



## КРАТКИЕ СООБЩЕНИЯ

### SHORT COMMUNICATION

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# Seroprevalence of herpes simplex virus type 1 (Herpesviridae: *Simplexvirus: Human alphaherpesvirus 1*) in smokers

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### Abstract

**Introduction.** Herpes simplex virus type 1 (HSV-1) is one of the most common human viral infections and has a double-stranded DNA genome belonging to the Herpesviridae family. Smoking is one of the leading causes of disease and premature death worldwide, responsible for the death of up to six million people annually. The purpose of the current study was to determine the seroprevalence of HSV-1 infection among smokers.†

**Methods.** The search strategy was conducted in the period from December 2022 to January 2023. The study included a random sample of 94 (88 males, and 6 females) healthy participants, aged between  $\leq 20$  to  $\geq 60$  years, with 50 participants as the control group. The HSV serological testing consisted of detecting antibodies to HSV-1 IgG with the help of ELISA.

**Results.** Most participants were university students, consisting of 45.7% males and 5.3% females, followed by employed smokers, consisting of 0.2% males and 1.1% females. The number of females was much lower than that of males reaching 6.4 and 93.6% respectively, due to customs and traditions. The seroprevalence was 24.47, 22.3 and 2.1% in males and females respectively. The seroprevalence rate was 13.8% in hookah and cigarette smokers, 9% in cigarette smokers and 1.1% in hookah smokers exclusively. The highest rate was observed in the age groups of 21–30 and 31–40 years with 12.80% and 7.40% respectively.

**Conclusions.** The study revealed that the seroprevalence of HSV-1 IgG was 24.47%, and was higher among hookah and cigarette smokers compared to those who exclusively smoked cigarettes or hookah.

**Keywords:** HSV-1; Herpesviridae; Smoking; Seroprevalence; ELISA

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**Conflict of interest.** The authors declare no apparent or potential conflicts of interest related to the publication of this article.

**Ethics approval.** The study was conducted with the informed consent of the patients. The research protocol was approved by the Ethics Committee of the Microbiology Department, College of Medicine, University of Basrah (Protocol No. 030401-042-2023 dated 25/6/2022).

## КРАТКОЕ СООБЩЕНИЕ

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# Серопревалентность вируса простого герпеса 1-го типа (Herpesviridae: Simplexvirus: Human alphaherpesvirus 1) у курильщиков

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**Введение.** Вирус простого герпеса 1-го типа (ВПГ-1) – один из самых распространенных вирусных агентов, инфицирующих человека, имеет геном с двухцепочечной ДНК и относится к семейству *Herpesviridae*. Курение – одна из основных причин заболеваний и преждевременной смерти во всем мире, от которой ежегодно умирает до 6 млн человек.

**Цель** настоящего исследования – определение серопревалентности ВПГ-1 среди курильщиков.

**Методы.** Исследование проводили в период с декабря 2022 г. по январь 2023 г. В исследование была включена случайная выборка из 94 (88 мужчин и 6 женщин) здоровых лиц в возрасте от 20 до 60 лет, 50 участников составили контрольную группу. Серологическое тестирование на ВПГ заключалось в выявлении антител к ВПГ-1 класса IgG с помощью ИФА.

**Результаты.** Большинство участников были студентами университета – 45,7% мужчин и 5,3% женщин, за ними следовали работающие курильщики – 0,2% мужчин и 1,1% женщин. Число женщин было значительно меньше, чем мужчин, и составило 6,4 и 93,6% соответственно, что объясняется обычаями и традициями. Серопревалентность составила 24,47, 22,3 и 2,1% среди мужчин и женщин соответственно. Уровень серопревалентности составил 13,8% среди курильщиков кальяна и сигарет, 9% исключительно среди курильщиков сигарет и 1,1% исключительно среди курильщиков кальяна. Наибольший уровень выявляемости антител наблюдался в возрастных группах 21–30 и 31–40 лет – 12,80 и 7,40% соответственно.

**Заключение.** Исследование показало, что серопревалентность ВПГ-1 IgG составила 24,47% и была выше среди курильщиков кальяна и сигарет по сравнению с теми, кто курил исключительно сигареты или кальян.

