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(RESEARCH ARTICLE)

Evaluating the prevalence and antibiotics susceptibility profile of *Streptococcus pyogenes* among patients 5 – 20 years with acute bacterial pharyngitis attending the Limbe Regional Hospital, South West, Cameroon

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Abstract

Background: *Streptococcus pyogenes (S. pyogenes*) is a gram-positive bacterium which is the leading cause of pharyngitis, skin and soft tissue infection and post streptococcal syndromes. Due to lack of β-lactamase enzyme production, it is considered universally susceptible to penicillin group and later generation of β-lactam antibiotics. As such, empirical treatment is common which might lead to the development of antibiotics resistance. Therefore, determining the prevalence and antibiotics susceptibility of *Streptococcus pyogenes* acute pharyngitis is really a public health concern in this community.

Objective: This study was aimed at determining the prevalence and antibiotics susceptibility profile among patients 5 – 20 years with acute bacterial pharyngitis at the Limbe. Regional Hospital

Methods: A hospital based cross-sectional study design was used with enrollment of 98 participants aged 5 – 20 years using a convenience sampling technique for a period of one month. A structured questionnaire was used to collect socio-demographic data and risk factors. *Streptococcus pyogenes* was identified by a throat swab and subsequent culture on 5% sheep blood agar with an overnight incubation at 37°C. A gram stain, catalase and bacitracin test was done to identify *S. pyogenes*. After identifying the *S. pyogenes*, an antibiotics sensitivity testing was done to determine the sensitive antibiotics for the *S. pyogenes* acute pharyngitis. Then the data collected was entered and analyse using SPSS version 28. Finally, stepwise, chi square were carried out for identifying factors having significant association *(*$p<0.05$) with acute pharyngitis using SPSS version 20.

Result: A majority of participants where aged 5-9 yrs *(*41.8%), male: female ratio 1:1 and over 80.6% lived in urban zonws and over half acquired primary education. The prevalence of *S. pyogenes* was 10.2%. Prevalence was not statistically significant with socio-demographic data *(*$p>0.05$). Prevalence with respect to symptoms was found not statistically significant with $p>0.05$, however more positive cases were observed with pain on swallowing and itchy throat. Some risk factors identified were greatly significant to *S. pyogenes* acute pharyngitis, which were; malnutrition, passive smoker and number of 1`people that share bed with their P-values 0.003, 0.006 and 0.004 respectively. All isolates were sensitive to penicillin and ampicillin wheras other antibiotics were resistance which were; clindamycin, ceftriaxone, chloramphenicol, tetracycline and erythromycin with percentages 5 *(*50%), 4 *(*40%), 2 *(*20%), 2 *(*20%) and 1 *(*10%) respectively.

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Conclusion: The prevalence of *S. pyogenes* was guaged at 10.2% which is considered as low prevalence. Malnutrition, passive smokers and number of bed shared were some risk factors identified with P-values 0.003, 0.006 and 0.004 respectively. All *S. pyogenes* isolate remain sensitive to penicillin and ampicillin and resistant to clindamycin, ceftriaxone and erythromycin. Continuous surveillance of antibiotics resistance pattern of *S. pyogenes* for acute pharyngitis must be strengthen to improve the use of antibiotics in hospitals.

Keywords: Prevalence; *Streptococcus pyogenes*; Antibiotic Susceptibility; Acute Pharyngitis; Regional Hospital Limbe

1 Introduction

Streptococcus pyogenes (S. pyogenes) is a Gram positive, extracellular, spherical shape and β-hemolytic bacterium which can be cultured on enrichment culture media *(*Kebede et al., 2021a). According to a study carried out in Ethiopia, Group A Streptococcus *(*GAS) is a Gram positive spherical bacterium that causes different types of human infections, ranging from pharyngitis and pyoderma, to life threatening immunological complications such as acute rheumatic fever.

