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Bacterial pharyngotonsillitis and antimicrobial sensitivity in adults in a tertiary health facility in north west Nigeria

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Abstract

Background: Pharyngotonsillitis is inflammation of the pharynx and tonsils, characterised by increased redness, exudate, ulceration, and membranes over it. The most common bacterial cause is *Streptococcus pyogenes*. Although the diagnosis is clinical, throat culture is the gold standard for confirmation. The aim was to determine the pattern of bacterial pharyngotonsillitis and antimicrobial sensitivities among adults at a tertiary health facility in North West Nigeria.
Materials and Methods: This was a hospital-based, descriptive, cross-sectional study of adults presenting to the outpatient clinic of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. The study period spanned January 2024 to July 2024. Interviewer-administered questionnaires were filled out by consenting adults, and throat swabs were taken for bacteriology and antimicrobial sensitivity.
Results: 120 adult patients. Most of them were female (95, 79.2%), and the rest were male (25, 20.8%), with a ratio of M: F 1:1.4. The majority of the participants reported odynophagia (100%), sore throat (114, 95%), and fever (60, 50%). About 83 (69.2%) of respondents were off antibiotics for the last four weeks, (42, 35.8%) had URTI, (39,32.5%) had lived with and had a primary relative with similar complaints.
The prevalence of bacterial pharyngotonsillitis in adults was 84.2%. Most isolated bacteria were *Streptococcus Pyogenes*, 54.5%, closely followed by *Staphylococcus aureus* 44.5%, *Streptococcus Pyogenes* was highly sensitive to Levofloxacin (70.9%), followed by Azithromycin (65.5%). Staphylococcus aureus was also sensitive to Levofloxacin (82.2%) and azithromycin (68.9%), and resistant to meropenem and some cephalosporins.
Conclusion: Group A β-haemolytic streptococci remain a major cause of bacterial pharyngotonsillitis. Levofloxacin and azithromycin demonstrated higher sensitivity against S. pyogenes and Staph. aureus, whereas meropenem and some cephalosporins exhibited resistance, which is worrisome. The emergence of antibiotic-resistant clinical isolates highlights the need for local sensitivity and empirical use of levofloxacin and azithromycin where facilities are absent.

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1.0 Introduction:

Pharyngotonsillitis is the inflammation of the pharynx and palatine tonsils caused by infectious

and non-infectious factors.[1] It is one of the common upper respiratory tract infections, accounting for 10–30% of episodes in children aged 5-15 years and 5–10% in adults.[2] The commonest etiological agent is bacteria, of which Group A beta-haemolytic *streptococcus* (GABHS), followed by viruses.[3] Sore throat is its most common presentation associated with painful swallowing in adults and feeding refusal in children.[1,4] The pharynx is lined by a ring of lymphoid tissues called tonsils.[1,5] The normal flora of the pharynx includes a large number of species observed in throat cultures: *Viridans* (alpha-haemolytic) *streptococci* and *pneumococci,* non-pathogenic *Neisseria spp., Moraxella catarrhalis, staphylococci* (S. *aureus,* S. *epidermis*), diphtheroids (except C. diphtheria) and yeasts (*Candida spp.*) in limited quantity.[6] There are also Gram-positive *cocci* and Gram-negative rods anaerobes, which are part of the normal flora.[7] The throat swabs of elderly and immunosuppressed patients may be colonized by *Staphylococcus aureus, Escherichia coli, Klebsiella spp. Acinetobacter spp. Pseudomonas spp. and Candida spp*.[6,7,8]

Staphylococcus aureus from immunocompetent can be isolated in chronically inflamed tonsils and peritonsillar abscesses that produce β-lactamase, which interferes with the eradication of GABHS. Methicillin-resistant *S. aureus* (MRSA) and *H. influenzae* cause recurrence and hyperplasia of the tonsils.[3] Pharyngotonsillitis is a clinical diagnosis with 80% sensitivity and 60% specificity,[9] whereas throat culture alone or in conjunction with rapid antigen testing, which is specific (88% to 100%) but not sensitive (61% to 95%).[10]