**Ключевые слова:** ВПГ-1; *Herpesviridae*; курение; серопревалентность; ИФА

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**Финансирование.** Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

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**Конфликт интересов.** Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

**Этическое утверждение.** Авторы подтверждают, что добровольное информированное согласие было получено от всех участников исследования. Протокол исследования одобрен Этическим комитетом отдела микробиологии, Медицинский колледж, Университет Басры (Протокол № 030401-042-2023 от 25.06.2022)

## Introduction

Herpes simplex virus type 1 (HSV-1) is a worldwide infection [1]. HSV-1 is one of the most common human viral pathogens and has a double-stranded DNA genome belonging to the Herpesviridae family [2–4]. The virus, which can cause lifelong infection, is mainly transmitted orally, through direct contact with body fluids and through contact with an infected individual [5, 6]. There are three subfamilies of herpesviruses: alpha, beta, and gamma. HSV-1 is classified as part of the *Alphaherpesvirinae* subfamily [7–9].

The virus can infect people of all ages and cause persistent and recurrent infections [10, 11]. The first instance of HSV-1 infection appears as febrile vesicles on facial skin, which are called herpes labials or fever blisters, and also

commonly known as cold sores on the lips [4, 12]. HSV-1 infection acquisition typically takes place in childhood, well before sexual debut, and is made more likely by close contact with parents, other family members and classmates [6, 13]. Many diseases are caused by HSV-1 infection, however, oral herpes is the most prevalent clinical presentation [5, 6, 13]. A number of studies in many countries have indicated that HSV-1 is mostly contracted through the genitals, rather than through the mouth and it has also been observed that a large number of young people are exposed to the virus for the first time through oral sex [6, 14–22].

Although there is possibly a link between smoking cigarettes and herpes virus infection, it is especially concerning in people who smoke cigarettes more frequent-

ly. Smoking is one of the leading causes of disease and premature death worldwide, responsible for the death of up to six million people annually. The World Health Organization (WHO) released statistics showing that by 2030, there will be as many as eight million deaths [23]. According to previous studies, there are 700 million smokers in developing nations overall. In total, 6 trillion cigarettes are smoked annually around the world, with men accounting for 47% of smokers and women for 12% [24]. The purpose of the current study was to determine the seroprevalence of HSV-1 infection among smokers.

## Methods

### Study design and serological testing

The study was designed to assess the seroprevalence of HSV-1 IgG in smokers. The survey population is a random sample of individuals who participated. The

**Table 1.** Demographic characteristics of the individuals who participated in this study

Age Group (years) Возрастная группа (годы)	Gender Пол		Total Всего (%)
	male мужской (%)	female женский (%)	
≤ 20	8.5	1.1	9.6
21–30	47.9	2.1	50.0
31–40	13.8	2.1	16.0
41–50	9.6	1.1	10.6
51–60	4.3	0.0	4.3
>60	9.6	0.0	9.6
Total Всего	93.6	6.4	100.0
Occupation Профессия			
Employed Работающий	20.2	1.1	21.28
Student Студент	45.7	5.3	51.06
Unemployed Безработный	19.1	0.0	19.15
Retired Пенсионер	8.5	0.0	8.51
Total Всего	93.62	6.38	100.00
No. positive of HSV-1 Число положительных по ВПГ-1, %	22.3	2.1	24.47
Mean ± SD Среднее ± SD		25 ± 13.57	
p-value значение p		0.5	

Note. SD – Standard deviation.

Примечание. SD – стандартное отклонение.

search strategy was conducted in the period from December 2022 to January 2023. The study included a random sample of 94 (88 males, 6 females) healthy participants, aged between ≤ 20 to ≥ 60 years, with 50 participants as the control group. The HSV serological testing was conducted on five milliliters of venous blood specimens that were drawn from each individual participating for the detection of IgG antibodies to HSV-1. Laboratory procedures involved centrifuging serum samples at 5000 RPM for five minutes at 4 °C and the serum was stored in Eppendorf tubes and maintained deeply frozen at –20 °C until testing [25]. The HerpeSelect 1 enzyme-linked immunosorbent assay (ELISA) commercial kit (SunLong Biotech Co., LTD.) was used to conduct HSV-1 serology testing according to the manufacturer’s instructions.

### Ethical approval and informed consent

Before collecting samples, Informed consent was obtained from all individuals and a survey was conducted to collect information on the type, duration and chronic diseases of smoking, as well as occupation. The research protocol was approved by the Ethics Committee of the Microbiology Department, College of Medicine, University of Basrah (Protocol No. 030401-042-2023 dated 25/6/2022).

