



(RESEARCH ARTICLE)



## Seroprevalence of HSV1 among Taiz University lecturers, Officers and students

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### Abstract

HSV1 is a herpesvirus that infect human and latent in the body. Recently infection with HSV1 lead to genital infection. This study aimed to determine the seroprevalence of HSV1 IgG among Taiz university lecturers, officers and students. Briefly, 5ml venous blood was collected from 180 participants in this study. Titer of HSV1 was determined by specific ELISA kit. Almost 91.1% (164/180) were seropositive to HSV1. Regarding to gender 91.93% of males and 89.28% of females were seropositive to HSV1. The highest seropositive 100% among 46-55 and 56-65 years old. Lower HSV1 seropositive among lecturers compared with officers and students. Lower infection was observed among members from faculty of Education, Art and Faculty of engineering and Information Technology. Almost infection was same between members from urban and rural regions. Among all people, 85.71% suffered from HSV1 reinfection. This study showed high seroprevalence of HSV1 among University members due to socioeconomic status and poor hygiene in Yemen as results from war and economic problems that country pass through. Improve hygiene, socioeconomic status and education about viral diseases may be contribute to decrease HSV1 infection in Yemen.

**Keywords:** Herpes Simplex Virus (HSV); Herpesvirus; dsDNA virus; Students; officers; Lecturers; Taiz; Yemen.

### 1. Introduction

HSV is an enveloped alpha herpes virus with a dsDNA genome (1). There are two types of HSV are known; HSV1 and HSV2 with 67% and 13% worldwide prevalence respectively (2). HSV1 is childhood transmission virus causing orolabial infection while HSV2 is a sexual transmission virus (3-6). Many studies were reported that, HSV1 causing herpes genital infection (2, 7-11).

HSV1 is transmitted through contact with infected body fluids during asymptomatic shedding especially during share utensils or food (12-19) or through contact with herpes lesions (12). The most common clinical feature associated with HSV-1 are fever, headache, malaise, enlarged lymph nodes, gingivostomatitis harisses of different sizes erupt within a few days of sexual contact, herpetic whitlow, ggingivostomatitis, meningitis, eencephalitis, cconjunctivitis, vvascular eruption of skin., eczema, corneal blindness due to herpetic keratitis and facial nerve palsy, Encephalitis in foetus caused 70% paediatric patients die (13, 20-25).

Like other herpesviruses, HSV1 can establishes latency in neurons after immune system clear the primary infection. It was noticed that infection with HSV1 increased in poor hygiene population (26). In addition, HSV1 can also be transmitted through oral sex or sexual intercourse (12, 27-31). Peripartum neonatal transmission was reported in infected pregnant female when HSV1 was shedding at time of delivery. Moreover, postnatally acquired HSV infection mediated by direct contact with HSV-infected persons, usually from an orolabial or cutaneous source (32). In Yemen,

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Assayaghi *et al.*, showed the HSV1 100% women with age in 14-24, > 46 years old (33). While another study was conducted in Yemen for pregnant women in Dhamar, showed that HSV1 infection rate was 6% in women) (34).

