

Full Length Research Paper

Evaluation of epidemiological factors of the bacterial pharyngitis in children in Shouk Al-Kameesh, Al-Khoms, Libya

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Pharyngitis is an inflammation or irritation of the pharynx or palatine tonsil. The etiology is usually viruses which cause the majority of the pharyngitis but most bacterial cases are attributed to group A *Streptococci* (GAS). This study aimed to identify the frequency of bacterial pharyngitis especially GAS of children, according to epidemiological factors. Symptoms present and signs for each patient were recorded, following which a throat swab was collected. There were 237 cases of children aged between 1 and 14 years with inflammation; out of 394 cases that visited the ENT primary care at Souk Al-Kameesh during the 12 months study period. From the incidence of 394 sore throat cases, GAS was observed in 237 cases (60.15%). Of these 110 (46.41%) were girls and 127 (53.59%) were boys. A higher proportion of children were found with GAS pharyngitis aged 5-9 and the lowest incidence of sore throat occurrence was 3-4 years. The highest incidence of children pharyngitis was recorded in January (Winter) and September (Autmn). The following factors showed independent positive correlation with GAS sore throat infection; patients visiting, months, year season, tonsillectomy, culture result, catalase test result and bacitracin test result with significant value of $P < 0.01$, whereas sex, age and gram stain results with $P > 0.01$. In conclusion, the results of this study found that cases of bacterial sore throat were higher than non-bacterial sore throat. The main cause of bacterial pharyngitis was GAS. Therefore, this study suggested that the use of the effectiveness of antibiotics and recommended anti-bacterial pharyngitis therapy to prevent initial rheumatic fever and its complications.

Key words: Pharyngitis, tonsillitis, epidemiological factors, *Streptococcus*, children.

INTRODUCTION

The most common etiology for Pharyngitis is by viral upper respiratory transmission. However, inflammatory processes of the nasopharynx are pharyngitis and

tonsillitis can be caused by bacteria (Lin et al., 2003). The bacteria that cause pharyngitis and tonsillitis are beta-hemolytic *Streptococcus* and *Staphylococcus aureus*

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(Bhalla et al., 2019). Bacteria cause erythema of the nasopharynx mucosa along with an exudative membrane (Leung and Kellner, 2004).

Most bacterial cases are due to group A *Streptococci* (GAS) infection (Van Schoor, 2013). Other causes include allergic reaction, trauma, toxin and neoplastic (Hildreth et al., 2015). Symptoms may include a sore throat, fever, headache and a hoarse voice (Rutter and Newb, 2015). *Gonorrhoea*, fungus, irritants such as smoke, allergies and gastro esophageal reflux cause Pharyngitis. Pharyngitis occurs mostly by people contact with nasal discharge, rather than by oral contacts (Kirkpatrick, 1996). Approximately 7.5% of people have a sore throat in any full three-months (Principi et al., 2013).

Identifying the cause of pharyngitis, especially group A Beta-Hemolytic *Streptococcus* (GABHS), is important to prevent the potentially life-threatening complications (Singer, 2001). Strep throat is a bacterial infection, which is the cause in about 25% of children and 10% of adults (Hildreth et al., 2015). An estimated 616 million cases of GABHS pharyngitis occur annually worldwide (Carapetis et al., 2005).

Rapid diagnosis and treatment of pharyngitis and tonsillitis patients with unnecessary antibiotic prescriptions in primary health care center lead to high costs and increased risk of antibiotic-resistance. Pharyngitis and its epidemiological factors are a public health problem. Since there is no such study in this area, this research was done in Souk Al-kamees, Libya. The aim of this study was: (i) to identify the frequency of childrens' pharyngitis in Souk Al-kamees, Libya, (ii) to study the epidemiological factors of pharyngitis according to gender, age, seasonal variation, history of tonsillectomy and associated disease among the survey population, and (iii) to identify the bacterial pharyngitis especially GABH among the study population.

METHODOLOGY

Study design

A study designed to be prospective of suspected cases of pharyngitis. The preliminary data collected by questionnaire from Souk Al-Kamees outpatient clinic, Alkhoms, Libya. The study was conducted for 12 month (February 2018 - January 2019). The study population age ranged between 1 and 14 years of those attending Souk Al-Kamees outpatient clinic with a suspected case of pharyngitis with throat-related complaints (sore throat).