In a clinical setting, obtaining pharyngeal swabs would help to define the infectious causes.[11] The cultural proof of anaerobes is provided upon special request.[12] The molecular proof of viral pharyngotonsillitis is by means of multiplex polymerase chain reaction (PCR); however, because of the missing therapeutic consequence, virus detection is almost always insignificant in the clinical routine.[13] Risk factors of pharyngotonsillitis include; Young age, exposure to dust, rhinosinusitis or contact with people especially children with URTI,[14,15,16] indoor cooking with firewood and secondary smoking.[17,18]

The rising incidence of antimicrobial resistance (AMR) among the bacterial pathogens that cause pharyngitis is fueled by irrational antibiotic usage and self-medication.[19] These have led to the development of beta-lactamases, genetic mutation, and biofilm formation.[17] This epidemic is worse in resource-constrained settings such as Nigeria due to inadequate access to microbiological testing.[20,21,22] There is a lack of current local epidemiological data on bacterial pharyngotonsillitis, and this study aims to determine the specific organism, antimicrobial sensitivity and resistance in adults from a tertiary health facility in North West Nigeria.

2.0 Materials and Methods:

Study location:

The study was carried out at Usmanu Danfodiyo University Teaching Hospital (UDUTH), Wamakko LGA, within the Sokoto metropolis. It is a tertiary institution with 850 bed capacity, serving as a referral centre to several hospitals within the North-western region. It was commissioned in 1989 to provide preventive, curative, and rehabilitative services to people living within and around the state and serves as a training centre for several medical and paramedical courses at both undergraduate and postgraduate levels.[23] The ENT Department receives new, old and referred cases from other outpatient departments within the hospital and neighbouring states.

Study design: Descriptive cross-sectional hospital-based study of consenting patients who fulfilled the inclusion criteria. The study period spanned seven (7) months, from January 2024 to July 2024.

Study population: consenting study adults aged 18 years and above.[24]

- Inclusion and exclusion criteria:
- Inclusion criteria:
- New adult patients attending the ENT outpatient clinic, with clinically diagnosed pharyngotonsillitis.
- Exclusion criteria:
- Patients with Complications of Pharyngotonsillitis.

Sample size determination:

- Given:
- p=10%=0.10 25
- q=1-p=1-0.10=0.90
- Confidence level = 90% → Z=1.645

- Margin of error = 5% = 0.05
- Cochran's Formula: n_0=(Z^2×p×q)/e^2
- Z^2=〖1.645〗^2=2.706025,
- p×q=0.10×0.90=0.09
- n_0=0.24354225/0.0025
- n_0= 97.4169 approximately 98
- anticipated 90% response rate, the attrition = 10%
- New sample size (NS) = n/ 0.9=108.However, 120 participants were recruited.

Study instruments:

- Headlight, tongue depressors (wooden and metallic), face-mask for the researcher, disposable gloves, Sterile swab sticks
- Mac Conkey, Chocolate, and 5% Sheep Blood agar plates: for bacterial culture and nutrient agar
- Structured interviewer-administered questionnaire.

Sampling technique: A consecutive sampling technique was used to recruit participants into the study

Study procedure: Interviewer-administered questionnaires were administered to consenting adults greater than 18 years to obtain demographics, clinical history of sore throats, pain on swallowing, and positive examination findings of hyperaemic tonsils and tender jugulodigastric nodes. Samples were collected using sterile swabs rubbed in a turning way the tonsils and posterior pharyngeal wall, avoiding the intraoral mucosa, 8 inserted into a culture medium and sent to the laboratory or stored in the refrigerator for a maximum six (6) hours (as per protocol, though Clinical and Laboratory Standards Institute(CLSI) guidelines noted an ideal max of 12 hours) 12at 4–6 °C. Samples were inoculated onto Blood agar, MacConkey agar, and chocolate agar for isolates. Plates were incubated at 37°C for 24-48 hours under optimal conditions, and appropriate biochemical tests, including Gram stain, were used to identify the isolates

Data analysis: using International Business Machine (IBM)-Statistical Package for Social Science (SPSS) version 23 for Windows (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were done with results expressed in frequencies, percentages and graphs.

Ethical issues: Ethical clearance was obtained from the Ethics and Research Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto (UDUTH/HREC/2023/1324/V2) on October 2023.

