EVALUATION OF ANTIBIOTIC PRESCRIPTION PATTERNS IN ENDODONTICS -A CROSS-SECTIONAL SURVEY.

ABSTRACT

Objectives:
The present study aimed to evaluate antibiotic prescription patterns among endodontists, other dental specialists, general dentists, and post-graduate students for endodontic procedures. It also assessed awareness regarding antimicrobial stewardship (AMS), rational antibiotic use, and the World Health Organization (WHO) Access, Watch, and Reserve (AWaRe) classification system.

Method:
A cross-sectional questionnaire-based survey was conducted from April 2025 to May 2025 among dental practitioners and post-graduate students involved in endodontic procedures. The questionnaire, adapted from previously published studies with necessary modifications, consisted of 23 questions covering demographic characteristics, knowledge, attitudes, and antibiotic prescription practices in endodontics. A total of 300 questionnaires were distributed through social media platforms, including WhatsApp, Instagram, and Facebook Messenger. Of these, 270 completed responses were received and included in the analysis. Participants comprised general dentists, endodontists, endodontic post-graduate students, post-graduates from other specialties, and other dental specialists.

Statistical Analysis:
Data were entered into Microsoft Excel and analyzed using SPSS trial version 25. Descriptive statistics and Chi-square tests were used to evaluate associations between demographic variables and participants' knowledge, attitudes, and prescribing practices. A p-value of <0.05 was considered statistically significant.

Results:
Among the respondents, 40.4% were general dentists, 18.1% endodontic post-graduates, 15.9% post-graduates from other specialties, 14.8% endodontists, and 10.7% other dental specialists. Approximately 11.9% prescribed systemic antibiotics in 50–80% of endodontic cases. Amoxicillin was the most frequently prescribed antibiotic (98.9%). Nearly 30.7% of participants were unaware of AMS concepts and the WHO AWaRe classification.

Conclusion:
The study revealed notable overprescription of antibiotics among dental practitioners, particularly general dentists. Continuous education on evidence-based prescribing, AMS principles, and accurate endodontic diagnosis is essential to promote rational antibiotic use and help combat antimicrobial resistance.

Keywords: Antibiotics, Antimicrobial Stewardship, Antimicrobial Resistance, Endodontics, Dental Practitioners, Knowledge, Attitude and Practice

INTRODUCTION

Antibiotics are antimicrobial agents active against bacteria that either kill bacteria or inhibit their growth[1]. They are broadly classified into broad-spectrum, extended-spectrum, and narrow-spectrum antibiotics based on their range of activity against microorganisms[2]. Endodontic infections are polymicrobial in nature, involving a complex combination of gram-positive, gram-negative, facultative anaerobic, and strict anaerobic bacteria[3]. The widespread and inappropriate use of antibiotics in endodontic practice has contributed significantly to the emergence of antibiotic resistance, which has become a major global health concern[4].

In endodontic infections, antibiotic prescription is usually empirical because samples from the root canal or periapical region are not routinely collected and microbiologically analysed. Based on clinical presentation and bacterial epidemiological data, the causative microorganisms can only be presumed, leading to the frequent prescription of broad-spectrum antibiotics such as amoxicillin, metronidazole, clindamycin, azithromycin, and ciprofloxacin. [5]

The use of antibiotics in endodontics is recommended only in specific clinical situations. Antibiotics are indicated in cases of diffuse swelling or rapidly spreading odontogenic infections, especially when accompanied by systemic signs and symptoms such as fever, malaise, and lymphadenopathy. They are also prescribed for persistent or recurrent infections that do not respond adequately to local endodontic treatment procedures alone[6]. In addition, immunocompromised patients may require antibiotic therapy because of their increased susceptibility to systemic spread of infection[7]. Prophylactic antibiotics may also be indicated in patients who are at risk of developing infective endocarditis before undergoing endodontic procedures[8].

The use of antibiotics in endodontics is contraindicated in conditions where local treatment alone is sufficient to control the infection[6]. Antibiotics are generally not indicated in cases of symptomatic reversible pulpitis, irreversible pulpitis, pulpal necrosis, acute apical periodontitis, chronic apical abscess, and localized acute apical abscess without systemic involvement. In such conditions, appropriate endodontic procedures such as drainage, debridement, and removal of the source of infection are considered adequate for successful management[6].