*(*ARF), rheumatic heart disease *(*RHD), post streptococcal glomerulonephritis *(*PSGN), toxic shock syndrome *(*TSS) and necrotizing fasciitis *(*Tesfaw *et al.,* 2015). It was identified as the cause of erysipelas in 1883 by Friedrich Fehleisen *(*Kebede *et al.,* 2021a). However, in 1933, Rebecca Lancefield made serologic classification of Group A Streptococcus *(*GAS) based on group A carbohydrate that composed of N-acetyl glucosamine linked to *S. pyogenes* cell wall antigens as rhamnose polymer backbone. As a result, GAS was named as *S. pyogenes*. *S. pyogenes* is responsible for causing several clinical discomfort such as scarlet fever, acute rheumatic fever, glomerulonephritis, and sepsis, necrotizing fasciitis, meningitis, streptococcal toxic shock syndrome, impetigo and acute pharyngitis *(*Avire *et al.,* 2021).

A study carried out in 2021, WHO reported a global estimate of *S. pyogenes*, approximately, 18.1 million prevalence and 1.78 million new cases recording 500,000 deaths globally per year *(* Barth *et al.,* 2015; Avire *et al*., 2021). According to global disease burden figures, WHO ranked GAS as the ninth leading cause of human mortality, with the majority of deaths attributable to invasive GAS infections and rheumatic heart disease *(*RHD) *(*Barth *et al.,* 2015). In the developed world, a decline in the prevalence and incidence of ARF/RHD has been observed over the past 150 years as a result of improved living conditions and the extensive use of penicillin, including for the treatment of GAS pharyngitis *(*Barth *et al.,* 2015). Together, ARF and RHD affect around 15.6 million people worldwide, and lead to the death of at least 350 000 people per annum worldwide *(*Barth et al., 2015). More so, in developing countries, which account for 80% of the world's population, continue to experience high cases even due to the control measures set in place to control this infection. ARF/RHD affect over 2.4 million children aged 5–14 years old residing in developing countries *(*Barth et al., 2015). Cellulitis is an infection caused by GAS which presents with the signs pain in the skin, warmness of the body, blisters red rashes and swollen body. In can also show signs of fever, chills malaise. Cellulitis alone account for 1447 disabled people in Cameroon which most of this disabled people were men *(*Njim *et al.,* 2017).

In addition to this, acute pharyngitis is one of the complications caused by *S. pyogenes*. This infection comes as a result of inflammation of the oropharynx mucous membrane and the tonsil and present different clinical manifestation which is; sore throat, red pharynx, sudden onset fever, enlarged tonsil *(*Kebede et al., 2021a). In African countries, *S. pyogenes* was isolated from children with acute pharyngitis and their prevalence was as high as 66.7, 28, 2.3, and 11.3% in Nigeria, Egypt, Kenya Jimma, and Ethiopia, respectively *(*Tesfaw *et al.,* 2015), *(*Kebede et al., 2021a). A study carried out in Cameroon by Hardis revealed that, streptococcal pharyngitis represent 8.49% of inflammation pathologies that affect the ear, nose and the throat. It was also revealed that, it is most frequent in age groups 3 – 30 years *(*Gonsu *et al.,* 2015).

GAS transmission can be through direct contact, or food borne contamination or droplets from those with pharyngeal infection or colonization *(*Kebede et al., 2021a). Most *S. pyogenes* infections were treated with penicillin because the GAS do not produce β-lactamase which will interact with the penicillin drug *(*Kebede et al., 2021a). However, patients that showed allergic reactions as due to the penicillin, have been treated with erythromycin, amoxicillin, cotrimoxazole, chloramphenicol, tetracycline, azithromycin and clindamycin *(*Kebede et al., 2021a). Hence, current treatment guidelines discourage the empirical use of antibiotics due to unnecessary antibiotic exposure and drug resistance.

2 Materials and Methods

2.1 Study area

This study was carried out in Limbe a metropolitan town in the South West Region of Cameroon precisely at the Limbe Regional Hospital also known as the mile 1 Hospital that stands as the main referral hospital found in the South-West

Region of Cameroon. Limbe also is the regional head quarter of the South West Region. The Limbe Regional Hospital has several units that offer health care delivery services to all. The units include the pediatric, maternity, Internal medicine male and female,surgical, Tuberculosis Unit, and an Outpatient deparment. This study was carried out at the pediatric ward of the hospital that has a bed capacity of 15 beds with a consultant paediatrician,10 nurses and 2 general practitioners.

