Research Article

Knowledge about antibiotic resistance among dental students in Chengalpattu district, Tamil Nadu – A cross-sectional study

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ABSTRACT

Objectives: Antibiotic resistance is rising to dangerously high levels in all parts of the world. New resistance mechanism is emerging and spreading globally, threatening our ability to treat common infectious diseases. Dentists prescribe about 9–11% of all common antibiotics. The aim of this study was to assess the knowledge and attitude of antibiotic resistance among graduating dental students.

Materials and Methods: A cross-sectional study was conducted among 294 participants between November 2019 and December 2019. A structured questionnaire consisting of 14 questions was administered to the dental students. Descriptive analysis of demographic variables was done and knowledge score and attitude score were performed using Kruskal–Wallis H test.

Results: About 85% of the participants suggested amoxicillin as the choice of antibiotic. Among the four domains suggesting the solution for antibiotic resistance, 48% of the final year students suggested avoiding self-medication as a solution, 34% of interns suggested avoiding over dosage, and 48% of the 3rd year students suggested completing the course of antibiotics. A majority of (87%) of the final year students suggested the usage of prophylactic antibiotics in patients with infective endocarditis. The difference in mean change in attitude scores among the groups was statistically significant ($P = 0.028$).

Conclusion: The research showed variable levels of knowledge and attitude about antibiotic resistance among the students of different year of study. The study result insists the need to educate the dental students more regarding antibiotics and their proper use.

Keywords: Antimicrobial resistance, Dentistry, Knowledge

INTRODUCTION

Antimicrobial resistance (AMR) occurs when microorganisms such as bacteria, viruses, fungi, and parasites change in ways that render the medications used to cure the infections they cause ineffective. When microorganisms become resistant to most antimicrobial, they are often referred to as "superbugs." Low-quality medicines, wrong prescriptions and poor infection prevention and control also encourage the development and spread of drug resistance. Lack of government commitment to address these issues, poor surveillance and a diminishing arsenal of tools to diagnose, treat and prevent also hinder the control of antimicrobial drug resistance.[1]

A recent database voiced the presence of more than 20,000 possible resistance genes (r genes) of strictly 400 different types, as analyzed from available bacterial genome sequence.[2] New resistance

mechanism is emerging and spreading globally, threatening our ability to treat common infectious diseases.[3] The most common drugs causing AMR are penicillin, cephalosporin, tetracycline, antibiotics used in combination therapies, and fluoroquinolones.[2] According to the World Health Organization (WHO), among patients with suspected blood stream infection, the proportion that had bacteria resistant to antibiotics ranged to a maximum of 82%. The report confirms the serious situation of antibiotic resistance worldwide.[1]

A growing list of infections – such as pneumonia, tuberculosis, blood poisoning, gonorrhea, and food borne diseases is becoming harder and sometimes impossible to treat as antibiotic becomes less effective.[4] Where antibiotics can be bought for human and animal use without a prescription, the emergence and spread of resistance is made worse.[5] Similarly, in countries without standard treatment guidelines, antibiotics are often over prescribed by health workers and overused by public.[1]

With the WHO announcing AMR as an urgent priority area, India has framed its National Action Plan for AMR.[1] With 700,000 people losing battle to AMR per year and another 10 million are projected to die from it by 2050. AMR alone is killing more people than cancer and road traffic accidents combined together.[5] In India, 70% isolates of *Escherichia coli*, *Klebsiella pneumonia*, and 50% of *Pseudomonas aeruginosa* are resistant to fluoroquinolones and cephalosporin. India has been referred as "AMR capital of the world." Factors such as poverty, illiteracy, and self-medication further attribute to the issue of antibiotic resistance in India.[6] Van Boeckel *et al.* have also projected 67% rise in antibiotic consumption by 2030 that would approximately double in Brazil, Russia, India, China, and South Africa block of the rapidly developing and highly populated countries of the world.[7]

There are many circumstances during dental treatment where antibiotics are prescribed by dentist to prevent further infection.[8] Dental caries and periodontal diseases are historically known as the top oral health burden in both developed and developing nations affecting 20–50% of population and the uppermost reason for tooth loss.[8] Dentists prescribe 7–11% of all common antibiotics.[9] The most common antibiotics prescribed by dentist are amoxicillin, tetracycline, cephalosporin, metronidazole, and cotrimoxazole. The antibiotics are used in the treatment of acute oral infections such as dental abscess, pericoronitis, salivary gland infections, and post-extraction infections. Several studies reported that antibiotics are often irrationally and over prescribed in dental diseases which are the basis of AMR.[8]

Since we are heading for a post-antibiotic era in which common infection and minor injuries can lead to increased use of antibiotics and cause AMR. Therefore future dentists should have basic knowledge concerning the use of antibiotics and its sequale during their graduation itself. Their knowledge of the rationale and responsible use of antibiotics is of great importance in the combat of resistance. Therefore, the need for the study is to assess the knowledge and attitude of antibiotic resistance among dental students in Chengalpattu district.

