Throat culture screening for β-haemolytic streptococci among schoolboys in Saudi Arabia

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تحري العقديات الحالّة للدم بيتا في مزارع عينات من الحلق بين التلاميذ في المملكة العربية السعودية

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خلاصة : صُممت هذه الدراسة بهدف تقدير معدل حاملي العقديات الحالّة للدم بيتا بين 972 من تلاميذ المدارس الإبتدائية في منطقة مرتفعة بالمملكة العربية السعودية . واستهدفت الدراسة كذلك تعيين الاختلافات الموسمية للعدوى ، ومدى ارتباطها بالطبقات الاجتماعية وبمنسب الازدحام ومنسب كتلة الجسم . وتبيّن أن معدل حاملي العقديات الحالة للدم بيتا يبلغ 13.1% ، وكان في الربيع يزيد كثيرا عنه في الشتاء . أما العلاقة بين عدوى العقديات وبين الطبقات الاجتماعية أو منسب الازدحام أو منسب كتلة الجسم فلم تكن مما يُعتدّ به إحصائياً . وربما يعزى انخفاض معدل انتشار العدوى بالعقديات إلى ارتفاع المنطقة ، ولكن للتحقق من ذلك يجب إجراء المزيد من الدراسات .

ABSTRACT This study was designed to estimate the carrier rate of β-haemolytic streptococci among 972 primary-school boys in a high-altitude area of Saudi Arabia, and its association with social class, crowding index and body mass index, and also to determine the seasonal variation of infection. A carrier rate of 13.1% for β-haemolytic streptococci was detected. The carrier rate was significantly higher in spring than in winter. The association between streptococcal infection and social class, crowding index, or body mass index was statistically not significant. The low prevalence of streptococcal infection might be attributed to the high altitude but further studies are needed to determine whether this is the case.

Recherche de streptocoques β-hémolytiques par la culture des prélèvements de gorge chez des écoliers en Arabie saoudite

RESUME L'objet de cette étude était d'estimer le taux de porteurs de streptocoques β-hémolytiques chez 972 écoliers du primaire dans une zone de haute altitude en Arabie saoudite et de déterminer la variation saisonnière de l'infection ainsi que la relation qui existe avec la classe sociale, le degré de peuplement et l'indice de masse corporelle. On a trouvé un taux de porteurs de streptocoques β-hémolytiques s'élevant à 13,1%. Ce taux était considérablement plus élevé au printemps qu'en hiver. La relation entre l'infection à streptocoques et la classe sociale, le degré de peuplement ou l'indice de masse corporelle n'était pas statistiquement significative. Le faible niveau de la prévalence de l'infection à streptocoques pourrait être attribué à l'altitude élevée mais des études supplémentaires sont nécessaires afin de déterminer la véracité de cette hypothèse.

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Introduction

Sore throat or pharyngitis is one of the most common complaints presented in schools, particularly among elementary schools [*1*]. Although such illness is self limiting and usually not considered serious, when the causative agent is group A β-haemolytic streptococci, which accounts for about 5%–30% of acute cases of pharyntgitis [2], there is a potential risk of complications to the child such as rheumatic fever, with considerable morbidity, and rheumatic carditis. Thus, the prime concern remains the differentiation in etiology between nonstreptococcal and streptococcal infection.

The prevalence of group A streptococci varies considerably, but has been found to range from 10% to 50% in the throats of healthy schoolchildren [*3*]. The prevalence depends on epidemiological and environmental factors. Significant geographical differences in streptococcal groups isolated from the throats of healthy schoolchildren have been reported; group A is the most common in temperate countries, and groups C and G are the most common in tropical countries [*3*]. Figures for Saudi Arabia are less well established. However, a study of group B streptococcal infection and colonization among term-pregnant women in Asir province [*4*] revealed a colonization rate of only 3% compared to 15% in European studies [*5,6*] and 15%–30% in studies from the United States of America [*7,8*].

Abha, the capital of the Asir region, is in the Asir mountains approximately 3000 m above sea level. It has the lowest mean annual temperature of any of the southern urban areas of Saudi Arabia, with summer temperatures of 16–28 °C and winter temperatures of 5–15 °C. There is a clinical impression of a high frequency of sore throat problems among children in Abha, attributed usually to the cold climate that characterizes the city. People in Abha live in houses of more urbanized features with modern facilities and the families are of a higher socioeconomic level than those in rural areas.

The aims of the present study were:

- to determine the carrier rate of streptococcus among schoolboys in Abha and its association with social class, crowding index and body mass index;
- to determine the seasonal variation of the streptococcal carrier state;
- to discuss the need for a mass culturing programme in the management of streptococcal pharyngitis in a community.