Moreover, patient demographics clinical data include age, sex, race, blood sample, and patient symptoms were recorded. The samples were collected by the throat swab from just above the tonsils of an infected throat of the patients. The sample was immediately placed in a nutrient broth and incubated at 37°C for 24 h. The samples were transported to the laboratory for culture and identification.

Methods

The collected swabs from the patients were cultured on the Blood

agar and incubated at 37°C in an anaerobic incubator for 24 to 48 h. The colonies were tested with Gram stain for morphology and identification (Biomaghret, Tunisia). Biochemical tests like catalase test were done with the slide test for the identification of Group A beta hemolytic *Streptococcus*. A bacitracin disc was added to a plate of blood agar to find the GABH sensitive to bacitracin (huge inhibition occurred around bacitracin disk). *Streptococcus pyogenes* are sensitive to bacitracin (Pires et al., 2009). The ASO serological methods like latex agglutination for the qualitative and semi-quantitative measurement of antibody to anti streptolysin-O in human serum were done (Biomaghret, Tunisia). The collected data were analysed by SPSS software version 1.3 and significance level of $P < 0.01$.

RESULTS

This study was done for a period of 12 months from February 2018 to January 2019 on 394 children. But 237 were found with acute pharyngitis in targeted-age (1-14 years). Samples were taken in Souk Al-Kamees Primary Clinic, throat swab were collected from patients for blood culture and biochemical tests and the blood samples were taken for Anti Streptolysin-O titre.

Frequency of sore throat cases from the total number of patients

Total number of patients who visited the clinic with age bracket of 1 to 14 years were 394. Table 1 shows the percent of sore throats from the total number of visited patients was 60.15%. Significant relationship between sore throat cases and the number of patients visiting primary health care units by $P < 0.01$. Observed and expected counts of infected patients are as shown in Figure 1. The result indicates that sore throat is one of the most common reasons for visits to the clinic.

Frequency of sex and age (as age interval)

Table 2 shows age range 5-9 years, is the most affected by sore throat with 43.46% and age range 10-14 years is less affected by 14.77%. In females, the most affected by pharyngitis is age range 1-4 years by 44.55% and in male the most affected by pharyngitis is age range 5-9 years with 44.09%. The results also show that the cases of sore throat in males by 53.59% were higher than females by 46.41%. Figure 2 shows the shape of the distribution of the age by sex of the normal curve. No significant relation was found between age and sex and occurrence of pharyngitis in children by $P > 0.01$ (Table 3).

Occurrence pharyngitis in children according to months

Table 4 shows that during the different months of this study; January and September have the highest rate of

Table 1. Frequency of sore throat with total number.

Infection	Count	Percent	Chi-Square	P-Value
No (absent)	157	39.85		
Present	237	60.15		
Total	394	100	16.2437	0.000

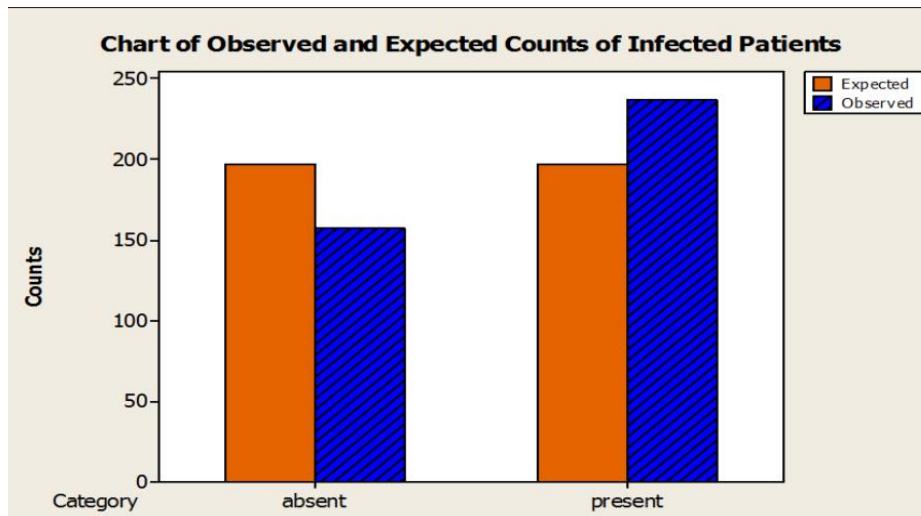


Figure 1. Observed and expected counts of infected patients.