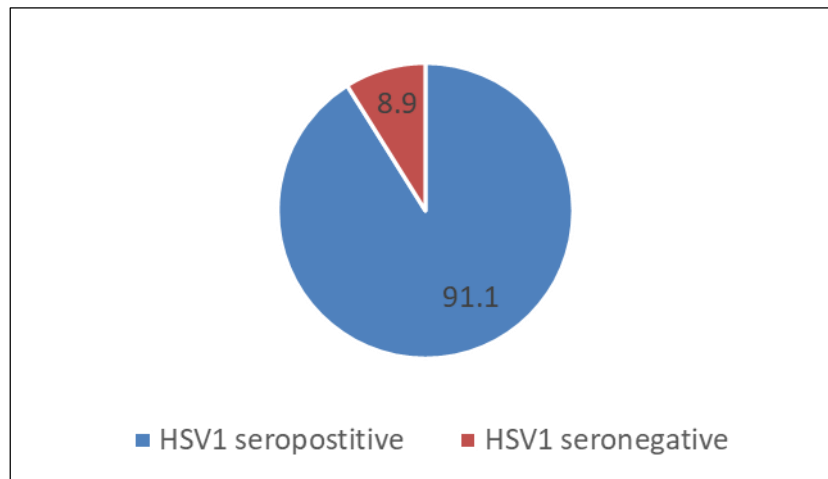
## 2. Material and methods

Taiz University was selected as an area for conduct this scientific research. Samples were collected from the lectures, officers and students at Taiz University. All candidates were signed agreement for samples collection and data sharing. Among of 180 samples were selected, amount of 4-5 ml of blood was withdrawn and placed in gel blood tubes. The blood was centrifuged through a fridge centrifuge at 1000  $Xg$  for 5 minutes, and then the serum was separated and placed in Eppendorf tubes. Samples were kept in the freezer at a temperature of  $-70\text{ }^{\circ}\text{C}$  until work was resumed. Anti-HSV1 IgG was detected by using ELISA kit according to standard protocols of manufacture.

Briefly, Amount of 90  $\mu\text{l}$  of sample diluent was added into the wells of the plate for preliminary sample dilution and 10  $\mu\text{l}$  of the tested serum samples also were added to corresponding wells. Carefully the samples were mix by pipetting. After that amount of 100  $\mu\text{l}$  of positive and negative controls were added into three wells and one well was used as a blank. The 100  $\mu\text{l}$  of diluted samples was added to ELISA plate to the rest of the wells. Carefully, the plate was mix gently and incubated at room temperature ( $18\text{-}24\text{ }^{\circ}\text{C}$ ) for 15 minutes. The well contents were removed and wells was washed with 350  $\mu\text{l}$  of working washing solution for five times. Amount of 100  $\mu\text{l}$  of enzyme conjugate was added into each well and the plate was incubated at room temperature ( $18\text{-}24\text{ }^{\circ}\text{C}$ ) for 15 minutes. Carefully contents of the wells were aspirated and washed as mentioned above. Amount of 100  $\mu\text{l}$  of TMB-Substrate was added into each well and the plate was incubated at room temperature ( $18\text{-}24\text{ }^{\circ}\text{C}$ ) for 5 minutes in dark place. The reaction was stop by adding a 100  $\mu\text{l}$  of stopping reagent into each well and results was read by microplate reader at wavelength of 450 nm, with reference filter at 620-680 nm. Data was analyzed by using IMB SPSS version 23 and linked with factors.

## 3. Result:

In this study, the overall Seroprevalence of HSV1 among Taiz university lecturers, officers and student is 91.1% as shown in figure 1.



**Figure 1** HSV1 Seroprevalence among Lecturers, Officers and Students at Taiz University

In this study, 180 samples were collected from 124 males and 56 females. Almost 91.93 (114/124) males were seropositive to HSV1, while 89.28 (50/56) females were seropositive to HSV1 (Table 1). There were no significant differences between male and females regarding acquiring HSV1 infections,  $P > 0.05$ . Participants were divided to 5 age groups. The highest seropositive was 100% and among age groups 46-55 years old (11/11) and (3/3) 56-65 years old. In comparison, the lowest seroprevalence was 98.28 (25/28) in age group 26-35 years old. The samples 180 samples were collected from three main groups at Taiz University. The highest seropositive was among student 91.73 (111/121), following by officer 91.42 (32/35), and lecturers 87.5 (21/24) (Table 1).

**Table 1** Seroprevalence of HSV1 among Taiz University lecturers, officers and students according to gender, age groups and occupations.

HSV1		N	%	Seropositive		Seronegative		$\chi^2$	P-value
				N	%	N	%		
Overall seroprevalence		180	100%	164	91.1%	16	9.8%		
Gender	Male	124	68.9%	114	91.93%	10	8.06%	0.334	0.563
	Female	56	31.1%	50	89.28%	6	10.71%		
	Total	180	100%	164	91.1%	16	9.8%		
Age Groups	15-25 years old	112	62.2%	101	90.17%	11	9.82%	1.647	0.800
	26-35 years old	28	15.6%	25	89.28%	03	10.71%		
	36-45 years old	26	14.4%	24	92.30%	02	7.69%		
	46-55 years old	11	6.1%	11	100%	00	00%		
	56-65 years old	3	1.7%	3	100%	00	00%		
	Total years old	180	100%	164	91.1%	16	9.8%		
Occupations/Jobs	Lecturers	24	13.3%	21	87.5%	03	12.5%	0.449	0.799
	Officers	35	19.4%	32	91.42%	03	8.57%		
	Students	121	67.2%	111	91.73%	10	8.26%		
	Total	180	100%	164	91.1%	16	9.8%		

