

# The Prevalence of Group A Beta Haemolytic Streptococcal Carriers Among School Children in Coimbatore, South India

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## ABSTRACT

**Background and Objectives:** Infections which are caused by the group A *Streptococcus* continue to be an important problem in India and other developing countries, therefore, a continued surveillance is imperative to monitor the epidemiological trends. The asymptomatic pharyngeal carriage of the Group A *Streptococci* (GAS) in children may lead to the spread of respiratory infections in the community. The data on the healthy GAS carriers in the community are therefore important. We carried out this pilot study to screen the school children in Coimbatore city, south India to detect the pharyngeal carriage of GAS.

**Methods:** Throat swabs were collected from a total of 255 children who were aged 8–11 years, from 2 schools in Coimbatore. The

isolates of the beta haemolytic streptococci were serogrouped by agglutination tests, by using specific antisera.

**Results:** Beta haemolytic streptococci were isolated from 27 samples out of the 255 asymptomatic children. The percentage of asymptomatic GAS carriers were 5.09 in our study.

**Conclusion:** The carriage rate of the beta haemolytic streptococci which are seen in children poses a threat to the community and it should be checked. Carrier rates which ranged from 2.3% to 34 % were reported from different parts of our country. A regular screening needs to be done to control the development of non-suppurative sequelae such as acute rheumatic fever and post streptococcal glomerulonephritis, which are debilitating and difficult to treat.

**Key Words:** Beta haemolytic streptococci, Children, Streptococcal carriers

## INTRODUCTION

The Group A Beta Haemolytic *Streptococcus* (GABHS) or *Streptococcus pyogenes* has remained a significant human pathogen for centuries. This organism causes a wide variety of infections in humans, which ranges from mild upper respiratory and skin infections, to severe suppurative and invasive conditions like necrotizing fasciitis and toxic shock syndrome. One of major concern are the post-infectious sequelae like acute rheumatic fever and post streptococcal glomerulonephritis, which continue to occur worldwide despite the efforts which are by clinicians, scientists and public health officials to comprehend their pathogenesis and to devise methods of disease control [1].

It has been estimated that approximately 7 sore throat episodes occur per child per year; with 13.5% of these being caused by the Group A *Streptococcus* (GAS) [2]. The information on the occurrence of invasive streptococcal disease in India is limited. Although acute rheumatic fever and rheumatic heart disease have declined in many parts of the world, they continue to be a major cause of the cardiovascular morbidity and mortality in India. Children are the major reservoirs of the Group A *Streptococci*, with recurrent episodes of pharyngitis, suppurative and nonsuppurative complications which are caused by GAS. The peak age incidence for the infections which are caused by GAS is between 5 and 15 years [3]. They represent the pool from which adults with severe invasive disease acquire their infections.

Infections which are caused by the Group A *Streptococcus* continue to be an important problem in India and in other developing countries. Therefore, a continued surveillance is imperative to monitor the epidemiological trends.

## PATIENTS AND METHODS

A total of 255 children were enrolled in this study from 2 schools in Coimbatore, south India. After obtaining permission from the school authorities, an informed consent was sent to the parents of all the children who were included in the study. The consent explained about the study and the throat swabs which were intended to be taken from their children. Thus, an informed consent was obtained from the parents. A throat swab was taken by depressing the tongue and 2 swabs were passed well over the tonsils, the tonsillar fossa and over the posterior pharyngeal wall. The swabs were placed in sterile test tubes with the ends sticking outside to facilitate handling and they were immediately transported to the lab. They were then plated on 6% sheep blood agar. The plates were incubated at 37°C in CO<sub>2</sub> and they were read after 24 hours and 48 hours.

Gram staining and the catalase test were performed on the colonies which showed beta-haemolysis.

Bacitracin sensitivity testing (0.04 units/disc) and CAMP (Christie, Atkins, Munch Peterson) test was done on all the samples which had beta-haemolytic *Streptococci*. Grouping was done on the bacitracin sensitive and the CAMP negative isolates by subjecting them to antigen extraction by the micronitrous acid extraction method and further by doing a co-agglutination technique [4].