Materials and methods

Sampling procedure

A two-stage random sample of 1005 children (of whom 972 responded after the exclusion of apparently ill children from the study) from six primary schools for boys was selected out of a total of 17 such schools in Abha. The sample constituted 17.6% of the original school population of 5537 children from all schools with an age range of 6–12 years (mean 8.8 ± 1.34 years).

In the first sampling stage, the 17 schools were classified into three groups according to geographical location and socioeconomic level (roughly categorized into high, moderate and low social classes based on expert opinion). Then, using an equal allocation method of sampling, two schools were randomly selected from each of the three groups.

In the second sampling stage, six classes were selected randomly from each of the six selected schools to represent the different grades. Thus, a total of 36 classes were

included in the sample. Each class was considered as a cluster and all children in the selected classes constituted the target group of the present study.

A questionnaire was devised to collect social data about the child. The questionnaire was sent with each child to his parents to be completed at home. The socioeconomic status of the children was assessed using a scoring system [*9*] based on the type of house (5 points), number of livestock (5 points), crowding index (2 points), father's education (4 points), and mother's education and work (4 points). The maximum score was 20. The mean score for the entire group was 10.0 ± 3.0. The socioeconomic status was classified as follows: score < 10 = low, score 10–15 = moderate; and score 16–20 = high.

Children were referred to the main school health unit in Abha to be examined according to a time schedule covering the two academic semesters of the year.

Throat culture

Each schoolboy was subjected to vigorous swabbing of tonsillar surfaces (or fossae) and the posterior pharyngeal wall. The swab was then immediately subjected to the rapid streptococcal antigen detection test (Patho Dx™ strep A physician's kit, California, USA), which is a latex agglutination test highly specific and sensitive to group A streptococci (GAS) and group C streptococci (GCS) strains. Throat culture on blood agar plates was done (during the same visit) when results obtained by the previous rapid method were uninterpretable. A swab was taken and the dry sterile applicator was plated onto 5% sheep blood agar, chocolate blood agar and McConkey's agar plates and streaked. It was then incubated in 5% carbon dioxide at 35 °C for 18–24 hours, examined for the presence of β-haemolytic streptococci and subcultured using bacitracin to differentiate group A from non-group A β-haemolytic streptococci.

Anthropometry

The children were measured by one male nurse for consistency, using a fixed wall ruler and a beam balance to obtain height and weight. For heights, traction was applied to the mastoid process and measurements recorded to the nearest 0.25 cm. Weight measurements were recorded with light clothes to the nearest 0.1 kg. Body mass index (BMI) was calculated for each child using the formula of [weight (kg)/ height $(m)^2$] [*10*].

Data analysis

Statistical analysis using the chi-square test was performed to determine the association between the culture results and the season, social class, crowding index, and body mass index of the child. Statistical significance was assumed for P values less than 0.05.

Results

Table 1 shows the distribution of streptococcal carriers among the 972 schoolboys according to season. A streptococcal carrier rate of 13.1% was detected. GAS were responsible for 40.2% while GCS were responsible for 59.8% of streptococcal infections, giving a prevalence rate of 5.3% and 7.8% respectively. The table shows a significantly ($P < 0.01$) higher carrier rate of β-haemolytic streptococci among schoolboys in spring (18.7%) than in winter (8.1%). This higher rate was significant for both GAS (7.5% versus 3.3%) and GCS (11.2% versus 4.8%).

No significant association was detected between the social class of schoolboys and their being carriers for GAS ($\chi^2 = 0.018$; $P = 0.893$) or GCS ($\chi^2 = 0.025$; $P = 0.874$) (Table 2).

Table 1 **Prevalence and distribution of streptococcal carriers by season**

Season		Total number examined	Streptococcal carriers		
			GAS	GCS	Total
Winter	No.	518	17	25	42
	%		3.3	4.8	8.1
Spring	No.	454	34	51	85
	%		7.5	11.2	18.7
Total	No.	972	51	76	127
	%		5.3	7.8	13.1
Statistical differences					
χ^2			10.279	15.439	23.998
P			< 0.01[a]	< 0.01[a]	< 0.01[a]

[a] *Statistically significant*
GAS = Group A streptococci
GCS = Group C streptococci

Higher, though not significant, carrier rates were detected among children living in homes of higher crowding index (5.7% GAS and 10.2% GCS) than those among children living in homes of lower crowding index (4.7% GAS and 7.2% GCS) (Table 3).

Also higher, though not significant, carrier rates were detected among children of BMI < 20 kg/m² (5.6% GAS and 8.0% GCS) than those among children of BMI ≥ 20 kg/m² (1.4% GAS and 5.6% GCS) as shown in Table 4.