N: Frequency, %: Percent

The highest seroprevalence were noticed among participants from faculty of Law 100% (19/19), Continuing Education Center 95.28 (20/21), Faculty of Administrative Sciences 95.28 (20/21) and Faculty of Applied sciences 95% (19/20) as it shown in table 2.

**Table 2** Seroprevalence of HSV1 among Taiz University lecturers, officers and students according to University Faculties and Centers

HSV1		N	%	Seropositive		Seronegative		$\chi^2$	P-value
				N	%	N	%		
Faculties/ Universities centres	Faculty of Medicine and Health Sciences	20	11.1%	18	90%	02	10%	8.745	0.556
	Faculty of Applied sciences	20	11.1%	19	95%	01	5%		
	Faculty of Education	22	12.2%	18	81.81%	4	18.18%		

Continuing education centre	21	11.7%	20	95.23%	01	4.76%
Faculty of administrative sciences	21	11.7%	20	95.23%	01	4.76%
Faculty of law	19	10.6%	19	100%	0	00%
Faculty of engineering and Information Technology	23	12.8%	20	86.95%	03	13.04%
Art Faculty	24	13.3%	20	83.33%	04	16.66%
Student affairs	3	1.7%	3	100%	00	00%
Serviced center	4	2.2%	4	100%	00	00%
Central library	3	1.7%	3	100%	00	00%
<b>Total</b>	<b>180</b>	<b>100%</b>	<b>164</b>	<b>91.1%</b>	<b>16</b>	<b>9.8%</b>

N: Frequency, %: Percent

According to cities that participants came from it, majority of participants are from Taiz city with 90.69 (156/176) seroprevalence. In this study, majority of participants were from urban area 153 and 91.50% of them were seropositive to HSV1. While the rest of participants were from rural area 25 with 92% seropositive (23/25) as in table 3.

**Table 3** Seroprevalence of HSV1 among Taiz University lecturers, officers and students according to cities, urban/rural area

HSV1		N	%	Seropositive		Seronegative		$\chi^2$	P-value
				N	%	N	%		
Cities	Taiz City	172	95.6%	156	90.69%	16	9.30%	0.817	0.845
	Al Dhale City	4	2.2%	4	100%	00	00%		
	Lahij City	3	1.7%	3	100%	00	00%		
	Ibb city	1	0.6%	1	100%	00	00%		
	Total	180	100%	164		16			
Urban /Rural	Urban	153	85%	140	91.50%	13	8.50%	0.007	0.934
	Rural	25	13.9%	23	92%	02	8%		
	Total	178	98.9%	163		15			
	Missing	2	1.1%						
	<b>Total</b>	<b>180</b>	<b>100%</b>						

N: Frequency, %: Percent

The most common clinical features were headache and exhaustion, almost 41.89% (75/179) of participant suffer from them and among them only 89.33 (67/75) with headache were seropositive to HSV1 and 88% (66/75) with exhaustion were seropositive to HSV1. The less common symptom was meningitis 1.1%, only 2 suffer from it (2/180) and both of them were seropositive to HSV1.

**Table 4** Seroprevalence of HSV1 among Taiz University lecturers, officers and students according to clinical features.

