

## RESEARCH ARTICLE

## THE RATE OF ASYMPTOMATIC THROAT CARRIAGE OF *STREPTOCOCCUS PYOGENES* AND ITS ASSOCIATED RISK FACTORS AMONG MEDICAL STUDENTS OF QUEEN ARWA UNIVERSITY IN SANA'A CITY, YEMEN

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### Abstract

The throat carriage of *Streptococcus pyogenes* could play a crucial role in the transmission of infection to households and community settings. In Yemen, there is no information about *S. pyogenes* throat carriage among university students. This study aimed to find out the rate of asymptomatic throat carriage of *Streptococcus pyogenes* and its associated risk factors among medical students at Queen Arwa University in Sana'a City, Yemen. This cross-sectional study was conducted at Queen Arwa, between December 2022 and April 2023. A total of 300 throat swabs were randomly collected from medical university students. *Streptococcus pyogenes* was isolated and identified using standard bacteriological procedures. Additionally, the required data were obtained by using the designed questionnaire. Out of 300 specimens, 5 (1.7%) were positive for *S. pyogenes* throat carriage. The high rate of *S. pyogenes* was among females (2%), the age group of 25–30 years (8.3%), dental students (3.9%), and those who studied at the third level (3.7%). Additionally, the high rate of carriage was among those whose fathers' were in the trading field (3.7%) and whose mothers were housewives (2%), whose fathers and mothers held a university certificate (2.9%) and primary school (6.5%), respectively, with a low income (12.5%), none of their families have a sore throat (2.1%), or a history of hospitalization (3.2%). There was a relatively low rate of *S. pyogenes* throat carriage in healthy medical students compared with international investigations. Standard precautions such as adequate hand and respiratory hygiene and avoiding overcrowded settings are used to prevent and control the transmission of GAS infections.

**Keywords:** Asymptomatic, Medical students, *Streptococcus pyogenes*, Throat carriage, Sana'a, Yemen

### Introduction

*Streptococcus pyogenes* (*S. pyogenes*), Additionally called group A streptococcus (GAS), is a gram-positive, beta-hemolytic bacterium in the genus *Streptococcus*. *S. pyogenes* is the major human pathogen that colonizes epithelial and mucosal tissues. It causes several diseases ranging from mild, including skin and upper respiratory tract infections, to severe, life-threatening conditions such as rheumatic fever, glomerulonephritis, septicemia,

pneumonia, and streptococcal toxic shock syndrome [1, 2].

*S. pyogenes* transmission occurs largely through droplets resulting from respiratory secretions. Additionally, it spreads through direct contact with secretions, such as saliva, wound discharge, or nasal secretions, from an infected person. People with GAS pharyngitis are much more likely to transmit the bacteria to others than asymptomatic pharyngeal carriers [2].

Globally, the burden from *S. pyogenes* is estimated to be 33 million cases of severe disease and more than 600,000 deaths each year [3]. The high burden is particularly prevalent in countries with limited resources due to overcrowding conditions, inadequate personal hygiene, and a lack of health awareness. Experts estimate that *S. pyogenes* causes 20% to 30% of pharyngitis incidents in children. In comparison, experts estimate it causes approximately 5% to 15% of pharyngitis infections in adults. However, in adults, GAS pharyngitis will typically occur before the age of 40 and decline steadily after that [4].

*S. pyogenes* colonize the oropharynx without causing any signs of disease; this is known as an asymptomatic carriage. Individuals who asymptotically carry *S. pyogenes* could play a role in the spread of infection to households and community settings, particularly environments where large crowds get together, such as schools, universities, daycare centers, and offices [5, 6]. The *S. pyogenes* carriage rate among children can be over 10%, while in adults the reported carriage rate is much lower [7].

According to previous studies conducted among adult students in some countries, the prevalence rate of *S. pyogenes* throat carriage was reported at 2-46% in Turkey [8], 9.6% in Philadelphia [9], 15.6% in Poland [10], 11.2- 34% in India [11], 3.6% in Cyprus [5], and 16.9% in Kabul University [12].