Discussion

Direct exposure to increased solar radiation inhibits the growth of some bacteria because of the ultraviolet component of sunlight [*11*]. A lower incidence of many common flora of bacterial, viral and protozoal origin has been observed in soldiers at altitudes above 5538 m [*12*]. The present

Table 2 **Distribution of streptococcal carriers according to social class**

Social class		Total number examined	Streptococcal carriers		
			GAS	GCS	Total
Low	No.	352	17	29	46
	%		4.8	8.2	13.1
Moderate and high	No.	555	28	44	72
	%		5.1	7.9	13.0
Total	No.	907	45	73	118
	%		5.0	8.0	13.0
Statistical differences					
χ^2			0.018	0.025	0.002
P			0.983	0.874	0.967

GAS = Group A streptococci
GCS = Group C streptococci

Table 3 **Distribution of streptococcal carriers according to home crowding index**

Crowding index (persons per room)		Total number examined	Streptococcal carriers		
			GAS	GCS	Total
Lower (< 2)	No.	664	31	48	79
	%		4.7	7.2	11.9
Higher (≥ 2)	No.	245	14	25	39
	%		5.7	10.2	15.9
Total	No.	909	45	73	118
	%		5.0	8.0	13.0
Statistical differences					
χ^2			0.564	2.296	2.561
P			0.453	0.13	0.11

GAS = Group A streptococci
GCS = Group C streptococci

Table 4 **Distribution of streptococcal carriers according to body mass index**

Body mass index (kg/m²)		Total number examined	Streptococcal carriers		
			GAS	GCS	Total
< 20	No.	900	50	72	122
	%		5.6	8.0	13.6
≥ 20	No.	72	1	4	5
	%		1.4	5.6	6.9
Total	No.	972	51	76	127
	%		5.2	7.8	13.1
Statistical differences					
χ^2			3.277	0.796	2.787
P			0.07	0.372	0.095

GAS = Group A streptococci
GCS = Group C streptococci

study revealed a carrier rate of 13.1% for β-haemolytic streptococci among schoolboys in Abha. This figure is low compared to that in neighbouring and nearby countries such as Egypt (50%) [*13*] and Kuwait (46%) [*14*]. It is also lower than in other tropical countries such as southern India (49%) [*15*] and Liberia (49%) [*16*]. It is, however, comparable to that in some temperate countries such as the United States of America (11%–28%) and Czechoslovakia (11.6%–19.3%) [*3*]. This lower prevalence might be attributed to the cold climate similar to that of temperate regions. The abuse of antibiotic prescribing for sore throat could also explain the lower prevalence; the abuse of antibiotics might lead to the eradication of streptococcal strains in the throats of carriers.

The pattern of streptococcal groups carried by humans in tropical and subtropical regions differs from that in the temperate zones; group A streptococci, for example, are present in over 60% of carriers in temperate regions but in around only 20% of carriers in tropical and subtropical regions. In the present study, group A streptococci were responsible for only 40% of the isolated strains, while group C constituted 60%, i.e. a pattern of tropical and subtropical regions.

It has been reported that the prevalence of group A streptococci depends on the season, the age group, and socioeconomic and other epidemiological and environmental factors [*3*]. The present study revealed a higher, though not significant, prevalence of streptococcal carrier rates among schoolboys of lower socioeconomic crowded families, and of lower body mass index. In Manila, investigation of schoolchildren revealed a streptococcal infection rate of 6.4%–7.8% in the dry season (January to April) that rose to 21.8% by the end of the wet season (October and November) [*17*]. Such seasonal variation was also evident in the present study, where the rate of infection rose from 8.1% during December and January (winter) to 18.7% during March and April (spring).

Upper respiratory tract infections are the most common conditions for which doctors feel uncomfortable in prescribing [*18*]. Throat culture has been recommended to avoid treating viral pharyngitis too frequently [*19*]. However, the cost–benefit effectiveness of mass culturing programmes is open to question [*1*]. In the present study, 13.1% of apparently well schoolboys were culture-positive for streptococcus. Those would inevitably be treated, perhaps unnecessarily, which would increase the potential for antibiotic reaction and create unnecessary parental anxiety. Even though this rapid culture test detects the presence of streptococcus, it is unable to differentiate carrier patients from disease patients.

Conclusion and recommendations

According to the present study, the streptococcal carrier rate in Abha (a high-altitude area) is comparable to the low prevalence in temperate regions, while the pattern of streptococcal groups follows that of tropical and subtropical regions (with GAS less prevalent than GCS). The carrier rate is significantly higher in the spring. Further studies comparing the prevalence of streptococcal infection in populations in high- and low-altitude areas in Saudi Arabia are needed to determine whether our findings are indeed altitude dependent. The findings of this study could help to develop standard audit principles for improving personal or practice prescribing policy of antibiotics in such an area.

Acknowledgements

This study is part of a project supported by a grant from the College of Medicine Research Center (CMRC) in Abha. The authors wish to acknowledge the contribution of Mr Nassir Al-Awwagy, the Director of the School Health Unit in Abha. Special thanks are due to Mr Mohamed Hanafi, the laboratory technician in the Unit.

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Note to our readers

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