Table 2. Frequency of sex and age (as age interval)

Sex	Age(1-4)	Age(5-9)	Age(10-14)	All
Female	49 (44.55%)	47(19.88%)	14(5.91%)	110 (46.41%)
Male	50(21.10%)	56(44.09%)	21(8.86%)	127 (53.59%)
All	99(41.77%)	103 (43.46%)	35 (14.77%)	237 (100%)

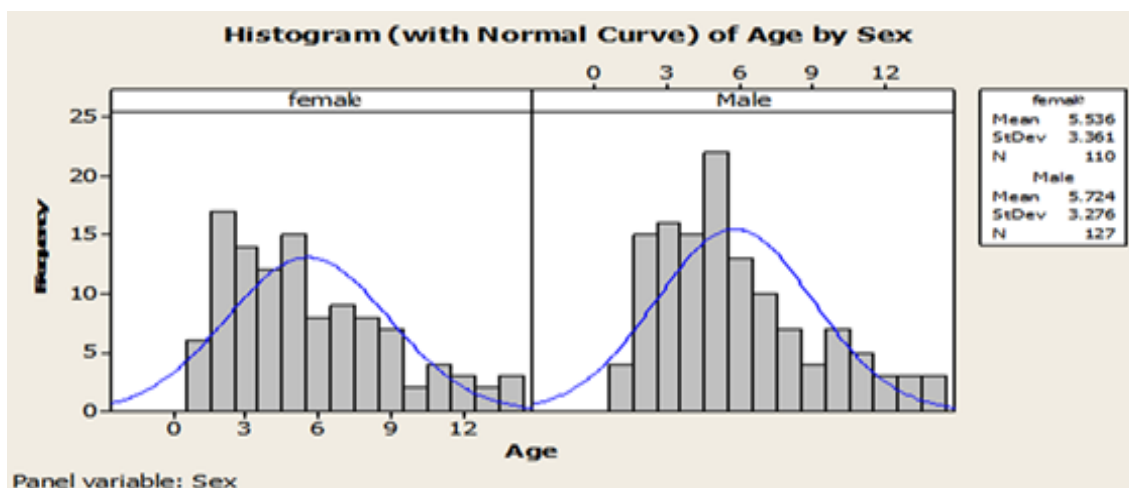


Figure 2. Normal curve of age by sex

Table 3. chi-square goodness-of-fit test for categorical variable, sex and age (as age interval).

Patient	Chi-Square	P-Value
Pearson	0.982	0.612
Likelihood Ratio	0.987	0.611

Table 4. Occurrence and frequency of pharyngitis in children according to months.

Month	Frequency	Percent	Chi-Square	P-Value
Jan	39	16.5		
Feb	14	5.9		
Mar	7	3		
Apr	9	3.8		
May	19	8%		
Jun	10	4.2		
Jul	10	4.2		
Aug	20	8.4		
Sep	33	13.9		
Oct	30	12.7		
Nov	26	11		
Dec	20	8.4	60.3671	0.000

Table 5. Occurrence of pharyngitis in children according to season.

Season	Frequency	Percent	Chi-Square	P-Value
Winter	73	30.8		
Spring	35	14.8		
Summer	40	16.9		
Autumn	89	37.5		
Total	237	100.0	34.308	0.000

acute pharyngitis in children by 16.5% and 13.9% respectively. While the lowest rate of acute pharyngitis in children in March and April by 3 and 3.8%, respectively, showing significant relation between occurrence pharyngitis in children and months by $P < 0.01$.

Occurrence of pharyngitis in children according to season

Table 5 shows that acute pharyngitis in children peaked twice during autumn by 37.5% (November, October and September) and winter by 30.8% (December, January and February), showing a significant relation between occurrence pharyngitis in children and season by $P < 0.01$.

Occurrence of pharyngitis in children according to symptoms

Table 6 shows that fever, cough, and running nose were the

highest symptoms among children with acute pharyngitis (64% of fever, 47.7% of cough and 43% of running nose).