In developing nations such as Yemen, overcrowding conditions, a lack of health awareness, food insecurity, widespread poverty, and limited access to health services contribute to the prevalence of preventable diseases in the community [13-16]. Most of the earlier studies conducted in Yemen country focused on *S. pyogenes* among children [6, 17]. Furthermore, there has been no previous study regarding the asymptomatic carriage of *S. pyogenes* among university students in Yemen. Therefore, the present study aimed to determine the rate of asymptomatic throat carriage of *S. pyogenes* and its associated risk factors among medical students at Queen Arwa University in Sana'a City, Yemen.

## Materials and Methods

### Study area and period

This cross-sectional study was carried out among medical university students studying in the Faculty of Medical Sciences, Queen Arwa University (QAU), Sana'a City, Yemen, between December 2022 and April 2023.

### Study population

The study population consisted of medical university students aged between 18 and 30 years. The participants are attending four medical departments, including

laboratories, pharmacy, dental, and therapeutic nutrition, at QAU during the study period.

### Sample size

The sample size was calculated by using Epi Info 7 (version 7.2.5) as the subsequent: The total number of registered medical students at QAU is 1593. According to previous reports, the expected prevalence of *S. pyogenes* was 10.03% [5, 9, 12]. Additionally, 5% and 5% were set as acceptable margins of error and confidence levels, respectively. So, the required sample size for this study was 208 based on the program calculation. The sample size was raised to 300 to obtain more accurate results.

### Information collection

A questionnaire was used to gather the required data. The demographic and socioeconomic characteristics, such as gender, age, major field of study, study level, parents' jobs, parents' education levels, monthly income, housing, number of people per room, number of children in the household, sharing clothes, towels, and shaving equipment, fever, cough, suffering from heart rheumatism, receiving treatment for rheumatic heart, one of your family members had an upper respiratory infection, infected with skin rash due to sore throat previously, are all taken into consideration.

### Inclusion and exclusion criteria

All study participants who signed the consent form, supplied a throat swab, had no indications of GAS pharyngitis, and did not use antimicrobial medicines in the days preceding sampling were included. Medical university students were excluded from the study if they had an upper respiratory tract infection, a sore throat, or had used antibiotics within two weeks after sample collection.

### Specimen size and collection

The swab specimens were collected with a sterile cotton swab that was swabbed from the upper tonsil and posterior pharyngeal areas. Sampled swabs were labeled with participant data and immediately transported (within 1 h) to the medical microbiology lab. in the QAU for microbiology examination.

### Isolation and identification of *S. pyogenes*

The collected swabs were immediately inoculated on a blood agar plate (counting 5% sheep blood) (HiMedia Lab., India) by rolling the swab over an area of the plate and streaking and stabbing the sample using a sterile loop. The inoculated plates were incubated at 37 °C with a 5% CO<sub>2</sub> atmosphere for 24–48 h. The beta-haemolytic colonies were confirmed for their sensitivity to bacitracin. Additionally, gram stain and biochemical tests were subjected to further purification [18].

**Ethical considerations**

The Queen Arwa University Ethics Committee approved the project's ethical approval. The aims of the investigation were thoroughly described to the medical students prior to data and specimen collection, and they agreed to participate in this study. Participants supplied their informed written consent to participate in the work on a voluntary basis.

**Statistical analysis**

The results were statistically analyzed using SPSS version 26 (IBM SPSS Inc., Chicago., USA). Figures and tables were prepared for presenting variables in categories in frequencies and percentages. The Chi-square test ( $\chi^2$ ) was used to verify the existence of

associations. *P*-values less than 0.05 were considered statistically significant.

**Results**

**Sociodemographic characteristics**

Out of 300 medical students who took part in the current study, 150 (50%) were males and girls, 276 (92%) were between the ages of 18 and 24, dental students (42%), and third-year students (27.3%). Furthermore, 153 (51%) participants' fathers were employees, 253 (84.3%) students' mothers were housewives, 137 (45.7%) participants' fathers had university certificates, 83 (26.7%) students' mothers had secondary school certificates, and 243 (81%) participants had a middle monthly income (Table 1).