3.0. Results:

3.1 Socio-demographics of patients with pharyngotonsillitis:

A total of 120 adults who had pharyngotonsillitis were recruited. Of which, males comprised 25 (20.8%), females 95 (79.2%), resulting in a ratio of M: F of 1:1.4. The 21-30 age group had the highest representation 48 (40%) and mean age 31.7 (+/- 11.7) compared to other age groups. This is summarized in Table 1.

Table I: Socio-demographics of patients with pharyngotonsillitis

Variable	Frequency N= 120	Percentage (%)
Sex		
Male	25	20.8
Female	**95**	**79.2**
Age group		
18-20 years	20	16.7
21-30years	48	**40.0**
31-40years	32	26.7
41-50years	11	9.2
51-60years	6	5.0
61-70 years	3	2.5
Mean age(sd)	**31.7(11.7)**	

3.2 Clinical profiles of adults with bacterial pharyngotonsillitis

Figure 1 below shows the commonly reported clinical symptoms by the adult patients. The most common symptoms reported by the majority of the patients was Odynophagia (100.0%) followed by sore throat (95.0%), fever (50.8%), and the least common reported symptom was earache (6.7%). An

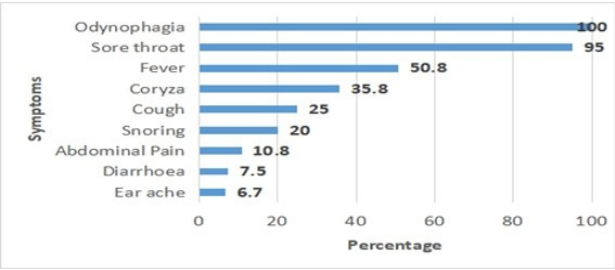

Figure I: Prevalence of clinical symptoms reported by adult patients (n=120)

overwhelming majority, 101(84.2%) had bacterial pharyngotonsillitis.

3.3. Clinical history of patients with bacterial pharyngotonsillitis

Over half of the adult patients had not been on any antibiotics for more than 4 weeks 83(69.2%) with slightly above one-quarter having a history of nasal discharge 43(35.8%). About half of the patients had a history of peptic ulcer disease, with about four per cent having a history of alcohol use 5 (4.2%). Less than two per cent of the patients have used tobacco in the past 2(1.7%) with less than one per cent having had a history of oral sex 1(0.8%). About one third of the patients had a family member with similar complaints 39 (32.5%). This is illustrated below in Table II.

Table II: Clinical History of the Patients with Bacterial Pharyngotonsillitis

Variable	Frequency n=120	Percentages
Duration of antibiotics		
<3weeks	37	30.8
>3 weeks	83	69.2
History of Nasal discharge		
Yes	43	35.8
No	77	64.2
History of Peptic Ulcer Disease		
Yes	61	50.8
No	59	49.2
History of Alcohol Use		
Yes	5	4.2
No	115	95.8
History of Tobacco Use		
Yes	2	1.7
No	118	98.8
History of Oral Sex		
Yes	1	0.8
No	119	99.2
Family Members with similar complaints		
Yes	39	32.5
No	81	67.5

3.4. Distribution of bacteria isolates:

Bacterial isolates made up 84.2 of % results, with 98% being gram-positive and 5% no growth or commensals. Slightly above half bacterial isolates were *Streptococcus Pyogenes* 55(54.5%) followed by *Staphylococcus aureus* 45(44.5%). Table III

3.5 Antibiotic susceptibility profile of cultured bacterial isolates:

In this study, *Staphylococcus aureus* isolated showed the highest sensitivity to Levofloxacin (82.2%) with resistance to Ceftriaxone, Ceftazidime, Meropenem, and *Cefepim*. *Streptococcus Pyogenes* was most sensitive to Levofloxacin (70.9%), followed by Azithromycin (65.5%), with the least sensitivity to Ceftazidime (1.8%) and Meropenem (1.8%). This is all seen in Figure 2

Table III: Microscopy of cultured bacteria

Microscopy of a Bacterial Organism cultured	Frequency (n=101)	Percentage (%)
Gram-positive aerobic Bacterial isolates cultured		
Staphylococcus aureus	45	44.5
Streptococcus pyogenes	55	54.5