MATERIALS AND METHODS

A cross-sectional study was conducted to assess the knowledge about the growing issue of antibiotic resistance, among dental students at a private dental college during November 2019 and December 2019. The study protocol was approved by the Institutional Review Board before start of the study.

The sample size was calculated with 80% statistical power, $\alpha = 0.05$, 95% confidence interval, 10% margin of error (E), and knowledge regarding antibiotic resistance (50%) using Gpower software. The size of the sample was estimated to be about 294 participants, which included students pursuing graduation in dentistry and those who are consented to participate in the study. The 1st year dental students, postgraduates, staffs, and medical and paramedical students were excluded from the study.

The participants were given brief explanation about the study and the participation was voluntary and self-administrative.

Questionnaire

A self-administrative questionnaire was used in the study, which encloses five domains which comprises sum total of 14 questions (closed-ended, semi-open single and multiple-choice questions) with additional items to ascertain demographic data on participant age, gender, and year of study. The research instrument used in the study was the proprietary questionnaire and was completed by the respondents.

The pilot survey was carried out and questionnaire assessed for content validity and internal consistency of questionnaire was found to be good (Cronbach's alpha = 0.84) and further modifications were done in questionnaire. The questions were rephrased, reframed, added, and removed from the questionnaire. The final set of questions was based on:
- Items to ascertain basic demographic data
- Attitude towards antibiotic
- Opinion for antibiotic therapy
- Compliance of antibiotic prescription and self-medication
- Knowledge of using antibiotics as prophylactic medication.

Data collection

The consented participants were assembled in the classroom, explained about the purpose of study and questionnaire was

distributed to them. The questionnaire was then filled within stipulated timed period and all the queries were discussed and clarified.

Data analysis

The data were initially compiled in Microsoft Excel spreadsheet, the data analysis was done with the Statistical Package for the Social Sciences for Windows version 20.0 software (IBM, Chicago Inc., IL, USA). Descriptive statistics were performed for demographic variables. Inferential statistics were done with Kruskal–Wallis with *post hoc* Tukey test for intragroup comparison. For all analysis, $P < 0.05$ was considered to be statistically significant.

RESULTS

[Table 1] shows the distribution of demographic variables among the study participants. Among the 294 participants enrolled, 31% were male and 69% were female. Among the total participants, 21% were II year students ($n = 61$), 29% were III year students ($n = 86$), 28% were IV year ($n = 82$), and 22% of them were interns.

[Table 2] describes the distribution based on attitude score and knowledge score among the study participants. The mean knowledge score for II year, III year, IV year, and interns was found to be 6.23 + 1.189, 6.14 + 1.142, 6.20 + 1.452, and 6.68 + 1.336, respectively. There was no statistically significant

Table 1: Demographic characteristics and course pursuing of the study participants.

Variable	Participants (%)
Gender	
Male	n=90 (31)
Female	n=204 (69)
Total	n=294 (100)
Course pursuing	
BDS – II year	n=61 (21)
BDS – III year	n=86 (29)
BDS – IV year	n=82 (28)
BDS – Interns	n=65 (22)

Table 2: Mean distribution of attitude score and knowledge score among dental students.

Dental students	Knowledge score		Attitude score	
	Mean±SD	*P*	Mean±SD	*P*
A. Second year	6.23+1.189	0.078	2.30+0.803	0.020*
B. Third year	6.14+1.142		2.33+0.836	
C. Fourth year	6.20+1.452		2.59+1.030	
D. Interns	6.68+1.336		2.60+1.101	

Kruskal–Wallis test, *statistically significant. *Post hoc* Tukey analysis: 0.02 (A,B), 0.07 (A,C), 0.81(A,D), 0.42 (B,C), 0.68 (B,D), 0.50 (C,D)

difference among the study participants in mean knowledge score. The mean attitude score for II year, III year, IV year, and interns was found to be 2.30 + 0.803, 2.33+ 0.836, 2.59+1.030, and 2.60 +1.101, respectively. The difference in mean change in attitude scores between the study groups was statistically significant ($P = 0.020*$). *Post hoc* analysis was performed to know the significant difference between intrayear comparisons which was found to be statistically significant between II year, III year, and IV year.