Relationship of occurrence of acute pharyngitis in children and tonsillectomy

Table 7 shows that only 23 patients from total of 237 patients had tonsillectomy. Most cases had viral sore throat; this means the tonsillectomy operation reduced GAS pharyngitis episodes in children. Showing significant relationship between occurrence of pharyngitis in children and operation of tonsillectomy by $P < 0.01$.

Occurrence of pharyngitis in children according to ASO titer and culture result

Table 8 shows that the ASO titer positive result associated with pharyngitis (GAS) by 95.42% more than another causes of pharyngitis (SPP) by 0.92%. It also

Table 6. Occurrence of pharyngitis in children according to symptoms.

Symptoms	Frequency	Percent
Cough	113	47.7
Running nose	102	43.0
Fever	152	64.1
Enlarged LN	81	34.2
Nausea vomiting-abdominal pain	69	29.1
Diarrhea	69	29.1
Odynophagia	68	28.7
Hoarseness of voice	61	25.7
Enlarged tonsils	92	38.8

Table 7. Relationship of occurrence and frequency of acute pharyngitis in children and tonsillectomy.

After tonsillectomy	Frequency	Percent	Chi-Square	P-Value
Absent	214	90.3		
Present	23	9.7		
Total	237	100	153.928	0.000

Table 8. Occurrence and frequency of pharyngitis in children according to ASO titer and culture result.

ASO titer	GAB	SPP	No bacteria	All	Chi-Square	P-Value
Positive	104 (95.42%)	1 (0.92%)	4(3.67%)	109		
Negative	4(3.13%)	10(7.81%)	114(89.10%)	128		
All	108(45.57%)	11(4.64%)	118(49.79%)	237	202.275	0.000

Table 9. Occurrence and frequency of pharyngitis in children according gram stain result.

Gram stain	Frequency	Percent	Chi-Square	P-Value
Negative	118	49.8		
Positive	119	50.2		
Total	237	100.0	0.0042194	0.948

shows positive result with no bacteria by 3.67% in some carrier cases. Showing significant relation ($P < 0.01$) between positive result of ASO titer in this study and pharyngitis by GAB.

Occurrence pharyngitis in children according to gram stain

Table 9 shows Gram positive bacteria as a cause of acute pharyngitis in children such as GAS that is most common then SPP. Showing No significant relationship between bacterial pharyngitis frequency in children and nonbacterial pharyngitis according to Gram stain results

by $P > 0.01$.

Occurrence pharyngitis in children according to catalase test

Table 10. shows catalase tests, more negative than positive results, which means that bacterial pharyngitis affects children with GAS type more than SPP. Non-bacterial samples were not tested. Showing significant relation ($P < 0.01$) between bacterial pharyngitis and catalase test results. This result of catalase test can be used to differentiate between two types of Gram-positive bacteria in this study.

Table 10. Occurrence and frequency of pharyngitis in children according to catalase test result.

Catalase test	Frequency	Percent	Chi-Square	P-Value
Negative	106	44.7		
Not done	119	50.2		
Positive	12	5.1		
Total	237	100.0	74.9831	0.000

Table 11: Occurrence pharyngitis in children according bacitracin test result.

Bacitracin test	Frequency	Percent	Chi-Square	P-Value
Not done	119	50.2		
Not sensitive	11	4.6		
Sensitive	107	45.1		
Total	237	100.0	263.329	0.000

Occurrence pharyngitis in children according to bacitracin test

Table 11 shows the bacitracin test result indicating that the sensitive results are more than non-sensitive tests. This result shows bacterial pharyngitis in children by GAS is more sensitive than SPP in this study. Non-bacterial samples were not tested. Showing significant relation ($P < 0.01$) between bacterial pharyngitis and bacitracin test results. So bacitracin test can be used to differentiate between two types of Gram-positive bacteria in this study.

DISCUSSION

Sore throat is still the most common reason for visits to physicians. In the present study the percent of sore throat from total number of visitor equals 60.15%. Similar result was found by Bisno et al. (2002) in America and also in another study by Linder and Stafford (2001).