**Table (1):** Sociodemographic characteristics of study subjects

Variables		No. examined	Percentage (%)
Gender	Male	150	50
	Female	150	50
Age group (in years)	18-24	276	92
	25-30	24	8
Major field of study	Laboratory	61	20.3
	Pharmacy	71	23.7
	Dental	126	42.0
	Therapeutic Nutrition	42	14.0
Study level	Frist	60	20.0
	Second	69	23.0
	Third	82	27.3
	Fourth	55	18.3
	Fifth	34	11.3
Father job	Employee	153	51.0
	Trading	27	9.0
	Farmer	8	2.7
	Other	112	37.3
Mother's job	Employee	42	14.0
	Trading	2	.7
	Farmer	3	1.0
	Housewife	253	84.3
	Other	0	0
Education level for father	Illiterate	24	8.0
	Primary	23	7.7
	Intermediate	27	9.0
	Secondary	89	29.7
	University	137	45.7
Education level for mother	Illiterate	76	25.3
	Primary	46	15.3
	Intermediate	51	17.0
	Secondary	83	27.7
	University	44	14.7

**Prevalence of *S. pyogenes* carriage**

The overall rate of *S. pyogenes* carriage among university students was 5 (1.7%), while 295 (98.3%) tested negative for *S. pyogenes* (Figure 1).

**Prevalence of *S. pyogenes* carriage concerning sociodemographic**

This finding shows the high rate of *S. pyogenes* carriage among females participating (2%), the age group of 25–30 years old (8.3%;  $P = 0.008$ ), dental students (3.9%), and those who studied at the third level (3.7%) (Table 2)

**Prevalence of *S. pyogenes* concerning parents education and job**

The high rate of *S. pyogenes* throat carriage among medical students whose fathers and mothers only work as housewives (2% and 3.7%, respectively) and traders (3.7%) is shown in Table 3 with no statistically significant differences ( $P > 0.05$ ). Additionally, the prevalence of *S. pyogenes* was greater among medical students whose mothers had a primary school diploma

(6.5%) and whose fathers had a university degree (2.9%) ( $P = 0.038$ ). Additionally, the rate of *S. pyogenes* carriage varied depending on monthly income, with participants with low incomes having the greatest rate (12.5%), and those with intermediate incomes having the lowest percentage (1.6%), with no statistically significant variations ( $P = 0.067$ ).

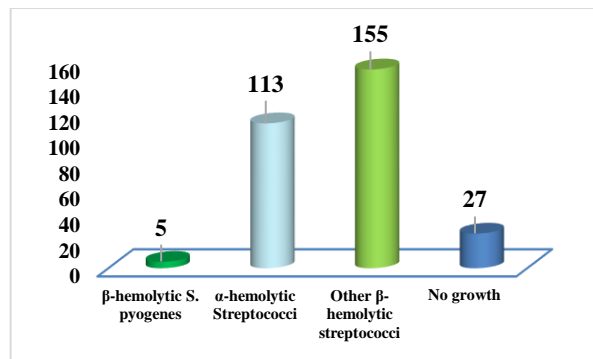


Fig. 1. Frequency of *S. pyogenes* and other beta hemolytic streptococci.

Table (2): Distribution of *S. pyogenes* carriage concerning sociodemographic

Variables	F. (%)	GAS		$\chi^2$	P- value	
		+ve (%)	-ve (%)			
Gender	Male	150(50)	2(1.3)	149(98.7)	0.203	0.653
	Female	150(50)	3(2)	146(98)		
Age group (in years)	18-24	276(92)	3(1.1)	273(98.9)	7.074	0.008
	25-30	24(8)	2(8.3)	22(91.7)		
Major field of study	Laboratory	61(20.3)	0(0)	61(100)	7.022	0.071
	Pharmacy	71(23.7)	0(0)	71(100)		
	Dental	126(42)	5(3.9)	121(96.1)		
	Therapeutic nutrition	42(14)	0(0)	42(100)		
Study level	Frist	60(20)	0(0)	60(100)	6.050	0.197
	Second	69(23)	0(0)	69(100)		
	Third	82(27.3)	3(3.7)	79(96.3)		
	Fourth	55(18.3)	2(3.6)	53(96.4)		
	Fifth	34(11.3)	0(0)	34(100)		

Significant statistics at  $P$ -value  $< 0.05$ .  $\chi^2 =$  Chi-square test.