HSV1	Variables		N	%	Seropositive		Seronegative		$\chi^2$	P-value
					N	%	N	%		
Clinical features	Fever	Yes	49	27.2%	45	91.83%	4		0.044	0.834
		No	131	72.8%	119	90.83%	12			
	Total		180	100%						
	Headache	Yes	75	41.7%	67	89.33%	08	10.66	0.502	0.479
		No	105	58.3%	97	92.30%	08	7.62%		
	Total		180	100%						
	Burring urination	Yes	39	21.7%	36	92.30%	03		0.008	0.767
		No	141	78.3%	128	90.78%	13			
	Total		180	100%						
	Diarrhoea	Yes	23	12.8%	21	91.30%	02	8.70%	0.001	0.972
		No	157	87.2%	143	91.08%	14	8.17%		
	Total		180	100%						
	Exhaustion	Yes	75	41.7%	66	88%	09	12%	1.486	0.223
		No	104	57.8%	97	93.26%	07	6.73%		
	Total		179	99.4%						
	Missing		1	0.6%						
Nausea	Yes	28	15.6%	24	85.72%	04	14.28%	0.606	0.436	
	No	152	84.4%	140	92.10%	12	7.89%			
Total		180	100%							
Lymphadenitis	Yes	6	3.3%	6	100%	00	00%	0.436	0.436	
	No	174	96.7%	158	90.80%	16	9.19%			
Total		180	100%							
Anorexia	Yes	44	24.4%	39	88.64%	05	11.36%	0.522	0.770	
	No	135	75%	124	91.85%	11	8.87%			
Total		179	99.4%							
Missing		1	0.6%							
Meningitis	Yes	2	1.1%	2	100%	00	00%	0.197	0.657	
	No	178	98.9%	162	91.01%	16	89.88%			
Total		180	100%							
Vomiting	Yes	7	3.9%	07	100%	00	00%	0.711	0.399	
	No	173	96.1%	157	90.75%	16	9.25%			
Total		180	100%							

N: Frequency, %: Percent

Almost 86.11% (31/36) participants that mentioned to HSV1 in families/ relative members were seropositive to HSV1. Otherwise, 92.20% (130/140) of other participants no evidence of HSV1 circulates among family. Recurrent infection or reactivation of HSV1 was reported among 14 of participants, 85.71% (12/14) of them were seropositive to HSV1. In addition, 150 participants were seropositive even though no recurrent infection was reported on them.

In this study, only 15 participants underwent blood transfusion and 86.66% (13/15) of them were seropositive to HSV1, but 163 participants did not receive blood or its products with 90.80% (148/163) were seropositive to HSV1 as shown in table 5.

**Table 5** Seroprevalence of HSV1 among Taiz University lecturers, officers and students according to HSV1 recurrent infection, Previous HSV1 infection among families/relatives' members, Blood Transfusion and Sharing tools.

HSV1		N	%	Seropositive		Seronegative		$\chi^2$	P-value
				N	%	N	%		
HSV1 recurrent infection	Yes	14	7.8%	12	85.71%	02	14.28%	0.521	0.470
	No	164	91.1%	150	91.46%	14	8.5%		
	Total	178	98.9%	162		16			
	Missing	2	1.1%						
	Total	180	100%						
Previous HSV1 infection among families/relatives' members	Yes	36	20%	31	86.11%	05	13.88%	1.292	0.256
	No	141	78.3%	130	92.20%	11	7.80%		
	Total	177	98.3%	161		16			
	Missing	3	1.7%						
	Total	180	100%						
Blood Transfusion	Yes	15	8.33%	13	86.67%	2	13.33%	0.469	0.791
	No	162	90%	148	91.36%	14	8.64%		
	Total	177	98.33%						
	Missing	3	1.67%						
	Total	180	100%						
Sharing tools	Yes	179	99.44%	163	91.06%	16	8.94%	9.342	0.859
	No	00	00	00	00%	00	00%		
	Total	179	99.44%						
	Missing	1	0.56%						
	Total	180	100%						

N: Frequency, %: Percent

Almost 179 of 180 (98.89%) participants are sharing different tools, 93.14% (95/102) of them were seropositive to HSV1. While other (67/76), 88.16% participants were seropositive even they don't share any tools with families' members and friends. The most common sharing tools among participants were shown in table 6.

**Table 6** Seroprevalence of HSV1 among Taiz University lecturers, officers and students according to most common sharing tools among participants.