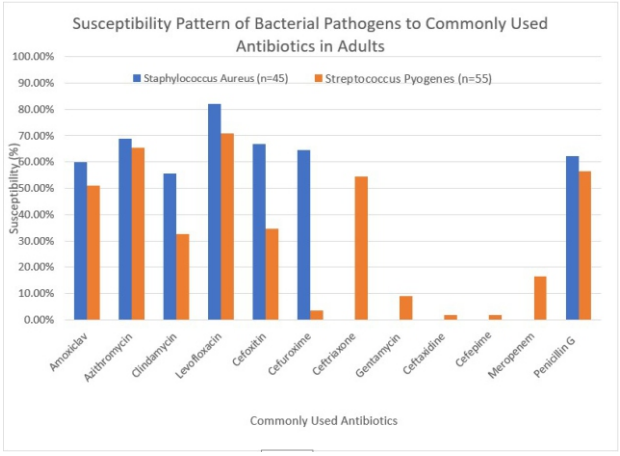

Figure 2. Graph showing antibacterial susceptibility in adults

4.0. Discussion:

Pharyngotonsillitis is one of the reasons for frequent empirical antibiotic prescriptions, which, in turn, can lead to misdiagnoses, inadequate treatment, and subsequent antimicrobial resistance and complications.[21,22,26,27] Bacterial isolates made up 84.2% results with 98% being gram-positive and 5% no growth or commensals, agreeing with most studies.[21,26,28,29,30] Higher female prevalence in this study of 79.2% may be due to indoor cooking and smoke exposure in the study population confirmed by Sani *et al* paper on Smoke Exposure Risk (SER) emanating from Household Cooking Practices in North-Western States of Nigeria,[18] Popoola *et al* added to this larger household sizes.[31] Shulman et al and Danchin et al reason was prolonged contact with kids with an active upper respiratory tract

infection.[14,32] Health-seeking behaviour is poor among women in this region despite the high prevalence in this study,[33] because most women still lack formal education and are economically weak.[34] This was different from studies by Palla *et al* and Adegbiji *et al*,[9] with higher male prevalence, citing feeding in public canteens as a reason.[26,29] The sample technique and study population, however, play a role in these differences. In this study, due to the low prevalence of exposures to alcohol, tobacco and oral sex, no meaningful analysis could be performed; however, Kebede *et al* showed tobacco use was a significant risk for bacterial pharyngotonsillitis.[35]

The majority of adult participants reported having odynophagia and sore throat, earache and abdominal pain; similar to studies by Abraham *et al* and Adegbiji *et al*.[26,29]

The most common isolates were *Streptococcus pyogenes* 54.5% followed by *Staphylococcus aureus* 45%. Similar findings were seen by Danchin *et al* and Adegbiji *et al*, who isolated *Streptococcus pyogenes* 26%.[32,29] Klagisa *et al* prospective study isolated mainly *Staphylococcus aureus* 33.3%.[28]

Quinolones, especially Levofloxacin was found to be most sensitive followed by macrolides. Co-Amoxiclav showed only moderate sensitivity in this study likely due to inactivation by beta-lactamases and poor antibiotic tissue penetration.[9,36,37] Similar to studies by Babaiwa *et al*[30] and Camara *et al*[38] but different from the findings of sensitivity to Cefuroxime, Gentamicin, Azithromycin and Ceftazidime, by Adegbiji *et al*, and Ceftriaxone, Azithromycin Doxycycline, Clindamycin and Ampicillin by Abraham *et al.*[26,29] Differences may be due to population and prescription policy. The increasing susceptibility to fluoroquinolones is due to their good tissue penetration, potency and low prescription rate.[39,40] Macrolides show similar activity because of their higher binding affinity, making them also useful in lower respiratory infections.[41,42] In the 2022 Global antimicrobial resistance and use surveillance system- World Health Organisation report, a change in susceptibility pattern was noted, reflecting growing antimicrobial resistance (AMR) among the most frequently consumed oral antibacterials.[22,43] Fluoroquinolones and macrolides have thus become the alternative with good compliance profiles.[9,37]