Table (3): Distribution of *S. pyogenes* concerning parent education, job, and monthly income

Variables	F. (%)	GAS		$\chi^2$	P- value	
		+ve (%)	- ve (%)			
Father's job	Employee	153(51)	3(2)	150(98)	1.309	0.457
	Trading	27(9)	1(3.7)	26(96.3)		
	Farmer	8(2.7)	0(0)	8(100)		
	Other	112(37.3)	1(0.9)	111(99.1)		
Mother's job	Employee	42(14)	0(0)	42(100)	0.945	0.342
	Trading	2(0.7)	0(0)	2(100)		
	Farmer	3(1.0)	0(0)	3(100)		
	Housewife	253(84.3)	5(2)	248(98)		
	Other	0	0(0)	0(0)		
Education level Father	Illiterate	24(8.0)	0(0)	24(100)	2.727	0.138
	Primary	23(7.7)	0(0)	23(100)		
	Intermediate	27(9.0)	0(0)	27(100)		
	Secondary	89(29.7)	1(1.1)	88(98.9)		
	University	137(45.7)	4(2.9)	133(97.1)		
Education level Mother	Illiterate	76(25.3)	2(2.6)	74(97.4)	10.065	0.038
	Primary	46(15.3)	3(6.5)	43(93.5)		
	Intermediate	51(17.0)	0(0)	51(100)		
	Secondary	83(27.7)	0(0)	83(100)		
	University	44(14.7)	0(0)	44(100)		
Monthly income	Low	8(2.7)	1(12.5)	7(87.5)	6.560	0.067
	Middle	243(81.0)	4(1.6)	239(98.4)		
	Upper	49(16.3)	0(0)	49(100)		

Significant statistics at  $P$ -value  $< 0.05$ .  $\chi^2 =$  Chi-square test.

**Prevalence of *S. pyogenes* concerning housing and sharing tools**

According to the findings, non-significant differences ( $P > 0.05$ ) were seen between participants who lived in a single home (2.9%), less than five people per room (1.5%), and households with less than five children (2.3%). Additionally, *S. pyogenes* carriage was considerably reduced (1.5%, 2.1%, 3.6%, and 2.1%, respectively) among participants who did not share their towels, clothes, or shaving equipment ( $P > 0.05$ ) (Table 4).

**Prevalence of *S. pyogenes* concerning some clinical risk factors**

As shown in Table (5), the current finding indicated that all study participants were negative respondents for the necessary risk factor and that 1.7% of them tested positive *S. pyogenes*. Additionally, a significant proportion of *S. pyogenes* carriage was discovered in participants with a history of hospitalization (3.2%), an illness with a skin rash brought on by a sore throat in the past (12.5%;  $P = 0.015$ ), and no upper respiratory infections in their families (Table 5).

**Table (4):** Distribution of *S. pyogenes* concerning housing and sharing tools

Variables	F. (%)	GAS		$\chi^2$	P- value	
		+ve (%)	-ve (%)			
Housing	Mixed	266(88.7)	4(1.5)	262(98.5)	0.380	0.539
	Single	34(11.3)	1(2.9)	33(97.1)		
Number of individuals per room	< 5	277(92.3)	5(1.8)	272(98.2)	0.422	0.517
	> 5	23(7.7)	0(0)	23(100)		
Number of children in household	< 5	133(44.3)	3(2.3)	130(97.7)	0.813	0.609
	> 5	29(9.7)	0(0)	29(100)		
	0	138(46.0)	2(1.4)	136(98.6)		
Sharing clothes	Yes	67(22.3)	0(0)	67(100)	1.462	0.228
	No	233(77.7)	5(2.1)	228(97.9)		
Sharing towels	Yes	56(18.7)	2(3.6)	54(96.4)	1.524	0.218
	No	244(81.3)	3(1.2)	241(98.8)		
Sharing shaving tools	Yes	8(2.7)	0(0)	8(100)	0.139	0.710
	No	292(97.3)	5(1.7)	287(98.3)		