### Statistical analyses

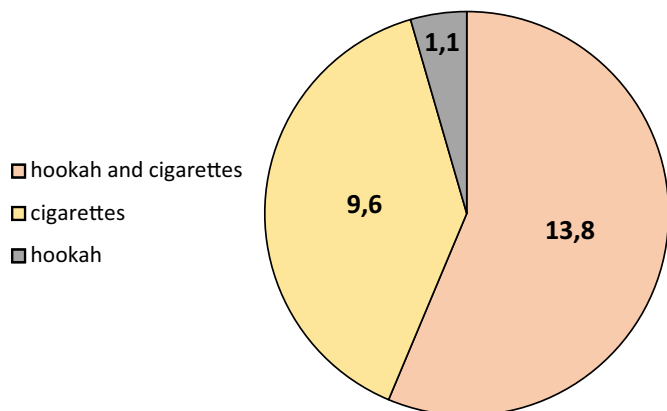
Microsoft Excel 2013 was used to store the information collected through the survey results. A normal distribution test was performed on quantitative variables, which were then given as means of standard deviation (SD). Qualitative variables were displayed as percentages. Data were analyzed through Version 26 of the Statistical Package for the Social Sciences (SPSS Inc.) software. The Chi-square test ( $\chi^2$ -test) was applied to determine the statistical significance of the data difference. Statistical significance is set at  $p < 0.05$ .

## Results

**Table 1** provides a breakdown of the demographic characteristics of participants in the study and is divided into two sections (gender and age group). The ages of the participants ranged between ≤ 20 and ≥ 60 years and were distributed into six categories. The overall average age of participants was 25 ± 13.57 years while the average age of healthy participants was 25 ± 13.15 years. There were 94 participants, with 93.6% (88) being males and 6.4% (6) being females, as well as healthy participants with 94% (47) and 6% (3) males and females respectively. The age group of 21 to 30 years of age had the highest participation rate (50%) of smokers in this study. Most participants were university students 45.7% of which were males and 5.3% – females, followed by employed smokers, consisting of 0.2% males and 1.1% females. The number of females was much lower than that of males reaching 6.4% and 93.6% respectively, due to customs and traditions (Table 1).

Among the 94 selected samples, the seroprevalence for HSV-1 was 24.47, 22.3 and 2.1% in males and females respectively. The seroprevalence rate was 13.8% in

hookah and cigarette smokers, 9% in cigarette smokers and 1.1% in hookah smokers exclusively (**Figure 1**), and was a highest rate in the age groups 21–30 and 31–40 years with 12.80% and 7.40% respectively (**Figure 2**).



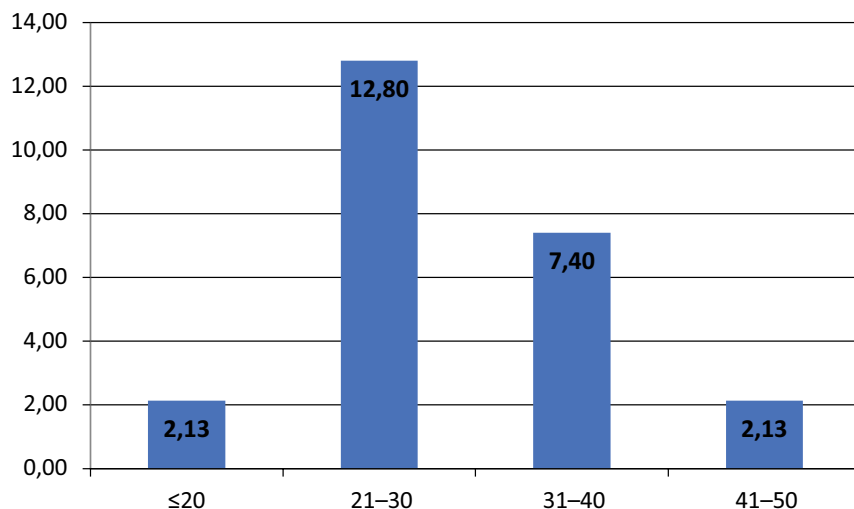
**Fig. 1.** Distribution of study participants according to the type of smoking.

**Рис. 1.** Распределение участников исследования по типу курения.

According to gender, a sizable fraction of hookah and cigarette smokers took part in this survey, where a rate of males 32.98% and females 1.06%. The percentage of cigarette smokers was 40.43% among males and 1.06% among females. The percentage for hookah and vape users among males was 3.19% and 1.06% among females. Hookah users among males and females were 14.89% and 3.19% respectively. and for Vape, hookah, and cigarette users was 1.06 % for males and females (**Figure 3**).