2.2 Study design

A cross-sectional design was used to determine the prevalence of antibiotics susceptibility profile of *Streptococcus pyogenes* among patients with acute pharyngitis at the Limbe Regional Hospital.

2.3 Study population

The participants included patients that consulted with signs and symptoms of acute bacterial pharyngitis at the Limbe Regional Hospital and reside in the Limbe municipality.

We included all participants aged 5-20yrs that consulted at the Limbe Regional Hospital with clinical signs and symptoms of acute bacterial pharyngitis with no history of antibiotics uptake within 2weeks from the onset of symptoms

2.4 Sampling

The sample size was calculated using the population proportion formula which is based on the assumption of 5% error, 95% confident values *(*Z1-α/2=1.96) and 13.5% prevalence based on a similar study in Yaounde, Cameroon *(*Gonsu et al., 2015). The convenient samping method was used because we recruited the participants as they presented at the pediatric ward after diagnosis.

$$N=\frac{Z^2_{1-\alpha/2}\, P\,(1-P)}{d^2}=\frac{(1.96)^2\times 0.135(1-0.135)}{0.05^2}=179.44=179 \text{ participants}$$

Where, P= proportion in the population
d = margin of error
N = sample size
$Z_{1-\alpha/2}$ =1.96 *(*from the Z table at type 1 error)

Sample size= 179 participants

2.5 Data collection procedure

After seeking concern by signing the consent form, data collection was done by the principal investigator and a well-trained nurse *(*assistance). Consequently, environmental factors, behavioral, housing related data was collected by a structured questionnaire using a face to face interview with parents/guardians.Participants aged greater than 15 yrs were interviewed by the investigor and the guardians responded fo participants less than 15yrs

Throat swabs was collected from all patients recruited into the study using aseptic technique to prevent contamination. All throat swabs were taken by a well-trained assistant nurse or the principal investigator of the research to the laboratory for analysis. A wooden tongue depressor was used to hold the tongue in place. Without touching the sides of the oral cavity or the tongue, a sterile swab stick was used to swab the posterior pharynx and tonsillar arches. The specimens was then taken to the laboratory immediately for analysis after collection.

2.5.1 Laboratory procedure

A Gram-stain was done on the smears made from the specimens and viewed under the light microscope at ×100. Classically, the GAS are Gram-positive cocci *(*Uzodimma et al., 2017).

2.5.2 Culture and identification

The sample obtained from a throat swab was cultured on a 5% sheep blood agar *(*Kebede et al., 2021a) in a standard laboratory *(*Regional Hospital Limbe) procedure for the microbiologic confirmation of GAS pharyngitis. If performed correctly, a throat culture has a sensitivity of 90% to 95%. A negative result can occur if the patient has received an antibiotic before sampling *(*Arnold & Nizet, 2018). Several variables affect the accuracy of throat culture results. One of the most important is the manner in which the specimen is obtained. The surface of both tonsils or tonsillar fossae and

the posterior pharyngeal wall was swabbed. Other areas of the pharynx and mouth (e.g., anterior mucosa, tongue, saliva), collecting from this site are not accepted. This because when carrying the procedure you will not get a good result.

Streptococcus pyogenes grows as β-hemolytic colonies on blood agar (Uzodimma et al., 2017). The time for incubation can impact the yield of throat cultures. Cultures was incubated at 35°C to 37°C for at least 18 to 24 hours before reading (Arnold & Nizet, 2018). Additionally, overnight incubation at room temperature, will however, identifies substantially more positive cultures. In a study of patients with pharyngitis and negative RADT results, 40% of positive GAS cultures were negative after 24 hours of incubation but positive after 48 hours (Arnold & Nizet, 2018), (Uzodimma et al., 2017). Even though a negative result can be revealed after 24hours, but it is advisable to wait for at least 48 hours for definite results.