HSV1	Variables		N	%	Seropositive		Seronegative		$\chi^2$	P-value	
					N	%	N	%			
Common Tools	Teeth brush	Yes	6	3.33%	5	83.33%	1	1.67%	9.342	0.859	
	Shaving tools	Yes	2	1.11%	2	100%	00	00			
	Towels	Yes	8	4.44%	7	87.50%	01	12.50%			
	Food tools	Yes	26	14.44%	25	96.15%	01	3.85%			
	Beauty tools	Yes	10	5.56%	09	90%	01	10%			
	No sharing	Yes	75	41.67%	66	88%	09	12%			
	Towels and Food tools	Yes	18	10%	18	100%	00	00%			
	Towels /Food tools and beauty tools	Yes	12	6.67%	12	100%	00	00%			
	Food and Beauty tools	Yes	13	7.22%	10	76.92%	03	23.08%			
	Shaving tools and food tools	Yes	2	1.11%	02	100%	00	00%			
	Teeth brush/Towels/Food tools	Yes	01	0.56%	01	100%	00	00%			
	Towels and Beauty Tools	Yes	01	0.56%	1	100%	0	00%			
	Teeth brush and Towels	Yes	01	0.56%	1	100%	00	00%			
	Teeth brush and Food Tools	Yes	1	0.56%	1	100%	00	00%			
	Shaving tools/Towels/Food tools/Beauty tools	Yes	1	0.56%	1	100%	00	00%			
	Towels and Beauty tools	Yes	01	0.56%	01	100%	00	00%			
	Teeth Brush and Shaving Tools	Yes	01	0.56%	01	100%	00	00%			
	Total			179	99.44%	163	91.06%	16			8.94%
	Missing			1	0.56%						
Total			180	100%							

N: Frequency, %: Percent

#### 4. Discussion

Detection of HSV1 IgG provides a powerful, rapid and economical method for investigation of HSV1 past infection (35). Even though HSV1 cause a mild infection, there is a rise evidence that HSV1 cause genital infection (3, 5, 9). The Overall seroprevalence of HSV1 was 91.1 % (164/180). On other hand, females in Sana'a had a seroprevalence was 99.4%

(313/315) (33). Neighbor country, KSA population had seroprevalence of HSV1 was 90% and decreased to 88.7% (4425 /4985) (37 ,36). In Qatar, study showed less seroprevalence of HSV1 81.4% (325/400) (38). In addition, other study in Qatar was performed among Filipino and Indian residents in Qatar showed a high seroprevalence of HSV1 84.9% (101/120) 48.3% (156/325) (38). In Iraq, the seroprevalence of HSV1 was 94.1% (427/454) (39). In Sudan, almost 34.6% (45/130) of pregnant Sudanese woman were HSV1 seropositive (El-Amin et al., 2013), while 73%-92% were seropositive to HSV1 among children in Tanzania (40), in Morocco, 98.8% of pregnant woman were seropositive to HSV1 respectively (41). Moreover, in Finland, 58.9% (168/285) of women were seropositive to HSV1 and 2 with 53.3% (64/120) among their Spouses (42). In Nigeran, children had HSV1 infection with 57% (218/377) seropositive rate (35). Another study in young women showed that 3.7% (127/3438) were seropositive in USA and Canada (8), the HSV1 seroprevalence decreased due to vaccination programmed that applied in both countries (27). Highest prevalence in Arab country due to close contact and poor hygiene among children who they are reservoir for HSV in their salivary glands.

In this study, 91.93% (114/124) of males and 89.28% (50/56) of females were seropositive to HSV1. This data was different from data was published in USA by Xu and his colleagues and mentioned that HSV1 seroprevalence in male and females were 55.9% (5511/11508) and 59.5% (5997/11508) respectively (27). In Nigeria girls had a higher HSV1 seropositive 61.5 (110/179) than boys 54.5% (108/198) (35).

In this study, the highest seropositive was 100% (11/11, 3/3) and among age groups 46-55 and (3/3) 56-65 years old. Other study in Yemen, showed highest seroprevalence for HSV1 among women was 100 % (108/108) in age 14-24 years old, > 46 years old (33). In comparison, the lowest seroprevalence was 98.28 (25/28) in age group 26-35 years old. Other study was in showed the highest age group were seropositive to HSV1 was 90.7%-94.3% among 20-29 years old and >30 years old (30). Study in Egypt showed the males were 98% and 100 % seropositive to HSV1 by age 30-39% and 45-49% years old respectively (43). In USA, HSV1 seropositive was high 63.5% and 65.3% in age groups 30-39 and 40-49 years old respectively (27).