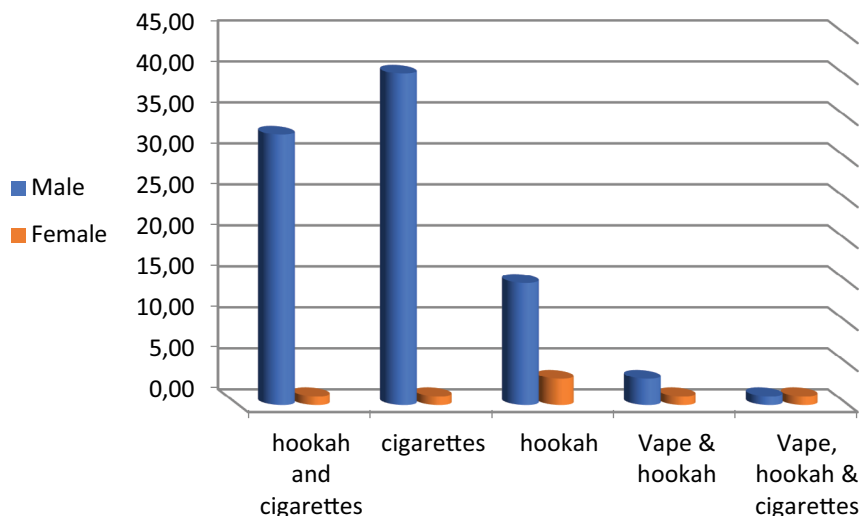
**Discussion**

Herpes simplex virus type 1 infection is lifelong and it is typically contracted orally and during childhood [13]. The infection can cause serious illness, including severe problems with the nervous system, the eye and the mucous membranes, even though it is almost always mild or asymptomatic [5, 13]. Given that cigarette smoking is one of the most significant possible causes of disrupting the immune system’s function by altering various immunological pathways, there is a close correlation between herpesvirus infection and host immune system response of smokers [26]. However, the effect of smoking on the



**Fig. 2.** Distribution of study participants according to the age groups.

**Рис. 2.** Распределение участников исследования по возрастным группам.



**Fig. 3.** Distribution of study participants according to gender.

**Рис. 3.** Распределение участников исследования по полу.

rate of infection with the herpes virus has not been investigated in many studies.

The findings of the current study differed from those of earlier studies on various demographic groups carried out in various countries. The study showed that there is a paucity of research on the seroprevalence of HSV-1 infection in Iraq. The study found that the seroprevalence was 24.47% for HSV-1, 22.3 and 2.1% for males and females respectively. The HSV-1 seroprevalence rate was 13.8% in hookah and cigarette smokers, 9% in cigarette smokers and 1.1% in hookah smokers exclusively. The highest seroprevalence rate of HSV-1 IgG was in the age groups 21–30 and 31–40 years amounting to 12.80 and 7.40% respectively. Urban studies of females in Uganda and Nigeria revealed high prevalence of HSV-1 infection at 98% and 96.6% respectively [27, 28]. According to the findings of previous studies, the prevalence rates of HSV-1 in the US, Canada and Northern Europe were 58, 51 and 57.7% respectively [29, 30]. When a population-based survey (NHANES III) was carried out from 1988 to 1994, it revealed the prevalence rate of HSV-2 infection in France and the United States amounting to 17.2 and 21.9% respectively [31]. HSV-1 was 68% prevalent globally in 2012, according to the WHO, with Africa having the highest frequency at 87% of the virus [3]. Debrah et al.'s study of women revealed that 99.2% of them had HSV-1 infection, which is a very high prevalence [32]. Adults in Europe have a seroprevalence of 20 to 100% for HSV-1. The average seroprevalence of HSV-1 in Western Europe, Southern Europe, Eastern Europe and Turkey, according to a study conducted in European subregions/countries, was 66.1, 77.2, 78.7 and 87.9%, respectively [30]. According to a previous study, approximately 80% of Australians have the HSV-1 virus, compared to lower prevalence rates in Western nations like Europe (74%), as well as higher prevalence rates in Asia [33], Latin America and the Caribbean [29], Africa [34], the Middle East and North Africa [35], as well as Asia [33], Latin America and the Caribbean [29].

Due to the fact that herpes infection can spread silently across the population and can have serious consequences as a result of the infection development and the emergence of its complications, it is important to increase awareness of these illnesses among the general public. In the current study, University students made up the majority of participants, followed by employees, and more men than women participated because the parents of female university students were unaware that they smoked, which was another factor in why they chose not to participate. The study revealed that the seroprevalence of HSV-1 IgG was higher among hookah and cigarette smokers compared to those who smoked cigarettes or hookah exclusively. Numerous factors, including the geographic location, the number of samples and the inspection process, may be responsible for the virus spreading at this rate in comparison to other nations.

### Conclusions

In the current study, the seroprevalence for HSV-1 IgG was 24.47%. University students made up the majority

of participants, followed by employed individuals. More men than women participated because the parents of female university students were unaware that they smoked, which was another reason why they chose not to participate. The study revealed that the seroprevalence of HSV-1 IgG was higher among hookah and cigarette smokers compared to those who smoke cigarettes or hookah exclusively.

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