2.5.3 Antibiotics susceptibility testing

Antimicrobial susceptibility testing was done by using the disc diffusion method according to criteria set by Clinical Laboratory and Standard Institute (CLSI) and European Committee of Antimicrobial Susceptibility Testing (EUCAST). A pure colony of GAS bacterial suspension from brain heart infusion broth (BHI) was spread evenly onto Muller Hinton agar supplemented with 5% sheep blood using sterile cotton swab (Tesfaw et al., 2015). Suspension was prepared from 3 to 5 pure *S. pyogenes* colonies mixed with 5 ml normal saline in sterile glass test tube which was matched with the 0.5 standard McFarland (Kebede et al., 2021a). This suspension was spread evenly onto Mueller Hinton agar supplemented with 5% sheep blood using sterile cotton swab and wait for a while about 2 minutes. Afterwards, antibiotic discs was then placed on the inoculated plate and the plates incubated at 37°C in a candle jar overnight. The following antimicrobial discs with respective concentration was used: penicillin (1 unit), ceftriaxone (30 lg) and chloramphenicol (30 lg) all from [Becton Deckinson BD, USA Company], amoxicillin (25 lg), erythromycin (15 lg), clindamycin (2 lg), and tetracycline (30 lg) all from [Oxoid, England]. The antibiotic discs were selected based on prescription pattern and recommendations from CLSI and EUCAST (Tesfaw et al., 2015). After then, zone of inhibition was measured with a ruler and interpreted as sensitive, intermediate and resistant according to the principles established by CLSI M100 guideline (Kebede et al., 2021a).

2.6 Data management and analysis

The data collected was tallied and saved in Microsoft spreadsheet, and later stored in the computer.The data was also uploaded on a disk as back up. The data was analyzed using statistical package for social science version 28. A p-value of <0.05 was set to be statistically significantData were summarized using descriptive statistics.. The results were presented as frequency tables, percentages, pie and bar charts.

2.7 Ethical consideration

Ethical clearance was obtained from the Faculty of Health Sciences University of Buea and Regional Delegation of Health and from the Director of the Hospital. Informed consent was gotten by signing the physical form.All procedures performed in this study was in accordance with the ethical review board.

3 Results

3.1 Socio-demographic characteristics of the study

A total of 98 children were recruited for this study. As demonstrated in the table below, majority 57 (58.2%) were female, 41 (41.8%) were male. The age group 4 – 9 were the most frequent to participate in the study and with the highest percentage of the participants coming from the primary school with 59 (60.2%). More than 3/4 of the total participants 79 (80.6%) were from the urban area and only about 1/4, 19 (19.4%) were from rural area.

3.2 Prevalence of *Streptococcus pyogenes* at Regional Hospital Limbe

3.2.1 Prevalence of S. pyogenes acute pharyngitis at Regional Hospital Limbe

In this our study, 98 participants were recruited. Only 10 (10.2%) of the total participants were tested positive for *S. pyogenes* acute pharyngitis while 88 (89.8%) were tested negative.

Table 1 Socio-demographic characteristics of patient 5 – 20 years with acute pharyngitis in Regional Hospital Limbe

Variables	Categories	Frequency (N)	Percentage (%)
Gender	Female	57	58.2
	Male	41	41.8
	Total	98	100
Age	4 – 9	41	41.8
	10 – 14	37	37.8
	15 – 20	20	20.4
	Total	98	100
Educational level	Primary	55	56.1
	Secondary	25	25.5
	Nursery	18	18.4
	Total	98	100
Residence	Urban	79	80.6
	Rural	19	19.4
	Total	98	100