The reported resistance in this study of *S. aureus* to Meropenem is a serious finding, suggesting MRSA or extensive beta-lactamase production. Similarly, there was very low sensitivity of *S. pyogenes* to cephalosporins and carbapenems in keeping with other studies.[44] Carbapenems inhibit bacterial cell wall synthesis, similar to other β-lactam antibiotics and are considered superior due to their resistance to degradation by β-lactamases and cephalosporinases. Generally, resistance to carbapenems develops through mutations in penicillin-binding proteins, production of metallo-β-lactamases, or reduced permeability of the bacterial outer membrane.[45] The resultant effect of these findings is increased multidrug resistance and the cost and treatment of these conditions. This can be solved with widespread use of rapid diagnostic kits in clinics to reduce inappropriate use of antibiotics in a time of Anti-Microbial Resistance (AMR). Further study on the use of C-reactive protein as an adjunct or substitute to throat swabs in establishing the bacterial cause of Pharyngotonsillitis.

5.0 Conclusion:

Group A β-haemolytic streptococci remains a major cause of bacterial pharyngotonsillitis. Levofloxacin and azithromycin demonstrated higher sensitivity against *S. pyogenes* and Staph. aureus, whereas meropenem and some cephalosporins exhibited resistance, which is worrisome. The emergence of antibiotic-resistant clinical isolates highlights the need for local sensitivity and empirical use of levofloxacin and azithromycin where facilities are absent.

6.0. Conflict of Interest:

The authors declare no conflict of interest

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8.0 References

1. Jayaram, S. Marnane C. Pharyngitis. In: Watkinson JC, Clarke R, editors. Scott-Brown's Otorhinolaryngology: Head and Neck Surgery. Eighth Edition. 8th ed. CRC Press; 2019. p. 791–808.
2. Muthanna A, Salim HS, Hamat RA, Shamsuddin NH, Zakariah SZ. Clinical Screening Tools to Diagnose Group A Streptococcal Pharyngotonsillitis in Primary Care Clinics to Improve Prescribing Habits. Malaysian Journal of Medical Sciences. 2018;25(6):6–21. doi:10.21315/mjms2018.25.6.2
3. Brook I. Pharyngotonsilitis. In: Schlossberg D, editor. Clinical Infectious Disease. 2nd ed. Cambridge: Cambridge University Press; 2015. p. 33–41. doi:DOl: 10.1007/978-1-4612-4640-4
4. Pelucchi C, Grigoryan L, Galeone C, Esposito S, Huovinen P, Little P, et al. Guideline for the management of acute sore throat: ESCMID Sore Throat Guideline Group. Clinical Microbiology and Infection. 2012;18:1–28. doi:10.1111/j.1469-0691.2012.03766.x PubMed PMID: 22432746.
5. Ellis H. The Pharynx. In: Ellis H, editor. Clinical Anatomy. A revision and applied anatomy for clinical students. Eleventh E. Oxford: Blackwell Publishing Ltd; 2006. p. 277–80.
6. Vandepitte J, Verhaegen J, Engbaek K, Rohner P, Piot P HC. Upper Respiratory Tract Infections. In: Basic Laboratory Procedures in Cinical Bacteriology. 2nd ed. WHO; 2003. p. 60–5.
7. Develioglu ON, Ipek HD, Bahar H, Can G, Kulekci M, Aygun G. Bacteriological evaluation of tonsillar microbial flora according to age and tonsillar size in recurrent tonsillitis. European Archives of Oto-Rhino-Laryngology. 2014 Jun 1;271(6):1661–5. doi:10.1007/s00405-014-2898-5
8. Vandepitte J, Verhaegen J, Engbaek K, Rohner P, Piot P, Heuck CC. Basic Laboratory Procedures in Clinical Bacteriology. World Health Organization; 2003. 20–23 p.
9. Palla AH, Khan RA, Gilani AH, Marra F. Over prescription of antibiotics for adult pharyngitis is prevalent in developing countries but can be reduced using McIsaac modification of Centor scores: a cross-sectional study. BMC Pulm Med. 2012;12(1):1–7. doi:10.1186/1471-2466-12-70 PubMed PMID: 23176084.
10. Georgalas CC, Tolley NS, Narula PA. Tonsillitis. BMJ Clin Evid. 2014;07(503):10–4. doi:10.1177/17557380231163604 PubMed PMID: 25051184.
11. Anderson J PE. StatPearls [Internet]. Treasure Island (FL) [Internet]. [cited 2023 Aug 26]. Tonsillitis. [Updated 2023 Aug 8]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK544342/%0A
12. Windfuhr JP, Toepfner N, Steffen G, Waldfahrer F, Berner R. Clinical practice guideline: tonsillitis I. Diagnostics and nonsurgical management. European Archives of Oto-Rhino-Laryngology. 2016;273:973–87.
13. Morozumi M, Shimizu H, Matsushima Y, Mitamura K, Tajima T, Iwata S, et al. Evaluation of new immunochromatographic assay kit for adenovirus detection in throat swab: comparison with culture and real-time PCR results. Journal of Infection and Chemotherapy. 2014;20(5):303–6.
14. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, et al. Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2012;55(10):86–102. doi:10.1093/cid/cis629 PubMed PMID: 22965026.
15. Bhalla K, Bhardwaj P, Gupta A, Mehra S, Nehra D, Nanda S. Role of epidemiological risk factors in improving the clinical diagnosis of streptococcal sore throat in pediatric clinical practice. J Family Med Prim Care. 2019;8(10):3130–5.
16. Doumbia-singare K, Kone FI, Dienta L, Timbo SK, Cisse N, Samake D, et al. Study of Factors Associated with Acute Pharyngitis. Int J Otorhinolaryngol. 2020;6(1):6–9.

