthesia and also had proper knowledge about the inhalation general anaesthetics and its complications.

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## CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in the present study.

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