In this study, the culture result shows the occurrence of bacterial pharyngitis in children was more than nonbacterial pharyngitis by 50.2%. Results have shown that the pharyngitis by GAS is the most common as a bacterial cause of pharyngitis in children by 45.6%. Previous studies have shown exudative pharyngitis in children with acute *Streptococcal* infection 86% in Spain (Baquero et al., 1999) and 54% in Latvia (Zavadska, 2010). Another study showed that the GAS disease prevalence ranged from 21.4 to 27% among children aged 1-15 years in northern Taiwan (Lin et al., 2003). In contrast, a study carried out by Chi et al. (2003) showed that virus caused most acute pharyngitis and that GAS pharyngitis was uncommon in Taipei and Jos, Nigeria. Previous reports have also shown that *Streptococcal* throat carriage rate was 9.78% amongst primary school

pupils in Benin, Nigeria (Sadoh, 2001).

The highest occurrence rate was in the 5-9 years age group. This might be due to high exposure to the outer environment and lack of awareness. Several previous studies show similar results as pharyngitis is the highest at age 5-15 year by 37% in England (Bisno, 1996; Pichichero, 1997; Pickering et al., 2000). Evidence suggests that the prevalence of infection in this age-group may be due to the increased activity of children, giving a higher chance for the exposure to infection (Saleh, 2009). Besides, this school-age children may be making contact with each other in classrooms leading to increased infections. In the current study, an occurrence of pharyngitis in children among boys was 53.6%, compared to 46.4% in girls. A study in Sabha, Libya done by Soliman (2012) showed the pharyngitis infection rates for males was 64.3% and that of females was 35.7%. In contrast, a study in Syria found that distribution of pharyngitis in male was 47.4% and female was 53.6% (Cherith et al., 2005).

A monthly comparison showed that January (16.5%) and September (13.9%) contain the highest rate of occurrence of acute pharyngitis in children. While the lowest rate of occurrence of acute pharyngitis in children occurred in March (3%) and April (3.8%). In addition, the acute pharyngitis in children peaked twice during year in autumn 37.6% (November, October and September) and winter by 30.8% (December, January and February). This results may be due to children staying mostly indoors in crowded conditions, which may increase the rate of transmission of infection. In a similar study in Benghazi by Alhouni (2005), the peak incidence of infection was reported in winter and autumn. In contrast, previous studies in Taiz/Yemen by Saleh (2009), found the highest prevalence during winter season (November and December) as well as rainy season (July and August). In north India, a study by Nandi et al. (2001) showed that

the relative incidence was higher during the winter (November to January) and rainy (August) months.

In the current study, results have shown that fever, cough, and running nose were the highest symptom among children with acute pharyngitis (64% of fever, 47.7% of cough and 43% of running nose). A study in Benin city showed fever and inflamed tonsils/pharynx were the most frequent signs or symptoms occurring in 89.04 and 87.67%, respectively (Wilson, 2008). Another study in Latvia showed pharyngeal erythema and fever were prevalent up to 90 and 85%, respectively (Zavadska, 2010).

The results of the study showed that only 23 patients out of the total number of patients have tonsillectomy, usually a viral sore throat, which means that the operation of tonsillectomy reduces the occurrence of pharyngitis in children. Similar to a study in Finland by Alho et al, (2007) reported that the tonsillectomy reduces the number of acute pharyngitis and symptoms.

Antistreptolysin-O (ASO) test is an accurate diagnosis of pharyngitis and, is necessary to rule out group A streptococcus (Vintilescu et al., 2020). In this study, the positive result of ASO titer is 46%; this percent represents previous infection by GAS and negative result by 54%. In similar study by Stollerman and Dale (2008), the ASO titer significantly elevated over normal levels during a *Streptococcal* infection. Therefore, the ASO titer is the standard serological assay for confirmation of Group A *Streptococcal* infection.

Conclusion

The study indicated both female and male have occurrence of pharyngitis in this age range (1-14 years), but no significant difference between the gender. The age range 5-9 years is the most affected with sore throat in patients. The January and September months contained the highest rate of occurrence of acute pharyngitis in children while the lowest rate of occurrence of acute pharyngitis in children was in March. Occurrence of acute pharyngitis in children peaked twice during the year in autumn and winter.

The clinical features like fever, cough, running nose were the highest symptoms among children with acute pharyngitis. Appearance of bacterial pharyngitis in children is more than non-bacterial pharyngitis and the most common is bacterial pharyngitis (GAS) in children. The positive results of ASO titer associated with pharyngitis by GAB are more than other causes of pharyngitis. However, this study shows two-Gram positive bacteria as a cause of bacterial pharyngitis in children, such as GAS, that is, the most common and *Staphylococcus* species.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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