The vast majority of the students suggested amoxicillin (85%) as the choice of antibiotic for dental infections. Other antibiotics mentioned by our respondents included 8% of the students suggested erythromycin, ciprofloxacin 4%, and 3% suggested that metronidazole was suitable for use in the dental treatment [Figure 1].

[Figure 2] points out the four major domains which were taken into consideration for the solution for antibiotic resistance. A considerable majority of the final year students 48% suggested that avoiding self-medication could be the solution for antibiotic resistance. About 34% of interns suggested that avoiding overdosage could prevent antibiotic resistance. About 48% of the 3rd year students suggested that completing the course of antibiotics and 34% of 3rd year students indicated the need of further research work on antibiotics.

To assess the knowledge of the population regarding prophylactic antibiotics, the response of the population to the negative question stating that "prophylactic antibiotics are not recommended" was framed. When asked about the preventive use of antibiotics before non-invasive dental procedures in individuals at high risk of infective endocarditis, 87% of the final year students and 72% of the interns stated the statement to be false. About 70% of the 2nd year students and 38% of the 3rd year students stated that they did not know about prophylactic antibiotics before dental procedures [Figure 3].

DISCUSSION

Antibiotic resistance is an emerging global health problem.[10] Several reasons for this growing problem were identified but the most important include the improper use and overuse
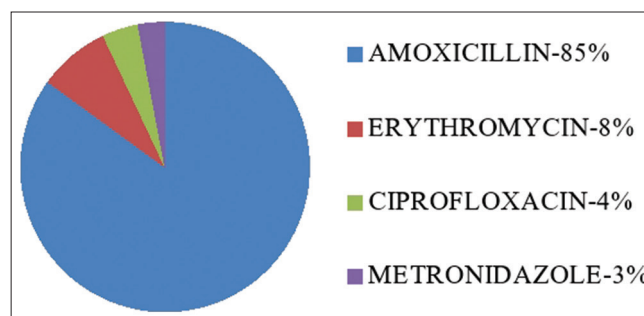

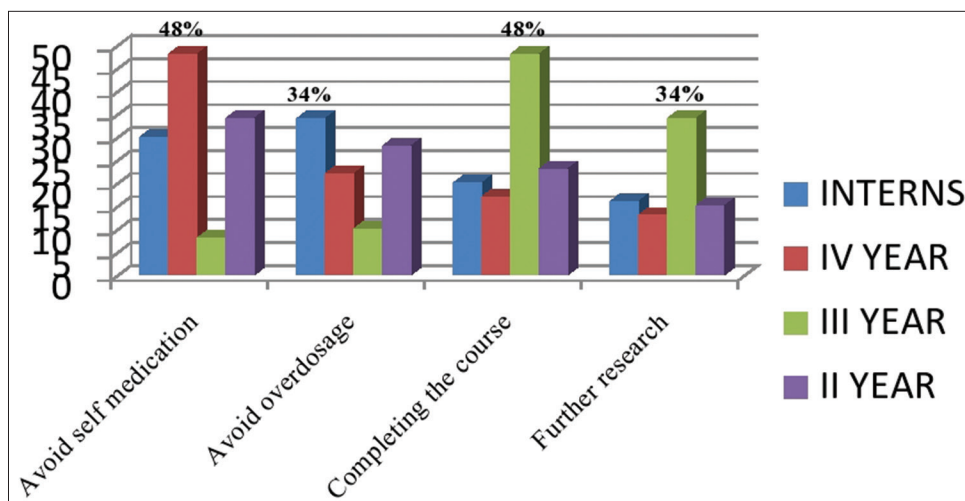**Figure 1:** Distribution of knowledge about antibiotics among dental students.