Significant statistics at  $P$ -value  $< 0.05$ .  $\chi^2$  = Chi-square test

**Table (5):** Distribution of *S. pyogenes* carriage concerning clinical risk factors

Variables	F. (%)	GAS		$\chi^2$	P- value	
		+ve (%)	-ve (%)			
Fever	Yes	0(0)	0(0)	0(0)	N.A	N.A
	No	300(100)	5(1.7)	295(98.3)		
Cough	Yes	0(0)	0(0)	0(0)	N.A	N.A
	No	300(100)	5(1.7)	295(98.3)		
Suffer from heart rheumatism	Yes	0(0)	0(0)	0(0)	N.A	N.A
	No	300(100)	5(1.7)	295(98.3)		
Receive treatment for rheumatic heart	Yes	0(0)	0(0)	0(0)	N.A	N.A
	No	300(100)	5(1.7)	295(98.3)		
One of your family had an upper respiratory infection	Yes	57(19)	0(0)	57(100)	1.193	0.276
	No	243(81)	5(2.1)	238(97.9)		
Infected with skin rash due to sore throat previously	Yes	8(2.7)	1(12.5)	7(87.5)	5.886	0.015
	No	292(97.3)	4(1.4)	288(98.6)		
History of hospitalization	Yes	31(10.3)	1(3.2)	30(96.8)	0.513	0.476
	No	269(89.7)	4(1.5)	265(98.5)		

Significant statistics at  $P$ -value  $< 0.05$ .  $\chi^2$  = Chi-square test, N.A = Not applicable

**Discussion**

According to our knowledge, this study is the first to document the prevalence of *S. pyogenes* among Yemeni medical students. Out of 300 medical university students enrolled in this study, 50% were males and females, and 92% were between the ages of 18 and 24. This finding is similar to previous reports [5, 9]. This result revealed that the overall rate of *S. pyogenes* carriage among university

students was 1.7%. The present result is in consonance with previous research [19], which showed that 1.1% of *S. pyogenes* was recorded among asymptomatic students at the University of Alabama.

However, our findings were in disagreement with the results of a previous study in which the prevalence rate of *S. pyogenes* carriage among adults was reported at 2-46% in Turkey [8], 9.6% in Philadelphia [9], 15.6% in young adult inhabitants of Wielkopolska, Poland [10],



between 11.2 and 34% in India [11], 3.6% among pharmacy students at a university in Cyprus [5], 16.9% in Kabul university [12], and 63% among the health community in Australia [20].

The variance in prevalence rate may be due to a variety of factors, including variations in geographic areas, sample size, study population, sanitary procedures, environmental conditions, socioeconomic status, dietary intake, and diagnostic techniques used by the participants [21–23].

According to this research, female participants had a greater rate of *S. pyogenes* carriage (2%) than did male participants (1.3%). This study contradicts the findings of earlier reports [12], which showed that males had a higher colonization rate of *S. pyogenes* (56.8%) than females (43.2%). These discrepancies may be caused by elements like the level of social engagement; for example, women may communicate with their families more frequently than men do. Even though theoretically both sexes are equally impacted.

In the present result, a high rate of *S. pyogenes* carriage was observed among the age group of 25–30 years (8.3%), and a lower rate was observed among 18–24 years (1.1%), with a significant difference ( $P=0.008$ ). In a study performed in Poland on 205 healthy adults between 18 and 44 years old, only three (1.5%) adults were reported to carry GAS [10]. Additionally, a previous investigation [9] reported the asymptomatic carriage rate of GAS as 9.6% among students aged 18–27 years.

However, the highest prevalence of *S. pyogenes* asymptomatic throat carriage was in the lowest age group (19–21 years) compared to other groups, which shows that throat carriage of this organism decreases with age [12].