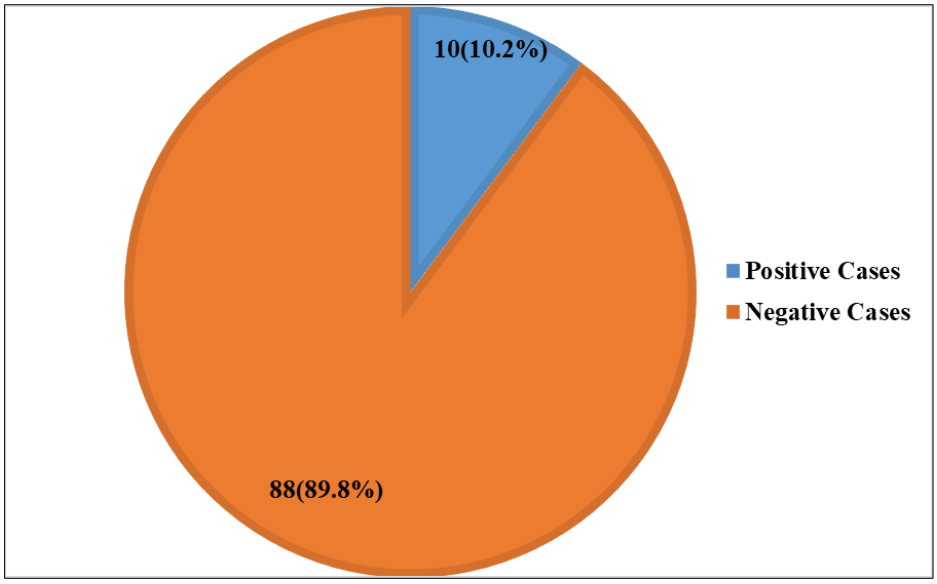

Figure 1 Prevalence of *Streptococcus pyogenes* among patients with acute pharyngitis

3.2.2 Prevalence of S. pyogenes with respect to Socio-demographic

The table below shows the prevalence of *S. pyogenes* acute pharyngitis with respect to socio-demographic at Regional Hospital Limbe. Majority of the total participants 57 (58.2%) were females with the positive cases 7 (7.14%) having statistical significant p-value 0.423. Most of the positive cases were from the group of age 4 – 9 and 10 – 14 years with prevalence 4 (4.08%) each. Children from the primary school had the highest number of positive cases 6 (6.1%) with p-value of 0.762.

Table 2 Prevalence of *S. pyogenes* with respect to socio-demographic

Variable	Categories	Positive	Negative	P-value
Age	4 – 9	4 (4.08%)	37 (37.8%)	0.988
	10 – 14	4 (4.08%)	33 (33.7%)	
	15 – 20	2 (2.04%)	18 (18.3%)	
	Total	10 (10.2%)	88 (89.8%)	
Gender	Female	7 (7.14%)	50 (51.0%)	0.423
	Male	3 (3.06%)	38 (38.8%)	
	Total	10 (10.2%)	88 (89.8%)	
Residence	Urban	7 (7.14%)	72 (73.5%)	0.370
	Rural	3 (3.06%)	16 (16.3%)	
	Total	10 (10.2%)	88 (89.8%)	
Educational level	Primary	6 (6.1%)	49 (50.0%)	0.762
	Secondary	3 (3.1%)	22 (22.4%)	
	Nursery	1 (1.0%)	17 (17.4%)	
	Total	10 (10.2%)	88 (89.8%)	

3.2.3 Prevalence of Streptococcus pyogenes among patients with acute pharyngitis with respect to the symptoms

Below shows a table that gives the prevalence of each symptoms that were associated with *S. pyogenes* acute pharyngitis in children 5 – 20 years at Regional Hospital Limbe. For these symptoms, for both positive and negative cases, gives the prevalence and the P-value of each. Majority of the participants 60 (61.2%) are those that had pain on swallowing. More than 3/4 of the total participants 79 (80.6%) did not have headache which statistically gave a P-value of 0.082 which is not significantly associated with the cause of acute pharyngitis. Most of the participants 86 (87.8%) did not have fever with the P-value of 0.213.

Table 3 Prevalence of *S. pyogenes* among patients with acute pharyngitis with respect to symptoms at Regional Hospital Limbe

Variables	Categories	Positive Negative		P-value
		N (%)	N (%)	
Pain on swallowing	Yes	6 (6.1%)	54 (55.1%)	0.933
	No	4 (4.1%)	34 (34.7%)	
	Total	10 (10.2%)	88 (89.8%)	
Headache	Yes	4 (4.1%)	15 (15.3%)	0.082
	No	6 (6.1%)	73 (74.5%)	
	Total	10 (10.2%)	88 (89.8%)	
Muscle ache	Yes	3 (3.06%)	23 (23.5%)	0.793
	No	7 (7.14%)	65 (66.3%)	
	Total	10 (10.2%)	88 (89.8%)	
Fever	Yes	0 (0.0%)	12 (12.2%)	0.213
	No	10 (10.2%)	76 (77.6%)	