17. Paulo AC, Lança J, Almeida ST, Hilty M, Sá-Leão R. The upper respiratory tract microbiota of healthy adults is affected by Streptococcus pneumoniae carriage, smoking habits, and contact with children. Microbiome. 2023;11(1):199.
18. Sani J, Ahmed A, Hassan AW, Wali IG, Usman J, Umar JH, et al. Assessing the Prevalence of Smoke Exposure Risk (SER) Emanating from Household Cooking Practices in North-Western States of Nigeria. BIMA JOURNAL OF SCIENCE AND TECHNOLOGY GOMBE. 2025;8(4B):182–91.
19. Cillóniz C, Garcia-Vidal C, Ceccato A, Torres A. Antimicrobial resistance among Streptococcus pneumoniae. Antimicrobial Resistance in the 21st Century. 2018;13–38.
20. Ughasoro MD, Onuorah J, Nneamaka A, Somkene E. Direct and Indirect Costs of Non surgical Treatment for Acute Tonsillitis in Children in Southeast Nigeria. Pharmacoecon Open. 2021;5(4):755–64. doi:10.1007/s41669-021-00259-6
21. Garba BI, Muhammad AS, Mohammed F, Onazi SO, Ahmad MM, Yusuf T. Antibiogram of pharyngeal isolates of children with pharyngotonsillitis in a specialist hospital in GUSAU, North-western Nigeria. Group (New York). 2017;1(2):4.
22. Organization WH. Global antimicrobial resistance and use surveillance system (GLASS) report 2022. World Health Organization; 2022.
23. National Population Commission of Nigeria. Nigeria Demographic and Health Survey 2013. National Population Commission [Internet]. National Population Commission, ICF International; 2014. Available from: https://dhsprogram.com/pubs/pdf/FR293/FR293.pdf
24. Resolution G. Convention on the Rights of the Child. United Nations. 1990 Sep.
25. Neuner JM, Hamel MB, Phillips RS, Bona K, Aronson MD. Diagnosis and management of adults with pharyngitis: a cost-effectiveness analysis. Ann Intern Med. 2003;139(2):113–22.
26. Abraham ZS, Bazilio J, Kahinga AA, Manyahi J, Ntunaguzi D, Massawe ER. Prevalence and bacteriology of tonsillitis among patients attending otorhinolaryngology Department at Muhimbili National Hospital, Dar es Salaam-Tanzania. Med J Zambia. 2019;46(1):33–40.
27. Bakir SH, Ali FA. Evaluation of multi-drug resistance and B-lactamase production in throat infected by gram positive bacteria. European Journal of Pharmaceutical and Medical Research. 2016;68–76.
28. Klagisa R, Racenis K, Broks R, Balode AO, Kise L, Kroica J. Analysis of Microorganism Colonization, Biofilm Production, and Antibacterial Susceptibility in Recurrent Tonsillitis and Peritonsillar Abscess Patients. Int J Mol Sci. 2022;23(18):1–12. doi:10.3390/ijms231810273 PubMed PMID: 36142185.
29. Adegbiji WA, Aremu SK. Clinicoepidemiological Survey of Tonsillitis in Ekiti State University Teaching Hospital, Nigeria. International Journal of Surgical Research. 2020;9(1):1–6.
30. Babaiwa UF, Onyeagwara NC, Akerele JO. Bacterial tonsillar microbiota and antibiogram in recurrent tonsillitis. Biomedical Research (India). 2013;24(3):298–302.
31. Popoola TO, Ibrahim S. Determinants of households' primary cooking fuel in Nigeria: Evidence from country-wide study. Ilorin Journal of Economic Policy. 2023;10(2):1–15.
32. Danchin MH, Rogers S, Kelpie L, Selvaraj G, Curtis N, Carlin JB, et al. Burden of acute sore throat and group A streptococcal pharyngitis in school-aged children and their families in Australia. Pediatrics. 2007;120(5):950–7.
33. Kubra Hassan H, Adamu Basirka I. Healthcare Seeking Behavior and Utilization of Maternal Healthcare Services among Women of Reproductive Age in Northwest, Nigeria. Gusau International Journal of Management and Social Sciences [Internet]. 2021 Apr 14;4(1):17. Available from: https://gijmss.com.ng/index.php/gijmss/article/view/34
34. Sinai I, Anyanti J, Khan M, Daroda R, Oguntunde O. Demand for women's health services in northern Nigeria: a review of the literature. Afr J Reprod Health. 2017;21(2):96–108.
35. Kebede D, Admas A, Mekonnen D. Prevalence and antibiotics susceptibility profiles of