Antibiotic susceptibility testing was performed on blood agar by the Kirby-Bauer disc diffusion method by using discs that were obtained from Hi-Media Laboratories Pvt Ltd, according to the CLSI standards. The antibiotics which were tested, included penicillin (10µg), erythromycin (15µg), linezolid(30µg), amikacin (30µg),

vancomycin (30µg), gentamycin (10µg), cotrimoxazole (23.75/.25) and chloramphenicol (30µg).

## RESULTS

Among the 255 students who were studied, 181 were females and 26 were males. The students belong to the age group of 8 to 11 years. 13 students (5.09%) were found to be group A beta-haemolytic streptococcal carriers. The group comprised of three males and ten females. At the time of the study, none of the 13 children were found to have streptococcal sore throat symptoms. The prevalence of the Beta Haemolytic Streptococci (BHS) and the Group A Streptococci (GAS) among the 8-11 yrs old school children of both the sexes are depicted in [Table/Fig-1].

27 beta haemolytic gram positive cocci were isolated in culture out of the 255 samples. Of these, 5 isolates were identified as methicillin sensitive *Staphylococcus aureus*. Of the remaining 22 isolates, 13 isolates were sensitive to bacitracin and they were CAMP negative, which were grouped as group A beta-haemolytic Streptococcus. These isolates were further confirmed by coagglutination technique using antisera which were obtained from Christian Medical College (CMC), Vellore. One was CAMP positive and hence it was identified as group B beta-haemolytic Streptococci or *Streptococcus agalactiae*. The rest of the 6 isolates were catalase negative, bacitracin resistant and CAMP negative, gram positive cocci in chains, which were grouped under the non-A and non-B beta-haemolytic Streptococci. The remaining 2 isolates were bile esculin positive, sorbitol positive, their growth occurred on 6.5% NaCl and they were identified as *Enterococcus faecalis*. The patterns of the various beta haemolytic gram positive cocci which were isolated in this study are shown in [Table/Fig-2].

Antibiotic sensitivity testing was carried out on the entire group A beta-haemolytic Streptococcus carriers. All the strains were sensitive to penicillin, vancomycin, linezolid, cotrimoxazole and chloramphenicol. The antibiotic sensitivity testing revealed that three strains (23.07%) were erythromycin resistant, two strains (15.4%) were amikacin resistant and that one strain (7.7%) was gentamicin resistant. The antibiotic susceptibility pattern of the group A beta-haemolytic Streptococcus carriers which were tested are given in [Table/Fig-3].

## DISCUSSION

The presence of group A streptococci in the upper respiratory tract may reflect either a true infection or a carrier state. The treatment and the prevention of dangerous complications in the group A beta haemolytic Streptococcal pharyngitis is of great importance. The healthy carriers of the group A beta hemolytic Streptococcus are the sources for bacterial dissemination which lead to disease and even to severe epidemics. According to different studies, the group A beta-haemolytic Streptococcus is more commonly seen in the pharynx of children as compared to that of adults.

A cohort study from Pennsylvania reported a carrier rate of 15.5% among school going children, with a mean age of 9.6 years [3]. In Tunisia, rheumatic fever remains an important health problem in children and a one year prospective study was conducted in 2 paediatric outpatient clinics, which showed Streptococcal strains in 12.9% of the controls and in 20.7% of the patients. The group A Streptococci had a frequency of 9% and 17.7% in the controls and in the patients respectively [5]. A study which was conducted in Sweden revealed a carrier rate of 5.0% [6]. The prevalence of beta-haemolytic Streptococcus in healthy individuals in Sweden

	Percentage (%) positive out of 255 children	Number of males positive out of total 26 male children	Number of females positive out of total 181 female children
Group A Streptococci (GAS)	5.09	3	10
Beta haemolytic Streptococci (BHS)	8.60	9	13

**[Table/Fig-1]:** Prevalence of Beta Haemolytic Streptococci (BHS) and Group A Streptococci (GAS) among 8-11 yr old school children of both sexes.

Beta haemolytic Gram positive cocci	Number isolated out of 255 samples
Group A Streptococci (GAS)	13
Group B Streptococci (GBS)	1
Non A Non-B beta hemolytic Streptococci	6
Group D Streptococci- Enterococcus faecalis	2
Methicillin sensitive Staphylococcus aureus (MSSA)	5
Total	27

**[Table/Fig-2]:** Pattern of various beta haemolytic Gram positive cocci isolated in this study are shown in this table.