	Total	10 (10.2%)	88 (89.8%)	
Itchy throat	Yes	6 (6.1%)	40 (40.8%)	0.382
	No	4 (4.1%0	48 (49.0%)	
	Total	10 (10.2%)	88 (89.8%)	
Runny nose	Yes	1 (1.0%)	34 (34.7%)	0.073
	No	9 (9.2%)	54 (55.1%)	
	Total	10 (10.2%)	88 (89.8%)	

3.3 Associated risk factors of *S. pyogenes* acute pharyngitis

Below is a table that shows factors that are associated with *S. pyogenes* among participants with acute pharyngitis at Regional Hospital Limbe. Nearly all the participants 97 (99.0%) were not malnourished, and just 1 (1.0%) was malnourished having a statistical significance of 0.003. Almost all the participants 78 (79.6%) were used to drinking cold drinks. More than 1/2 of the participants 61 (62.24%) that shared bed were less than 2 and the rest were >2 that shared bed.

The table below shows risk factors; malnourished, number per bed, frequent cold drink and passive smoker which some were significant from the significant value $p<0.05$.

Table 4 Prevalence of *S. pyogenes* among patients with acute pharyngitis with respect to risk factors

Variables	**Categories**	**Positive N (%)**	**Negative N (%)**	**P-value**
Malnutrition	Yes	1 (1.0%)	0 (0.0%)	**0.003**
	No	9 (9.2%)	88 (89.8%)	
	Total	10 (10.2%)	88 (89.8%)	
Frequent cold drink	Yes	6 (6.1%)	72 (73.5%)	0.105
	No	4 (4.1%)	16 (16.3%)	
	Total	10 (10.2%)	88 (89.8%)	
How many per bed	>2	8 (8.16%)	29 (29.6%)	**0.004**
	<2	2 (2.04%)	59 (60.2%)	
	Total	10 (10.2%)	88 (89.8%)	
Passive smoker	Yes	2 (2.04%)	57 (58.2%)	0.006
	No	8 (8.16%)	31 (31.6%)	
	Total	10 (10.2%)	88 (89.8%)	
Gender	Female	7 (7.14%)	50 (51.0%)	0.423
	Male	3 (3.06%)	38 (38.8%)	
	Total	10 (10.2%)	88 (89.8%)	
Residence	Urban	7 (7.14%)	72 (73.5%)	0.370
	Rural	3 (3.06%)	16 (16.3%)	
	Total	10 (10.2%)	88 (89.8%)	

3.4 Antibiotics susceptibility profile of *S. pyogenes* among patients with acute pharyngitis.

Different antibiotics classes were used for determining susceptibility profile of *S. pyogenes* isolates. As the result, all isolates of *S. pyogenes* were sensitive for both penicillin and ampicillin.

Furthermore, in some isolates, some antibiotics were intermediate which were, clindamycin 2 (20%), erythromycin 2 (20%) and tetracycline 1 (10%).

Out of the 10 (10.2%) positive cases, there were some multidrug resistance on the isolates which were clindamycin, erythromycin and tetracycline with percentages 5 (50%), 2 (20%) and 1 (10%) respectively.