In this study, the highest seropositive was among student 91.73 (111/121), following by officer 91.42 (32/35), and lecturers 87.5 (21/24). Educated groups showed less seroprevalence due to income and education which can affect personal hygiene and subsequently viral infection(44).

The highest seroprevalence were noticed among participants from faculty of Law 100% (19/19), Continuing Education Center 95.28 (20/21), Faculty of Administrative Sciences 95.28 (20/21) and Faculty of Applied sciences 95% (19/20). No previous study was established among university officers. No previous data was done among university students regarding HSV1 infection in Yemen.

Most Yemen cities that participants belong to them showed a high HSV1 seroprevalence that range from 90.69-100% due to economic problems, and country income (45). Since Yemen classified as lower middle-income country (45). In addition to war that affect the family income and the personal hygiene. Moreover, HSV1 infection was associated with socio-economic status (46).

In this study, no big different in HSV1 seroprevalence between participants in urban 91.50% or rural area 92% due to both regions suffer from poor facilities due to war in Yemen. In addition to economic problems that affect all Yemeni regions. Other study in Tanzania showed children had 73%-92% HSV1 seropositive to among in Urban area (40).

The most common clinical features were headache and exhaustion, almost 41.89% (75/179) of participant suffer from them and among them only 89.33% (67/75) with headache were seropositive to HSV1 and 88% (66/75) with exhaustion were seropositive to HSV1 (47). They are common general clinical features to most viral diseases including HSV1 The less common symptom was meningitis 1.1%, only 2 suffer from it (2/180) and both of them were seropositive to HSV1. Several studies mentioned to role of HSV1 in meningitis (48) Durate et al., 2019), but since no molecular techniques to approve its infection in majority of Yemen hospitals, this study could not link meningitis with HSV1.

Recurrent infection or reactivation of HSV1 was reported among 14 of participants, 85.71 (12/14) of them were seropositive to HSV1. In addition, 150 participants were seropositive even though no recurrent infection was reported on them. Recurrent of HSV1 from latent infection was reported by many researchers (49-51).

Almost 86.11% (31/36) participants that mentioned to HSV1 in families/ relative members were seropositive to HSV1. Otherwise, 92.20% (130/140) of other participants no evidence of HSV1 circulates among family. Close contact and sharing tools contaminated with HSV are major transmitted methods for HSV1 (12, 52).



Infection easily acquired from parents and family members. Mostly, 102 of 180 participants are sharing different tools, 93.14% (95/102) of them were seropositive to HSV1. While other 67/76, 88.16% participants were seropositive even they don't share any tools with families' members and friends.

In this study, only 15 participants underwent blood transfusion and 86.66% (13/15) of them were seropositive to HSV1, but 163 participants did not receive blood or its products with 90.80% (148/163) were seropositive to HSV1. HSV1 transmitted through blood or its products (39).

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## 5. Conclusion

Detection of HSV1 IgG provides a powerful, rapid and economical method for investigation of HSV1 past infection. The highest seroprevalence of HSV1 in this study reflect the poor hygiene in Yemen due to less government service that Yemeni citizen received especially lacking of water supply. Economic status also can play an important role, the income for Yemeni citizen become very low which affect their ability to buy detergents and improve their hygiene. The highest seroprevalence of HSV1 among students because their life mostly in college and they are dependent on their family for their life expenses that may not be enough for a good hygiene practice.

### *Recommendation*

Yemen government have to improve their service as well as the Yemeni citizen income to minimize such viral disruption and infection.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

### *Statement of ethical approval*

The study was approved by the Faculty of Applied Sciences. This study was carried out among lecturers, officers and students at Taiz University. Permission was obtained from both deans of Faculties and University Centers and the participants in the study. The blood samples were collected from students, officers and lecturers. One hundred and eighty questionnaires were distributed. Factors associated with HSV1 IgG seropositivity were gender, age, occupations, education level, hygiene, residence, sharing tools and blood transfusion.

### *Statement of informed consent*

No personal identifiers were used during samples or data collection; all samples were coded with a distinct research ID. Informed consent was obtained from all individual participants included in the study.

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