The inappropriate and excessive use of antibiotics has become a major public health concern worldwide[4]. Misuse of antibiotics not only contributes to the development of antibiotic resistance but also increases the risk of adverse drug reactions, including potentially fatal anaphylactic reactions, while exposing patients to unnecessary side effects[9]. Antimicrobial resistance (AMR) is currently responsible for approximately 1.27 million deaths annually worldwide[10]. The abuse and irrational prescription of antibiotics are considered the major contributing factors to the emergence and rapid spread of antimicrobial resistance[4].

Hence, the primary goal of this survey is to evaluate the antibiotic prescription pattern among endodontists, other dental specialists, general dentists, and post-graduates for endodontic procedures.

The null hypothesis is that there is no significant difference in antibiotic prescription patterns among endodontists and other dentists.

The research hypothesis is that there is a difference in antibiotic prescription patterns among endodontists and other dentists.

MATERIALS AND METHODS

This cross-sectional study was carried out from April 2025 to May 2025. This study was an anonymous questionnaire-based survey with voluntary participation and no collection of identifying information. Participants provided informed consent prior to participation. The purpose of this study is to evaluate the antibiotic prescription pattern among, endodontists, other dental specialist, general dentists and post-graduates for endodontic procedures. The current study's inclusion criteria include general dentists, endodontists, other dental specialists, and post-graduates of all dental specialties. Practitioners who refused to take part in the study and those who do not perform endodontic procedures were excluded.

The questionnaire used in the present survey was adopted from previously published literature by Vengidesh et al. and Kranti et al., with necessary modifications made to suit the objectives of the current study.The questionnaire consisted of 23 questions, of which 5 contained consent and demographic details and remaining 18 questions regarding endodontic practice.

The sample size of the current study was estimated as,

$$N = \frac{Z_{\alpha/2}^2 * p * q}{d^2}$$

$Z_{\alpha/2}$= Standard normal variate at 5% type 1 error= 1.96

p=77.3% (proportion of participants unaware of antibiotic stewardship programme) (Vengidesh et al ,2023)

q=1-p=22.7%

d= absolute precision=5%

Substituting the values,

N= 269.5

Accounting for 10% non- response rate,

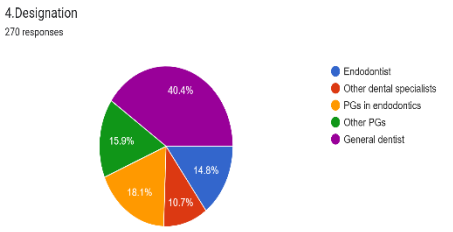
The minimum sample size can be rounded off to 300.

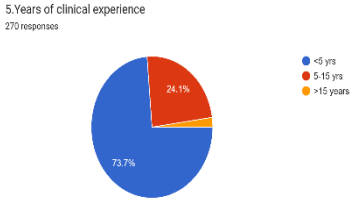
The required sample size for the present study was 300 participants. The questionnaire was circulated among 300 participants; however, only 270 participants responded to the survey. The questionnaire was distributed through social media platforms such as WhatsApp, Instagram, and Facebook Messenger.

RESULTS

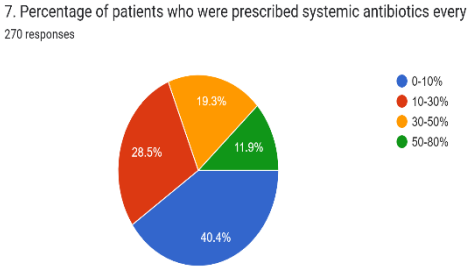
The data obtained were entered into Microsoft Excel and analyzed using SPSS (Statistical Package for the Social Sciences) trial version 25. Descriptive statistics were used to evaluate

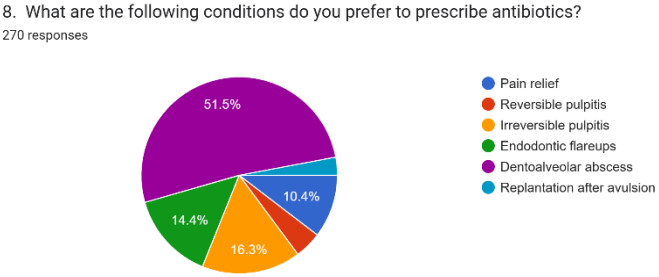
the study population. The association between designation, years of experience, knowledge, attitude, and practices regarding antibiotic usage was analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.



