

## Determination of Throat Carriage Rate of Group A Beta Hemolytic Streptococci Among Different Age Groups

Farklı Yaş Gruplarında Grup A Beta Hemolitik Streptokok Boğaz Taşıyıcılığının Belirlenmesi

Ebru Evren<sup>1</sup>, Alara Akdeniz<sup>2</sup>, Selin Diboğlu<sup>2</sup>, Berk Halilbeyoğlu<sup>2</sup>, Ege İleri<sup>2</sup>, Merve Kuş<sup>2</sup>, Utkun Moran<sup>2</sup>

<sup>1</sup>Baskent University Faculty of Medicine, Department of Medical Microbiology, Ankara, Turkey

<sup>2</sup>Baskent University Faculty of Medicine, Phase 2 Student, Ankara, Turkey

### ABSTRACT

**Objective:** To determine the throat carriage rate of Group A Beta Hemolytic Streptococci among different age groups.

**Methods:** A total of 259 participants from Başkent University Private Ayşeabla School first grade students, Başkent University Faculty of Medicine and Dentistry first and second phase students were enrolled in this study. Informed consent was obtained from all participants. The presence of any upper respiratory system infection symptoms, drug use, Group A Beta Hemolytic Streptococci (GAS) history, family carriage history, socio-economic status were determined by using a questionnaire. Throat culture specimens were obtained with a cotton-tipped swab containing transport medium, transported to the laboratory within two hours, and processed in the same day with standard techniques. For data analysis Pearson's Chi-square and Monte Carlo simulation Chi-square tests were used.

**Results:** Out of 259 samples GAS was determined from only two samples (about 1%) in two adults. Carriage was not determined among school children. GAS cases were seen in a girl and a boy between 18-19 ages. There was no statistically significant difference in terms of carriage rate between girls and boys.

**Conclusion:** Better socio-economic status and hygiene conditions and also changing climate seem to be important factors than age.

**Key Words:** Group A beta hemolytic Streptococci, carriage, throat culture, infection, prevalence

Received: 07.07.2014

Accepted: 07.20.2014

### ÖZET

**Amaç:** Grup A Beta Hemolitik Streptokok boğaz taşıyıcılığının değişik yaş gruplarında belirlenmesidir.

**Yöntem:** Başkent Üniversitesi Özel Ayşe Abla Okulları birinci sınıf öğrencileri, Başkent Üniversitesi Tıp ve Diş Hekimliği Fakültesi birinci ve ikinci sınıf öğrencileri olmak üzere toplam 259 kişi çalışmaya dahil edilmiştir. Çalışmaya katılan kişilerde semptom varlığı, ilaç kullanımı, Grup A Beta Hemolitik Streptokok (GAS) öyküsü, ailede taşıyıcılık olup olmadığı, sosyo-ekonomik durum düzenlenen anket aracılığıyla belirlenmiştir. Tüm katılımcılardan bilgilendirilmiş onam formu ile onay alınmıştır. Boğaz kültür örnekleri transport besiyeri içeren eküvyonlu pamuk ile alınmış, laboratuvara iki saat içinde ulaştırılarak standart tekniklerle ekimler yapılmıştır. Veri analizi için Pearson's Ki-kare ve Monte Carlo simülasyon ki-kare testleri kullanılmıştır.

**Bulgular:** 259 örneğin sadece ikisinde (%1) GAS tespit edilmiştir. Tespit edilen olgular 18-19 yaşın aralığında bir kız ve bir erkek öğrencidir. Kız ve erkek öğrenciler arasında taşıyıcılık oranları açısından istatistiksel olarak fark bulunmamıştır.

**Sonuç:** Sosyo-ekonomik düzeyin, hijyen koşullarının iyi olması ve hatta değişen iklim şartlarının yaş faktöründen önemli olabileceği sonucuna varılmıştır.

**Anahtar Sözcükler:** Grup A beta hemolitik streptokok, taşıyıcılık, boğaz kültürü, enfeksiyon, prevalans

Geliş Tarihi: 07.07.2014

Kabul Tarihi: 20.07.2014

## INTRODUCTION

Although viruses are the most common cause of acute pharyngitis, *Streptococcus pyogenes* (group A beta hemolytic streptococci-GAS) is an important bacterial pathogen (1). This bacterium is the significant cause of community-associated infections (2). Pharyngitis due to bacteria is a disease of children 5–15 years of age and it usually occurs in the winter and early spring (3,4). It can lead suppurative (impetigo, pneumonia, necrotizing fasciitis, cellulitis, bacteremia, osteomyelitis, otitis media, sinusitis, and meningitis), nonsuppurative such as acute rheumatic fever and poststreptococcal glomerulonephritis and invasive complications (5,6). Another status for this bacteria is carriage. Carriage is defined as prolonged presence of the bacteria in the pharynx without any symptoms (2).

GAS frequently colonizes in the throat of an asymptomatic person. Pharyngeal carriage rates of GAS among healthy school children vary according to different factors such as geographical location and seasons (4). Although GAS carriers do not generally require antimicrobial therapy or have no risk for developing suppurative or nonsuppurative complications, it is important to determine the carriage rate for epidemiological approach (2).