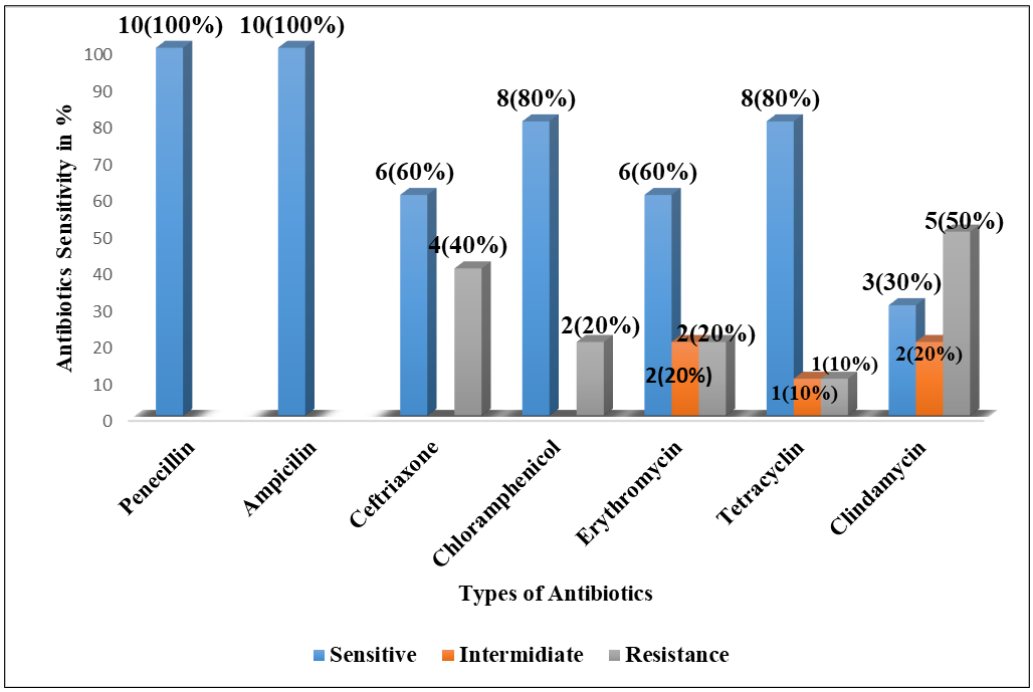

Figure 2 Antibiotics susceptibility profile of *S. pyogenes* with acute pharyngitis at Regional Hospital Limbe, 2022

4 Discussion

This study determined the prevalence, the risk factors and antibiotics susceptibility profile of *S. pyogenes* among patients with acute pharyngitis at the Regional Hospital Limbe. The risk factors that were identified in this study were age, gender, malnutrition, passive smoker, frequent cold drink and number of people that shared a bed. Antibiotics sensitive to S.pyogenes were penicillin and ampicillin. Antibiotics that were resistant and intermediate to the *S. pyogenes* isolates were ceftriaxone, tetracycline, clindamycin, chloramphenicol and erythromycin. *S. pyogenes* which is a gram positive bacteria causes a wide range of disorders that are multi-systemic and could complicate to death. Mode of transmission of this infection is getting in direct contact with air droplets of an infected person and an indirect contact by touching a contaminated surface or using an infected tissue by cleaning the face can lead to acquiring the infection.

Despite its existence for hundreds of years, GAS still create a great disease burden and death globally, mainly in children and young adults in less developed countries (Avire et al., 2021).

4.1 Prevalence of *S. pyogenes* among patients with acute pharyngitis attending Regional Hospital Limbe

The overall prevalence of *S. pyogenes* was 10.2% among the study participants. This prevalence is similar to a study that was carried out in Ethiopia 11.3%, Indonesia 13.5% (Kebede et al., 2021). However, our results were contradictory to studies that was carried out in Brazil 3.9% and Romania 4% (Kebede et al., 2021). The low prevalence could be as a result of the high standards of living and consequently better hygiene measures which makes it difficult for the spread of the bacteria among participants in the above respective countries. Another plausible explanation in the results could be the different age groups included in the studies above in contrast to this study where we recruited participants aged 4-20yrs. This is because children aged below 5 years have low immune defense to combat the respiratory infection compared to the young adults. The low prevalence could also be as a result of good preventive measures taken by the infected persons. When someone is infected with this disease and protect him/her self, it will reduce the rate of infection and hence low prevalence. Protecting yourself here in the sense of, using face shield, face mask.

4.2 Risk factors of *S. pyogenes* among patients with acute pharyngitis attending Regional Hospital Limbe

The prevalence of *S. pyogenes* acute pharyngitis was significantly associated with some risk factors; malnutrition, passive smoker and number of people sharing bed. The P-value for passive smoker was p = 0.006 which is significants. Exposure to cigarette fumes is a risk factor for developing respiratory tract infections. In a study that was carried in Nigeria in 2021, showed that smoking is a high risk of acquiring respiratory infections like acute pharyngitis *(*Tanya *et al.,* 2021). In a study, those living with smokers in their homes are 7.11 times more likely to develop *S. pyogenes* acute pharyngitis than those that do not live with smokers in homes *(*Kebede *et al*., 2021). This means that exposing yourself makes you more likely to get acute pharyngitis. Number of shared bed in a home predisposes one from getting respiratory tract infection which could be influenza, acute pharyngitis. When an infected person share the same bed with an uninfected person, there is a high probability that the uninfected person will get the infection since this infection can be transmitted from an infected person to an unifected by respiratory droplets *(*Jo *et al.*, 2021).