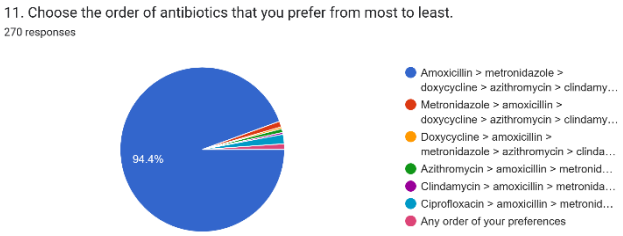


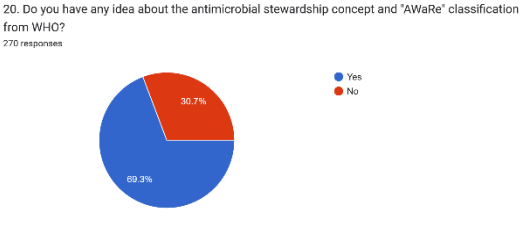
In this study, among 270 dentists who answered the questionnaire survey, 40.4% (109) were general dentists, 15.9% (43)were from other specialty PGs, 18.1%(49) were endodontic PGs, 14.8%(40) were endodontists, and only 10.7%(29) were other dental specialists.73.7% (199) had less than five years of clinical experience, 24.1% had 5-15 years of clinical experience, and only 2.2% had more than 15 years of clinical experience.For the total percentage of endodontic cases they handle on average in a day , about 39.3% (106) responded 0-5, 44.8% (121) responded 6-10,9.6% responded 11-15 and 6.3% responded 16-20.For the percentage of patients who were prescribed systemic antibiotics every day for endodontic reasons, about 40.4% (109) responded 0-10%, 28.5% (77) responded 10-30%,19.3% responded 30-50% and 11.9% responded 50-80%.





For the question conditions for which antibiotics were being prescribed, about 51.5% (139) responded dentoalveolar abscess, 3% replantation after avulsion, 10.4% responded pain relief, 4.4% reversible pulpitis,16.3% irreversible pulpitis, and14.4% endodontic flareups. For the most commonly prescribed antibiotics, about 98.9%(267) responded amoxicillin, and 1.1% responded metronidazole. In the clinical situation for which they prescribe antibiotics, about 35.2% (95) responded based on radiological findings like periapical lesions ,30.4%(82) responded that they would prescribe in the presence of systemic disorders like diabetes mellitus, hypertension, and cardiac conditions ,22.2% responded to prevent flare–up after root canal treatment and 12.2% responded depending on size of swelling.For the order of antibiotics they would prefer from most to least, about 94.4% (255) responded amoxicillin > metronidazole > doxycycline > azithromycin > clindamycin > ciprofloxacin.





Regarding the prophylactic prescription of antibiotics prior to endodontic surgery, 84.1% (227) responded "yes," and 15.9% (43) responded "no".For the question of whether they use local antibiotics, about 82.6%(223)answered yes and 17.4% responded no.For the question of whether they advise antibiotic culture tests for their patients,73.7 % (199) responded "No", and for question if patients had self-prescribed antibiotics 47.4% responded "yes", and 70.7% responded that their patients haven't responded to the prescribed antibiotics.With regard to prescription of drugs based on drug dosage formula, half-life, and weight of the patient 84.4% responded "yes", and 82.6% (223) upgraded themselves with the new guidelines and updates regarding antibiotics prescription patterns. About 30.7% of the total participants were unaware of the AMS concept and AwaRe classification from WHO. About 50% (135) have attended CDE programs with regard to antibiotic usage. 95.2% thinks that there is need to study antibiotics resistance phenomenon more in depth. 69.3% thinks susceptibility of antibiotic toward pathogen be labeled on its packet.

DISCUSSION

In this study, the majority of root canal treatments were performed by general dentists, with 40.4% of the participants being general dentists and only 14.8% being endodontists, which is consistent with a recent report by the American Association of Endodontists stating that general dentists perform the majority of root canal treatments compared to endodontists [11]. Furthermore, 73.7% of the participants had less than five years of clinical experience, indicating that younger practitioners constituted the majority of the study population. This may influence antibiotic prescribing practices because less experienced clinicians may tend to prescribe antibiotics more frequently due to uncertainty regarding diagnosis, fear of postoperative complications, or inadequate awareness of evidence-based prescribing guidelines.