The present finding showed that the high rate of *S. pyogenes* carriage was among medical students whose fathers' jobs were working in the trading field (3.7%) and whose mothers' jobs were working as housewives (2%). A similar report presented that *S. pyogenes* isolated from subjects whose mother's occupation was employed (17.0%) and whose fathers' occupational status was another kind, like daily labor, merchant, or student (14.8%) [24].

The present result showed that a higher rate of *S. pyogenes* carriage was observed among medical students whose fathers and mothers' held a university certificate (2.9%) and a primary school certificate (6.5%), respectively. According to another study from Ethiopia, the carrier rate of *S. pyogenes* was high in children who had illiterate parents (15.8%) [24]. Moreover, higher levels of education are linked to an overall better quality of life, including poor behavioral and physical health

problems, lower unemployment rates, and lower rates of incarceration [25].

According to monthly income, the medical university students with a low income in this result had the highest rate of *S. pyogenes* carriage at 12.5%. It was reported in some reports that low-income countries report high *S. pyogenes* strain diversity compared with high-income countries. The reason why this is so is not clear [26].

The existing result recorded that the prevalence rate of *S. pyogenes* carriage was detected among medical students who lived in a single house (2.9%), less than 5 individuals lived per room (1.5%), and less than 5 children lived in a household (2.3%). It was found that children from families with more than eleven members had a four-fold greater chance of carrying GAS than children from families with fewer members [27].

It was found that the number of children in the family was an important risk factor. Students with 1–3 children in the family had a 23-fold higher risk of carrying *S. pyogenes* than those who did not ( $p < 0.05$ ). Those students, who had 4–6 children in their family, had a 27-fold higher risk of carrying *S. pyogenes* in their throat than those who did not have any children ( $p < 0.05$ ) [12].

Exposure to asymptomatic people or cases of *S. pyogenes* infections can Additionally occur at the household level. Such exposure is high in overcrowded households, as discussed earlier. In addition, limited household resources, such as those for washing and laundry, contribute to an increase in the bacterial load on the skin of household members, or objects in the house, resulting in increased transmission. Moreover, sharing bedding and personal items like towels is Additionally a predisposing factor for the transmission of *S. pyogenes* infections. High numbers of social contacts, a key environmental factor that is common in schools, hospitals, and other enclosed social places, increase the chances of the transmission of *S. pyogenes* infections [28].

This data showed that the *S. pyogenes* carriage was recovered from participants who didn't share their clothes with others (2.1%), shared their towels (3.6%), and didn't share their shaving tools (1.5%). Additionally, there were non-significant differences reported between house characterization and *S. pyogenes* prevalence ( $P > 0.05$ ).

This finding presented that the high rate of *S. pyogenes* carriage was found among subjects whose none of their families had an upper respiratory infection (2.1%), were infected with a skin rash due to a sore throat previously (12.5%;  $P = 0.015$ ), and had a history of hospitalization (3.2%). Similarly, it was demonstrated that there is an increased risk of *S. pyogenes* transmission within a household when one family member is positive [29]. Moreover, *S. pyogenes* infections are commonly

spread in schools, nurseries, hospitals, care homes, military camps, and homeless shelters [28]. Additionally, a recent study [27] revealed a high rate of GAS among those who had a history of hospitalization (13.5%). Additionally, children who lived with a family member who had a sore throat were twice as likely to colonize Group A *Streptococcus* (GAS) as children who did not have a primary case or sore throat in their household [27].

There are numerous reasons that contribute significantly to the high prevalence of illnesses, particularly intestinal parasites, in Yemen. Living conditions, economic and environmental conditions, a lack of public health awareness, a lack of sanitary facilities and infrastructure, and a lack of access to clean water are all represented by these issues [30–34].

### Limitations of the study

The effect of seasonal influences on variations in prevalence could not be established because the study was a cross-sectional study carried out over a brief period. Because of the study's small sample size, statistical analysis was difficult. Due to a lack of funding, this study was additionally unable to conduct ASO titers and antibiotic susceptibility tests.