Antibiotic	Total number of isolates sensitive to antibiotics	% sensitive
Penicillin 10µg	13	100
Amikacin 30 µg	11	85
Gentamicin 10µg	12	92
Linezolid 30µg	13	100
Erythromycin 15µg	10	77
Vancomycin 30µg	13	100
Co-trimoxazole 1.25µg +23.75 µg	13	100
Chloramphenicol 30µg	13	100

**[Table/Fig-3]:** Antibiotic susceptibility pattern of group A beta-haemolytic Streptococcus isolates tested are given in this table.

Study	Country	Carrier Rate of Gas (%)	Article Reference Number
Gunnarsson et al.,	Sweden	5 – 21.2	7
Mzoughi et al.,	Tunisia	12.9	5
Sobhan et al.,	India	11.2 – 34	2
Menon et al.,	Chennai, South India	5.2 & 8.4	8 & 9
Koshy et al.,	Vellore, South India	2.3	10
Judith et al.,	Pennsylvania	15.5	3
Nabipour et al.,	Iran	28.5	11
Our Study	India	5.09	Present study

**[Table/Fig-4]:** Comparison of group A Streptococci carrier rates throughout the world shows

was low [in children below the age of 3 years (1.9-7.1%) and in adults above 16 years (2.4-3.7%)] and the highest in the age group of 3-15 years (5.0-21.2%) [7].

In India, the isolation rates of GAS in children with pharyngitis had ranged from 4.2% to 13.7%, which were comparable to the rates which were reported from the developed countries. The prevalence

of the asymptomatic carriage of GAS in different parts of India has been reported to lie in the range of 11.2-34% [2]. A study was conducted in Chennai, to determine the isolation rate and the biotypes of the group A Streptococci from the throat cultures of normal school children in south India. Among the 250 throat swabs which were collected from normal school going children who were aged between 5-15 years, GAS was isolated from 13 children (5.2%) [8]. In another study which was done in Chennai, the percentage of the asymptomatic GAS carriers was found to be 8.4% [9] and in the district of Vellore, India, the carriage rate of GAS was found to be 2.3% [10]. In our study, the carrier rate of the group A beta-haemolytic Streptococcus in young children was 5.09%. It correlated well with the findings of other studies which were done in south India and it also indicated that the percentage of the carrier rate was less as compared to that in northern India.

In a study which was conducted in Iran, 28.5% were group A beta-haemolytic Streptococcus carriers among which 54.4% were males and 45.5% were females [11].

[Table/Fig-4] shows the comparison of the group A Streptococci carrier rates throughout the world. The GAS which was isolated from carriers could cause active throat infections. GAS has also been reported to be found in the tonsillar epithelial cells in carriers, thus suggesting a reservoir status with the potential to cause reinfections.

Among the commonly used antibiotics for the treatment of the beta-haemolytic Streptococcus infections are Penicillin and its family. The American Academy of Pediatrics (AAP), the Centers for Disease Control and Prevention (CDC), and the Infectious Diseases Society of America (IDSA) have recommended penicillin as the antibiotic of choice for children with sore throat which was caused by GABHS. Most of our isolates were sensitive to penicillin and vancomycin. Macrolides are not the first-line choice for treating Streptococcal infections except in the case of penicillin allergy. In our study, 3 strains (23.07%) were erythromycin resistant, which correlated with the findings of another study from Vellore, South India, which showed that the resistance to macrolides was increasing [12].

Children with a peak age incidence between 5 and 15 years for infections which were caused by GAS, are the major reservoirs of GAS and are the target population for pharyngitis, as well as for the suppurative and non suppurative complications which are caused by GAS. They represent the pool from which adults with severe

invasive disease acquire the GAS infections.

The results of our study highlighted the importance of regular surveillance programmes to keep the group A Streptococcus infections and their carriage in check. The children who were found to be carriers could be adequately treated with antibiotics. This would further facilitate the control and the development of non-suppurative sequelae such as acute rheumatic fever and post streptococcal glomerulonephritis, which are debilitating and difficult to treat.

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