Studies have estimated that antimicrobial resistance (AMR) could result in nearly 10 million deaths globally per year by 2050, making drug resistance a major threat to the medical profession unless sustained preventive measures are implemented[12]. Various factors contribute to AMR, among which inappropriate antibiotic prescription by medical and dental practitioners plays a significant role[13]. In the present study, approximately 11.9% of the participants reported prescribing systemic antibiotics in 50–80% of endodontic cases, while 28.5% prescribed antibiotics in 10–30% of cases. Such prescribing trends suggest the possibility of antibiotic over prescription in routine dental practice.

The present study also revealed that antibiotics were prescribed for several clinical conditions where local operative treatment alone may often be sufficient. About 16.3% of participants prescribed antibiotics for irreversible pulpitis, 4.4% for reversible pulpitis, and 10.4% for pain relief. Current evidence-based guidelines indicate that systemic antibiotics are generally not required for irreversible pulpitis, reversible pulpitis, or localized endodontic pain without systemic involvement. The unnecessary use of antibiotics in such conditions may contribute to the development of resistant bacterial strains and increased adverse drug reactions[5]. The tendency to prescribe antibiotics for these conditions may be attributed to anxiety regarding pain development, prevention of endodontic flare-ups, improvement of patient comfort, and patient expectations.

Dentoalveolar abscess was the most common indication for antibiotic prescription in this study, accounting for 51.5% of responses. This finding is in accordance with current endodontic recommendations, where antibiotics are indicated in cases of acute apical abscess associated with systemic involvement, fever, cellulitis, or diffuse swelling[5]. Additionally, 14.4% of participants prescribed antibiotics for endodontic flare-ups, while 22.2% prescribed them to prevent flare-ups after root canal treatment. Although flare-ups may occasionally require antibiotic therapy when systemic signs are present, most postoperative pain and swelling can usually be managed effectively through local treatment and analgesics rather than antibiotics.

With regard to the choice of antibiotics, Amoxicillin was the most commonly prescribed antibiotic, reported by 98.9% of participants, followed by Metronidazole. Furthermore, 94.4% preferred the sequence Amoxicillin > Metronidazole > Doxycycline > Azithromycin > Clindamycin > Ciprofloxacin. These findings are consistent with the recommendations of the European Society of Endodontology position statement (2017), which recommends Penicillin V and Amoxicillin as first-line antibiotics for endodontic infections[5]. Amoxicillin remains the preferred choice because of its broad antimicrobial spectrum, good absorption, favorable safety profile, and effectiveness against most endodontic pathogens.

According to the European Society of Endodontology guidelines, Amoxicillin is administered with a loading dose of 1000 mg followed by 500 mg every 8 hours or 875 mg every 12 hours for 3–7 days. If initial therapy fails after 48–72 hours, Amoxicillin combined with clavulanic acid is recommended, while Metronidazole may be added when anaerobic bacterial coverage is required. For penicillin-allergic patients, alternatives such as Clindamycin, Clarithromycin, and Azithromycin are advised[5]. Awareness regarding such evidence-based guidelines is essential to ensure rational antibiotic usage in endodontic practice.

The present study also demonstrated that 84.1% of the participants prescribed prophylactic antibiotics prior to endodontic surgery. Although prophylactic antibiotics may be indicated in selected medically compromised patients or individuals at risk of infective endocarditis, routine prophylactic use in healthy individuals is generally not recommended. Excessive prophylactic use can contribute to unnecessary antimicrobial exposure and resistance development.

An interesting observation in this study was that 82.6% of the participants reported using local antibiotics in endodontic practice. Intracanal medicaments containing antibiotics may provide localized antimicrobial action; however, indiscriminate use may increase the risk of bacterial resistance and hypersensitivity reactions. Similarly, only a small proportion of participants advised antibiotic culture sensitivity testing, as 73.7% reported that they did not recommend culture tests for their patients. Culture and sensitivity testing can help in selecting targeted antimicrobial therapy, especially in persistent or resistant infections, thereby reducing empirical and irrational antibiotic use.