The aim of this study is to determine group A beta hemolytic streptococci carriage among the different age groups.

## METHODS

This study was carried out between February-March 2014. A total of 259 participants (154 girls, 105 boys) from Başkent University Private Ayşeabla School first grade students, Başkent University Faculty of Medicine and Dentistry Phase I and Phase II students were enrolled in this study. Informed consent was obtained from all participants.

The presence of any upper respiratory system infection symptoms, drug use, GAS history, family history about carriage, socio-economic status were determined by using a questionnaire. Working in three different age groups (7-8, 14-15, and 18-19 age groups) was also specified.

Throat culture specimens were obtained with a cotton-tipped swab containing transport medium (BBL Becton Dickinson, Sparks, MD), transported in the laboratory within 2 hours, and processed in the same day with standard techniques.

MacConkey agar (for Gram negatives) and 5% sheep blood agar were used. The streaked blood agar plates were incubated at 37 °C in a candle jar for 24 to 48 hours. MacConkey agar was incubated aerobically at 37 °C for 24 hours.

All the β-Hemolytic colonies were identified morphologically, and confirmation of *S. pyogenes* was with Gram staining, catalase test and bacitracin disc. Beta hemolytic, catalase negative, Gram positive cocci with bacitracin test sensitive was identified as Group A beta hemolytic *Streptococcus*. Beta hemolytic, catalase and coagulase positive, Gram positive cocci were identified as *Staphylococcus aureus*. For Gram negatives MacConkey agar and Gram stainings were investigated, no further identification was made.

For data analysis Pearson's Chi-square and Monte Carlo simulation Chi-square tests were used.  $P < 0.05$  was evaluated as significant. Analyses were performed with SPSS 17.0 statistical software package.

## RESULTS

Out of 259 samples, 243 (94%) were normal throat flora, 13 were (4.6%) *Staphylococcus aureus* colonization, one (0.4%) was Gram negative bacterial colonization. GAS was isolated only from two samples (1%).

GAS cases were a girl and a boy in 18-19 age groups. There was no statistically significant difference in terms of carriage rate between these two patients ( $p > 0.05$ ). GAS was not determined among any primary school students.

When all age groups were analyzed, 28 volunteers (10.8%) defined GAS carriage history while 231 (89.2%) were not. There was a statistically significant difference between GAS history and age ( $p < 0.005$ ). There was no GAS carriage history at 6-7 age groups. However, the carriage history rates were 16% and 84% at 14-15 and 18-19 ages groups, respectively. The increase of carriage rate at 14-15 age group was remarkable. There was not statistically significant difference between gender and GAS carriage history ( $p = 0.099$ ).

The age and gender distribution of volunteers was shown in Table 1. The number of GAS carriage history was shown in Table 2.

**Table 1.** The age and gender distribution of volunteers.

Gender	Age (n)			Total
	7-8	14-15	18-19	
Girl	26	12	116	154
Boy	28	22	55	105
<b>Total</b>	54	34	171	259

**Table 2.** The number of GAS carriage history.

GAS History	n	%
Positive	28	11
Negative	231	89
<i>Total</i>	259	

## DISCUSSION

*Streptococcus pyogenes* is facultative anaerobe, Gram positive cocci responsible for suppurative and nonsuppurative complications. GAS infections cause nearly 1.500.000 deaths per year (7). People are the only known reservoir for this bacterium. Although clinical manifestations are well defined, the pathogenesis of the disease is still controversial.

Besides clinical diseases carriage rates can be seen in more than 20% of children in spring and winter months (8). Although some authors reported that there is no need to treat carriage, some argue that is a risk factor especially in closed communities (8-10). As most studies about carriage were carried out in closed communities, it is claimed that these data does not reflect current rates (11).

According to the reported studies the carriage rate varies depending on age, country, region, season, socioeconomic level and such other factors (12,13). The carrier rate of this bacteria also varies from one population to another (12). In Turkey the carrier rate in adults is lower than children at about 9%. (14). For all age groups the carrier rate was between 9-25% in Turkey, 12% in USA, 9.7% in Ethiopia and 9% in Africa (9,13,15,10). In our study carriage rate was detected only in adults at a rate of about 1%.

As region is another factor that influence the carriage rate, the percentages about carriage rate also varies in different cities of Turkey. Hizel et al (3) reported that carriage rate was 3% between 3-12 age in Ankara city. Öztürk et al (16) also reported a carriage rate of 25.9% in school children in Düzce city. Toprak et al (17) reported a carriage rate of 6.5 % in Afyonkarahisar city. Kurtoğlu et al (18) reported this rate as 16% in Van city.

As season is another important factor about GAS carriage rates, we have also investigated the changing air temperatures. According to the last five years' Republic of Turkey Ministry of Forest and Water Management data average temperatures remained above the seasonal norms in Turkey. To the best of our knowledge GAS may colonize people in early spring and winter, however the temperatures are higher than expected in these seasons. As a conclusion climate changes may also affect the carriage rate (19).