Streptococcus pyogenes among pediatric patients with acute pharyngitis at Felege Hiwot Comprehensive Specialized Hospital, Northwest Ethiopia. BMC Microbiol. 2021;21(1):135.
36. Stjernquist-Desatnik A, Orrling A. Pharyngotonsillitis. Periodontol 2000. 2009;49(1):140–50. doi:10.1111/j.1600-0757.2008.00282.x PubMed PMID: 19152531.
37. Fairbanks DNF. Pocket Guide to Antimicrobial Therapy in Otolaryngology-Head and Neck Surgery [Internet]. 13th Edition. Fairbanks DNF, editor. The American Academy of Otolaryngology-Head and Neck Surgery Foundation; 2007. Available from: www.entnet.org
38. Camara M, Dieng A, Boye CSB. Antibiotic susceptibility of streptococcus pyogenes isolated from respiratory tract infections in dakar, senegal. Microbiol Insights. 2013;6:MBI-S12996.
39. Ughasoro MD, Akpeh JO, Echendu N, Mgbachi NG, Okpala S, Amah L, et al. The profile of microorganisms that associate with acute tonsillitis in children and their antibiotics sensitivity pattern in Nigeria. Sci Rep. 2021;11(1):20084. doi:10.1038/s41598-021-99570-9
40. Tomé AM, Filipe A. Quinolones: review of psychiatric and neurological adverse reactions. Drug Saf. 2011;34:465–88.
41. Hancock REW. Mechanisms of action of newer antibiotics for Gram-positive pathogens. Lancet Infect Dis. 2005;5(4):209–18.
42. Yildizoglu U, Polat B, Gumral R, Kilic A, Tosun F, Gerek M. Effect of antibiotic use on bacterial flora of tonsil core in patients with recurrent tonsillitis. European Archives of Oto-Rhino-Laryngology. 2015;272:1525–8.
43. Shen Y, Cai J, Davies MR, Zhang C, Gao K, Qiao D, et al. Identification and characterization of fluoroquinolone non-susceptible Streptococcus pyogenes clones harboring tetracycline and macrolide resistance in Shanghai, China. Front Microbiol. 2018;9:542.
44. Asaduzzaman M, Ullah MM, Redwan S, Alam J, Juliana FM, Hossain N, et al. Emergence of meropenem resistance in pathogens recovered from urine cultures in Bangladesh. IOSR JPBS. 2018;13(3):41–7.
45. Hochadel M. Mosby's drug reference for health professions. Elsevier Health Sciences; 2011.