The study also highlighted the growing problem of self-medication among dental patients, with 47.4% of participants reporting that patients had self-prescribed antibiotics before seeking professional care. Self-medication is a major contributor to antimicrobial resistance, particularly in developing countries where antibiotics are often easily accessible without prescription. In addition, 70.7% of participants reported encountering cases where patients did not respond adequately to prescribed antibiotics, which may reflect the increasing prevalence of resistant microbial strains.

Antimicrobial stewardship (AMS) is a coordinated approach aimed at optimizing the use of antimicrobials for effective treatment of infections while minimizing adverse effects and the development of AMR[15]. The core principles of AMS include conservation, which emphasizes determining when antimicrobials should or should not be used, and optimization, which focuses on appropriate selection, dosage, and duration of antimicrobial therapy. In the present study, encouraging findings were observed, as 84.4% of participants reported prescribing drugs based on dosage formula, half-life, and patient body weight, while 82.6% updated themselves regarding current antibiotic prescribing guidelines. However, approximately 30.7% of participants were unaware of the AMS concept and the World Health Organization AWaRe classification, indicating the need for greater awareness and educational initiatives.

The World Health Organization developed the AWaRe (Access, Watch, Reserve) classification as a global strategy to promote rational antibiotic use[17]. The Access group includes antibiotics with lower resistance potential and recommended first-line therapies. The Watch group includes antibiotics that possess higher resistance potential and require cautious use, while the Reserve group consists of last-resort antibiotics for multidrug-resistant infections. This classification system was developed to assist countries in monitoring antibiotic consumption, improving antimicrobial stewardship programs, and encouraging the judicious use of antibiotics. By guiding healthcare professionals toward appropriate antibiotic selection, the AWaRe framework aims to reduce the emergence and spread of antimicrobial resistance while ensuring effective treatment of infectious diseases worldwide[17].

Access	**Watch**	**Reserve**
Amoxicillin	Azithromycin	Ceftazidime/avibactam
Amoxicillin / clavulanic acid	Cefixime	Colistin
Ampicillin	Cefotaxime	Linezolid
Metronidazole	Cefuroxime	Fosfomycin(IV)
Cefalexin	Ceftriaxone	Meropenem/vaborbactam
Chloramphenicol	Ciprofloxacin	Plazomicin
Clindamycin	Clarithromycin	Polymyxin B

Another encouraging finding in this study was that 95.2% of participants believed there is a need to study antibiotic resistance more extensively, while 69.3% supported labeling antibiotic susceptibility information on drug packaging. Furthermore, nearly 50% of participants had attended continuing dental education (CDE) programs regarding antibiotic usage. These findings indicate a positive attitude among dental practitioners toward improving awareness and promoting rational antibiotic prescribing practices.

In dental practice, particularly in Endodontics, antimicrobial stewardship plays a crucial role in promoting evidence-based antibiotic use. Most endodontic infections can be effectively managed through local operative procedures such as drainage, debridement, and root canal treatment without the need for systemic antibiotics. Antibiotics should therefore be reserved for cases with systemic involvement, spreading infections, cellulitis, fever, lymphadenopathy,

or immunocompromised conditions[5]. Strict infection control measures, including sterilization protocols, hand hygiene, disinfection, and aseptic techniques, are equally important in preventing infections and reducing unnecessary antibiotic usage[18].

Patient education also forms an essential component of antimicrobial stewardship. Dental professionals should educate patients regarding the appropriate use of antibiotics, the importance of completing prescribed courses, and the dangers of self-medication and misuse of antibiotics. Patients should be informed that antibiotics are not substitutes for definitive dental treatment and that irrational consumption significantly contributes to antimicrobial resistance[15].

By adhering to the principles of antimicrobial stewardship, dental professionals can play a vital role in combating antimicrobial resistance while ensuring safe and effective patient care. Collective and responsible efforts by healthcare providers, patients, policymakers, and public health organizations are essential to preserve the effectiveness of existing antimicrobial agents and safeguard public health for future generations[15].