Our results are different from then the other data reported from Turkey. As our study was carried out only in private schools the lower carriage rates may be explained by this reason and also this can be addressed as the limitation of this study.

In our study carriage rate was detected only in adults at a rate of about 1%. However carriage was not determined among school children. This situation can be explained by better socio-economic status and hygiene conditions. Hygiene conditions may decrease bacterial colonization.

## CONCLUSION

When all parameters included in this study are analyzed better socio-economic status and hygiene conditions and also climate changes are seem to be important factors than age. More studies are needed to elucidate the prevalence of carriage rate and the factors that influence this rate in Turkey.

**Conflict of Interest**

No conflict of interest was declared by the authors.

**Acknowledgements**

This study was presented in XVI. Student Working Groups Symposium 14-16 May 2014, Ankara, Turkey.

This study was also approved by Baskent University Institutional Review Board (Project No: KA 13/261), and supported by Baskent University Research Fund.

**REFERENCES**

1. Bisno AL, Gerber MA, Gwaltney Jr JM, Kaplan EL, Richard H, Schwartz RH. Practice Guidelines for Streptococcal Pharyngitis. *CID* 2002;35:113-25.
2. 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. *Clin Infect Dis* 2012; 55:e86-102.
3. Hızal K, Emekdaş G, Coşguner M, Altanlar N, Akın A. Kreş ve ilkokul Çocuklarında A Grubu Beta Hemolitik Streptokok Taşıyıcılığı. *Türkiye Klinikleri J Pediatr* 1997;6:158-60.
4. Öngen B. A Grubu Streptokok İnfeksiyonlarında Bakteriyolojik Tanı. *ANKEM Derg* 2004; 18: 45-50.
5. Parlakay AO, Uysal M, Kara A. Group A streptococcal tonsillopharyngitis burden in a tertiary Turkish hospital. *The Turkish J Pediatr* 2012;54:474-7.
6. Elli M, Canter B, Citak C, Tunaoglu S, Dogan M. Invasive Group A Beta-Hemolytic Streptococcal Infection In Children In The 2000's: A case report *Gazi Medical Journal* 2008; 19: 84-6.
7. Cohen-Poradosu R, Kasper DL. Group A streptococcus epidemiology and vaccine implications. *Clin Infect Dis*. 2007;45: 863-5.
8. Tanz RR, Shulman ST. Chronic pharyngeal carriage of group A Streptococci. *Pediatr Infect Dis J* 2007; 26:175-6.
9. Bargh GJ, Hoch JS, Speechley M, Willey BM, McGeer A, Hwang SW. A streptococcal carriage among residents of an urban homeless shelter. Letter to the editor. *Can J Infect Dis Med Microbiol* 2007;17:316-8.
10. Engel ME, Mayosi BM. Clinical and epidemiological aspects of Streptococcus pyogenes pharyngitis and carriage in Africa. *SA Heart Journal* 2013;10:434-9.
11. Pichichero ME, Marsocci SM, Murphy ML, Hoeger W, Green JL, Sorrento A. Incidence of streptococcal carriers in private pediatric practice. *Arch Pediatr Adolesc Med* 1999;153:624-8.
12. Sevinc I, Enoz M. The Prevalence of Group A Beta-hemolytic Streptococcus in Healthy Turkish Children in Day-care Centers in Ankara. *Chang Gung Med J*. 2008;31:554-8.
13. Shaikh N, Leonard E, Martin JM. Prevalence of Streptococcal Pharyngitis and Streptococcal Carriage in Children: A Meta-analysis. *Pediatrics* 2010;126:557-64.
14. Adiloğlu AK, Can R, Kaya S, Cicioğlu Arıdoğan B. Isparta ili Kesme Köyünde 15-60 yaş arası gönüllülerde boğaz sürüntü örneklerinin incelenmesi. *Türk Mikrobiyol Cem Derg*. 2002;32:193-6.
15. Abdissa A, Asrat D, Kronvall G, Shitu B, Achiko D, Zeidan M et al. Throat carriage rate and antimicrobial susceptibility pattern of group A Streptococci (GAS) in healthy Ethiopian school children. *Ethiop Med J*. 2011;49):125-30.
16. Öztürk CE, Yavuz T, Kaya D, Yücel M. The rate of asymptomatic throat carriage of group A Streptococcus in school children and associated ASO titers in Duzce, Turkey. *Jpn J Infect Dis*. 2004;57:271-2.
17. Toprak D, Demirdal T, Aşçı Z, Orhan S, Çetinkaya Z, Demirtürk N. Sağlıklı okul çocuklarında nazofarinkste A grubu beta hemolitik streptokok taşıyıcılığı. *Düzce Tıp Fakültesi Dergisi* 2008;2:26-9.
18. Kurtoğlu MG, Berktaş M, Bozkurt H, Bayram Y, Gülmez S. Gündüz Bakımevlerinde A Grubu Beta Hemolitik Streptokok ve Haemophilus Influenzae Taşıyıcılığı. *İnfeksiyon Dergisi*. 2003;17:281-4.
19. [www.mgm.gov.tr](http://www.mgm.gov.tr) (Access date: May 14 2014).