4.3 Antibiotics susceptibility profile of *S. pyogenes* among patients with acute pharyngitis at Regional Hospital Limbe

Penicillin and ampicillin were 100% effective against every isolate of GAS used in this study. This concurs with Kebede *et al.,*(2021) and (Tesfaw *et al.,* 2015). This antibiotics' inability to produce the enzyme -lactamase allows penicillin and ampicillin to enter bacteria and lyse their cells. Some of these antibiotics, including clindamycin 5 (50%) and ceftriaxone 4 (40%) and 2 (20%) erythromycin and chloramphenicol 2 (20%), were resistant to the isolates. One (10%) Tetracycline was also resistant. Clindamycin 2 (20%), erythromycin 2 (20%), and 1 (10%) tetracycline were intermediate in certain isolates. According to this study (Tesfaw *et al.,* 2015), the antibiotics erythromycin 20%, clindamycin 50%, and ceftriaxone 40% that were resistant in our investigation were effective against them. Drug resistance may develop because of incomplete or delayed treatment for an infection as directed by a healthcare professional. Other possible causes of drug resistance include failure to take the medication as directed at the proper time. Other antimicrobial drugs utilized in our investigation included tetracycline and clindamycin, with percentages of 10% and 20% respectively, were intermediate in some isolates. Clindamycin, erythromycin, tetracycline, and chloramphenicol were shown to be intermediate in an Ethiopian investigation (Kebede *et al.,* 2021). This outcome resembles the one from our study.

5 Conclusion

S. pyogenes was present in 10.2% of individuals with acute pharyngitis, aged 5 to 20. Malnutrition, the number of individuals sharing a bed, and passive smoking were risk variables that were evaluated, statistically significant, and connected to S. pyogenes acute pharyngitis (p=0.003, p=0.004, and p=0.006). The frequency of consuming cold beverages was one of the other risk factors evaluated with a huge percentage affected. A hundred percent of the isolates were sensitive to penicillin and ampicillin. The study found that clindamycin 5 (50%) was the most resistant drug, followed by erythromycin 2 (20%), chloramphenicol 2 (20%), tetracycline 1 (10%), and ceftriaxone 4 (40%).

Recommendation

Based on the above findings, the following points are recommended;

- There should be routine throat culture and a continuous surveillance of antibiotics resistance pattern for *S. pyogenes* to improve the use of antibiotics in hospitals.
- Prescription of antibiotics should dome by a well-trained health practitioner.
- Infected persons should try as much as possible to prevent the infection from spreading

Compliance with ethical standards

Acknowledgments

We are thankful to all participants who took part in this study.

Disclosure of conflict of interest

We declare no conflict of interest.

Statement of ethical approval

Ethical consideration was gotten from Regional delegation of Public Health for South West Region as well as administrative authorization from the Limbe regional hospital.

Statement of informed consent

Informed consent and assent was obtained from all individual participants included in the study.

Authors Contribution

PBT and SY conceived and designed the study; SY, PBT and FAN participated in data collection process and shaping the work. All others were involved in data entry and analysis. SY, CTA, DDY and TBT participated in manuscript draft. FAN and PBT reviewed the manuscript and all authors approved the final version.

List of Abbreviations

- ARF: Acute Rheumatic Fever
- ASO: Antistreptolysin O
- CLS: Clinical Laboratory and Standard Institute
- DNA: Deoxyribonucleic acid
- EUCAST: European Committee of Antimicrobial Susceptibility Testing
- GABHS: Group A Beta-hemlytic Streptococcus
- GAS: Group A streptococcus
- GCS: Group C Streptococcus
- GGS: Group G Streptococcus
- HSV: Herpes Simplex Virus
- RADT: Rapid Antigen Detection Test
- RHD: Rheumatic Heart Disease
- WHO: World Health Organisation

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