Figure 2: Distribution of opinion to avoid antibiotic resistance among dental students.
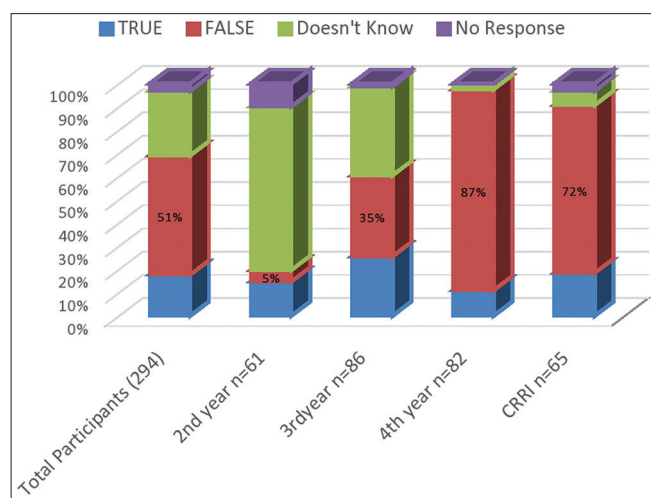

Figure 3: Distribution of student responses to the statement: "Preventive use of antibiotics before noninvasive dental procedures is not recommended."

of antibiotics.[11] The resistance mechanism of the bacteria occurs due to the genetic plasticity which allows them to respond to the antibiotic threat. One such resistance mechanism is the production of enzymes which can make the antibiotic ineffective.[12] Available data suggest that antimicrobial substances with sublethal concentrations have a significant impact on microbial physiology, microbial evolution, and they may act as effective signaling molecules which may induce host or microbial gene expression.[2] The alarming rate at which drug-resistant bacteria is increasing and outpacing the discovery of antibiotics calls for a different approach to prevent the estimated 700,000 deaths each year through AMR.[3]

In the era of a crisis in antibiotic therapy, more attention is being given to various actions leading to limitation of

the improper use of this valuable group of drugs. Dentists constitute an important group of antibiotic prescribers, and it was shown that their therapeutic decisions are not always rational.[11] Hence, a sound knowledge about prescribing antibiotics is essential for practitioners. Recognizing the role of dentists in antibiotic resistance, we have conducted a study to assess the knowledge and attitude of dental students about antibiotic resistance.

In the present study on comparing among the study groups regarding knowledge and attitude score, the score was less among II year students. A study conducted in Italy to assess the knowledge about antibiotic resistance among medical and dental students revealed that they lack thorough knowledge about antibiotic resistance.[13] Similar study conducted in Norway to assess the knowledge and attitude toward antibiotic resistance also suggested that only 57% of the study population had the knowledge of antibiotic resistance.[14] There are still certain gaps which should be covered in further training and included in the curriculum for dentists, especially in view of the level of knowledge gained.

In our study, majority of the dental students (85%) suggested amoxicillin, about 8% of our study population suggested erythromycin, 4% of them suggested ciprofloxacin, and 3% of them suggested metronidazole as the alternate antibiotics as the drug of choice for dental infections. This is in line with the study conducted at Saudi Arabia in which 63% of the study population suggested amoxicillin as the choice of antibiotics.[15] The rationale for the choice of amoxicillin could have been its wide spectrum with a low incidence of resistance with minimum adverse effects.[16] Students also expressed this view, and the majority of answers indicated that they were acquainted with evidence-based recommendations.

When asked about the solution for antibiotic resistance, 48% of the final year students and 38% of the interns suggested that avoiding self-medication and avoiding overdosage would prevent antibiotic resistance, respectively, which is in accordance with the study done by Aditya *et al.* (2013), 64% of students subscribed to this view and agreed that self-medication holds key to the development of antibiotic resistance.[17]

The present study aimed at assessing the knowledge about antibiotics with the question regarding preventive use of antibiotics before non-invasive dental procedures are not recommended. About 87% of the final year students and 72% of the interns stated the statement to be false. This is contrary to the study conducted by Struzycka *et al.* (2019), concluded that 59% of the students consider the statement that preventive use of antibiotics before non-invasive dental procedures in individuals at high risk of infective endocarditis is not recommended to be true, whereas one-third of the students (34%) consider it to be false.[11] However, the present study provides a positive result in statement according to the American Heart Association, prophylactic antibiotics are recommended for patients with high risk.[18]

Our study can be interpreted with the following limitations. The study was done using questionnaire with close-ended questions which give study participants less freedom to explain about instances of antibiotic resistance they encountered. The design of the study being cross sectional in nature, issues related to temporality shall be of concern. Further, the generalizability of this study results may be affected as convenient sampling was used for recruitment of participants.

It is recommended that necessary steps be taken to improve awareness through educational programs, highlighting the risks of unconventional antibiotic use and the study can be attempted to restrain the effects by selecting large samples and multiple colleges in future.

CONCLUSION

The present study results provide evidence that inadequate knowledge regarding antibiotic use and resistance exists and above research showed variable levels of understanding of antibiotics use among dental students. We hope that this study will accelerate the preparation of national guidelines of the rational use of antibiotics in dentistry.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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