### Conclusion

In healthy medical students, there was a comparatively low prevalence of *S. pyogenes* throat carriage when compared to studies conducted internationally. This finding offers valuable baseline information on the GAS carriage rate among healthy adult students in this study location. In order to prevent infection, it is crucial to maintain the emphasis on practicing good hand and respiratory cleanliness, as well as avoiding crowded environments. More research is required to comprehend the epidemiology of *S. pyogenes* in healthy people and related risk factors other than university students, and to create techniques for stranger control and prevention.

### Conflict of Interest

The authors declare that they have no competing interests.

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### Author's Contribution

The experimental investigation was designed and planned by Nasser Al-Aomary and Lutf Alrahabi. Nasser Al-Aomary isolated and identified of the bacteria. Wadhah Edrees and Bashir Al-Ofairi analyzed and presented the results in figures and tables. The document was created and written by Edrees and Al-Aomary as well. The manuscript was reviewed, updated, and submitted with the approval of all authors.

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## معدل انتشار الحمل بدون أعراض لبكتيريا المكورات السبحية المقيحة في الحلق وعوامل الخطر المرتبطة بها بين طلاب التخصصات الطبية في جامعة الملكة أروى في مدينة صنعاء – اليمن

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### المُلخَص

يمكن أن يلعب حامل الحلق لبكتيريا المكورات السبحية المقيحة دوراً هاماً في نقل العدوى إلى أفراد الأسرة والمجتمعات. في اليمن، لا توجد أي معلومات حول حمل الحلق لبكتيريا العنقودية السبحية المقيحة بين طلاب الجامعات. هدفت هذه الدراسة إلى معرفة معدل حمل الحلق بدون أعراض للمكورات السبحية المقيحة وعوامل الخطر المرتبطة بها بين طلاب الطب بجامعة الملكة أروى في مدينة صنعاء، اليمن. أجريت هذه الدراسة المقطعية في جامعة الملكة أروى، خلال الفترة من ديسمبر 2022م إلى أبريل 2023م. تم جمع عدد ثلاثة مائة (300) مسحة حلق بشكل عشوائي من طلاب التخصصات الطبية. تم عزل والتعرف على بكتيريا *S. pyogenes* من خلال استخدام الطرق البكتريولوجية القياسية المعتمدة. كما تم الحصول على البيانات المطلوبة للبحث باستخدام الاستبيان المصمم. من بين 300 عينة، وجد بأن معدل انتشار بكتيريا *S. pyogenes* بين طلبة الجامعة بنسبة (1.7%). وجد بأن أعلى معدل لانتشار بكتيريا *S. pyogenes* كان بين الإناث بنسبة (2%)، الفئة العمرية من 25-30 سنة (8.3%)، طلاب طب الأسنان (3.9%)، والذين يدرسون في المستوى الثالث (3.7%). كما لوحظ بأن النسبة العالية من انتشار بكتيريا *S. pyogenes* بين طلاب الذين لدى آبائهم وظيفة في المجال التجاري بنسبة (3.7%) وأمهاتهم كربات البيوت بنسبة (2%)، وحاصل آبائهم على شهادة جامعية بنسبة (2.9%)، وأمهاتهم حاصلات على شهادة الدراسة الابتدائية بنسبة (6.5%)، بين ذوي الدخل المنخفض بنسبة (12.5%)، بين الأشخاص الذي لم يعاني أحد من أسرهم من عدوى الجهاز التنفسي العلوي (2.1%)، ولهم تاريخ دخول المستشفى (3.2%). وجد بأن المعدل المنخفض نسبياً من انتشار بكتيريا *S. pyogenes* بين طلاب الطب مقارنةً بالتقارير الدولية السابقة. لذلك، يتم إتباع الاحتياطات القياسية مثل النظافة الكافية لليدين والجهاز التنفسي وتجنب البقاء في الأماكن المزدحمة وذلك لمنع ومكافحة انتقال عدوى بكتيريا *S. pyogenes*.

الكلمات المفتاحية: بدون أعراض، طلاب الطب، المكورات السبحية المقيحة، حمل الحلق، صنعاء، اليمن.

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