CONCLUSION

In conclusion, the findings of the present study indicate a significant over-prescription of antibiotics by dental practitioners, particularly among general dentists, without strict adherence to established guidelines for endodontic treatment. Such irrational use of antibiotics contributes to the growing problem of antimicrobial resistance and increases the risk of adverse drug reactions. Therefore, dental practitioners should remain updated regarding current evidence-based guidelines for antibiotic prescription, the principles of antimicrobial stewardship, and the World Health Organization AWaRe classification through continuing dental education (CDE) programs and professional training. In addition, adherence to proper endodontic diagnosis and treatment protocols is essential to prevent endodontic flare-ups and thereby minimize unnecessary antibiotic usage. Furthermore, patients must be educated about the harmful effects of self-medication and inappropriate antibiotic use. Collectively, these measures can promote rational antibiotic prescribing practices and help combat the global challenge of antimicrobial resistance.

REFERENCES

1. Katzung BG. Basic and Clinical Pharmacology. 14th ed. New York: McGraw-Hill Education; 2018.
2. Tripathi KD. Essentials of Medical Pharmacology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers; 2018.
3. Siqueira JF Jr, Rôças IN. Microbiology and treatment of endodontic infections. Dent Clin North Am. 2009;53(1):127-38.
4. Sweeney LC, Dave J, Chambers PA, Heritage J. Antibiotic resistance in general dental practice—a cause for concern? J Antimicrob Chemother. 2004;53(4):567-76.
5. Segura-Egea JJ, Gould K, Şen BH, Jonasson P, Cotti E, Mazzoni A, et al. Antibiotics in Endodontics: a review. Int Endod J. 2017;50(12):1169-84.
6. European Society of Endodontology. European Society of Endodontology position statement: the use of antibiotics in endodontics. Int Endod J. 2018;51(1):20-25.
7. Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association. Circulation. 2007;116(15):1736-54.

8. Lockhart PB, Tampi MP, Abt E, Aminoshariae A, Durkin MJ, Fouad AF, et al. Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling. J Am Dent Assoc. 2019;150(11):906-21.
9. Cope AL, Francis NA, Wood F, Chestnutt IG. Antibiotic prescribing in UK general dental practice: a cross-sectional study. Community Dent Oral Epidemiol. 2016;44(2):145-53.
10. World Health Organization. Antimicrobial resistance. Geneva: World Health Organization; 2023.
11. American Association of Endodontists. Endodontic treatment statistics and practice trends. Chicago: American Association of Endodontists; 2018.
12. O'Neill J,Tackling drug-resistant infections globally: final report and recommendations. London: Review on Antimicrobial Resistance; 2016.
13. Dar-Odeh NS, Abu-Hammad OA, Khraisat AS, Shehabi AA. An analysis of therapeutic, adult antibiotic prescriptions issued by dental practitioners in Jordan. Chemotherapy. 2008;54(1):17-22.
14. World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva: World Health Organization; 2014.
15. Dyar OJ, Huttner B, Schouten J, Pulcini C. What is antimicrobial stewardship? Clin Microbiol Infect. 2017;23(11):793-8.
16. Ministry of Health and Family Welfare. National Action Plan on Antimicrobial Resistance (NAP-AMR) 2017–2021. New Delhi: Government of India; 2017.
17. World Health Organization. The 2019 WHO AWaRe classification of antibiotics for evaluation and monitoring of use. Geneva: World Health Organization; 2019.
18. Centers for Disease Control and Prevention. Summary of infection prevention practices in dental settings: basic expectations for safe care. Atlanta: CDC; 2016.
19. Mohammadi Z. Antibiotics as intracanal medicaments: a review. J Calif Dent Assoc. 2009;37(2):98-108.
20. World Health Organization. WHO AWaRe classification database of antibiotics for evaluation and monitoring of use. Geneva: World Health Organization; 2023.
21. Palmer NOA, Martin MV, Pealing R, Ireland RS, Roy K, Smith A, et al. Antibiotic prescribing knowledge of National Health Service general dental practitioners in England and Scotland. J Antimicrob Chemother. 2001;47(2):233-7.
22. Vengidesh K, et al. Knowledge, attitude, and practice regarding antimicrobial stewardship and antibiotic prescription among dental practitioners: a questionnaire-based survey. J Pharm Bioallied Sci. 2023;15.
23. Kranti K, et al. Antibiotic prescription practices among dental practitioners for endodontic infections: a cross-sectional survey. Int J Appl Dent Sci. 2022;8(3).