(RESEARCH ARTICLE)

Prevalence of herpes simplex virus and associated risk factors among female students of natural and applied science, Nasarawa state university, Keffi

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Abstract

Herpes Simplex Type 2 Viruses (HSV-2) are one of the most common viral sexually transmitted diseases worldwide, which are now a significant health concern. This study aim at prevalence of herpes simplex virus type 2 IgG and IgM and the associated risk factors among female students of Natural and Applied Science, Nasarawa State University, Keffi. Blood samples were collected from 150 female students of Natural and Applied Science. The socio-demographic information of the participants was collected by using a structured questionnaire. The sera samples were screened for IgGand IgM using $NADAL^R$ HSV-2 IgG/IgM Rapid Antibody Test Cassette (Bulgarian Company for Biotechnology). The overall prevalence of HSV-2 IgG/IgM was 3.3% and 2.6%. The occurrence HSV-2 IgG in relation to the Age was high among age 26-30 years (100 %) and least among 21-25 years (2.0 %). The occurrence of HSV-2 IgM in relation to the Age was high among age 16-20 years (2.9 %) and least among was 21-25 years (2.0 %). the total prevalence of co-occurrence of HSV-2 IgG/IgM was 1.3%. the prevalence of In relation to knowledge of HSV-2 IgG and IgM in relation knowledge of HSV-2 infection was highest with no knowledge of HSV-2 recorded the IgG 4.5% and 3.4% with IgM. In relation to history of STI participants with history of STI recorded highest in IgG (23.5 %) and IgM (2.7 %). In relation to sharing sanitary facilities participants that share sanitary facilities recorded highest IgG 5.7% and IgM those that don't share sanitary recorded highest 3.0 %. The prevalence of the HSV-2 infections was high among female students of Natural and Applied Science.

Keywords: Herpes simplex type 2 virus; IgG/IgM; Female students; Prevalence

1. Introduction

Herpes simplex virus 1 and 2 (HSV-1 and HSV-2), also known by their taxonomical names Human alphaherpesvirus 1 and Human alphaherpesvirus 2, are two members of the human Herpesviridae family, a set of new viruses that produce viral infections in the majority of humans [1]. Both HSV-1 (which produces most cold sores) and HSV-2 (which produces most genital herpes) are common and contagious.

Herpes simplex is a viral infection caused by the herpes simplex virus (HSV). Infections are categorized based on the part of the body infected. Oral herpes (HSV-1) involves the face or mouth, It may result in small blisters in groups often called cold sores or fever blisters or may just cause a sore throat [2]. Genital herpes (HSV-2), often simply known as herpes, may have minimal symptoms or form blisters that break open and result in small ulcers [3]. Tingling or shooting pains may occur before the blisters appear. Herpes cycles between periods of active disease followed by periods without symptoms. The first episode is often more severe and may be associated with fever, muscle pains, swollen lymph nodes and headaches. Over time, episodes of active disease decrease in frequency and severity

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Globally, STDs are one of the major causes of infertility, long-term disability and death. It is also associated with severe medical and psychological consequences for millions of men, women and infants [4]. Herpes simplex virus type 2 (HSV--2), a sexually transmitted double stranded DNA virus is the etiologic agent of genital herpes infection and the primary cause of genital ulcer disease, a global public health concern especially among female population [5].

Herpes simplex virus type 2 (HSV-2) infections is a prevalent sexually transmitted infection with a sizable disease burden that is highest in sub-Saharan Africa. Nigeria is not left out among the African countries bearing the scourge of HSV-2 infection. A research carried out reported a prevalence of 77.9% among female patients attending skin and antenatal care (ANC) clinics at University of Nigeria Teaching Hospital at Enugu State Teaching Hospital, Enugu state, Nigeria [6]. Other diseases caused by herpes simplex virus include: herpetic whitlow when it involves the fingers, herpes infection of the brain [7] and neonatal herpes when it affects newborn among others [8]. The types of herpes simplex virus, type 1 (HSV-1) and type 2 (HSV-2) are transmitted by direct contact with body fluid or lesion of an infected individual, transmission may still occur when symptoms are not present. The most effective method of avoiding genital herpes infections is by avoiding vaginal, oral, and anal sex. There is no available vaccine and once infected, there is no cure. Genital herpes is classified as a sexually transmitted infection. It may be spreads to an infant during child birth. After infection, the viruses are transported along sensory nerves to the nerve cell bodies, where they reside lifelong. This study focuses on prevalence of herpes simplex virus and associated risk factors among female students of Natural and Applied Science, Nasarawa State University, Keffi.

2. Material and methods

2.1. Study population

Undergraduate female students of the faculty of Natural and Applied Science of Nasarawa State University Keffi (NSUK) were the target population. Female students within the age range of 16-35 years. Study participants were selected from each demographic at random between the months of October 2021 and January, 2022.

2.2. Sample Size Calculation

The sample size (N) was estimated using the formula described by [9]:

$$N = Z^2 PQ/d^2$$

Where;
N = required sample size,
Z = standard normal variate at 5 % (p<0.05) error or 95 % confidence interval is 1.96
P = proportion of the population with HSV-2 infection from pervious study,
Q = proportion of the population without HSV-2 infection (1- P) and
d = Absolute error margin is 0.05

$$N = \frac{1.96^2 \times 0.102 \times 0.898}{0.05^2}$$

For the calculation, a 95% confidence interval, a P value of 0.102, *i.e.,* a prevalence rate of 10.2 % from a previous study by [1], and margin of error (d) set at 0.05 was used to determine the minimum sample size required. To minimize errors arising from the likelihood of non-compliance, 10% of the sample size was added giving a final sample size of 150.

2.3. Ethical Approval

The ethical approval was obtained from South Atlantic Petroleum (SAPETRO) Medical Centre Nasarawa State University Keffi.

2.4. Eligibility of subjects

2.4.1. Inclusion criteria

Consenting apparently healthy undergraduate female students of the faculty of Natural and Applied Science of Nasarawa State University, Keffi were randomly recruited for the study.

2.4.2. Exclusion criteria

Undergraduate female students with history of anti-viral drugs or native herbal solution in the preceding two (2) weeks were excluded from the study. Also, undergraduate male students, as well as the postgraduate female and male students of the faculty of Natural and Applied Science of Nasarawa State University were excluded from the study.

2.5. Data Collection

Prior to specimen collection, demographic and clinical information were obtained from participants through administration of prepared questionnaires and personal interviews. Each questionnaire has a unique participant identification number (PIDN). The first part of the questionnaire contained the bio-data of the patients e.g. Sex, age, educational level, religion and marital status. Second part included history of genital infection (painful urination, itchy genital, swollen genital, genital discharge etc.), risk factors (if any), personal hygiene and health care-seeking behavior. The study population was stratified by age, study level, religion and location of residence. Response to structured questionnaire administered was used to collect data on epidemiology and demographic trends of HSV-2 infection. For the purpose of privacy, all information obtained from the participant was treated confidentially.

2.6. Specimen Collection and Storage

Blood specimen was collected from each participant via venous puncture using standard procedure. The collected blood specimens were conveyed to the laboratory unit of NSUK clinic. The blood specimens were made to stand for about an hour to clot, retracted and centrifuged afterwards at 3,500 rpm for 10 minutes at room temperature. The yielded serum was transferred to another clean sterile plain bottle and analyzed immediately, otherwise, where a delay was envisaged, the sera were stored at 2-8 °C for up to three days. The specimen was kept at a temperature below -20 °C for long term storage. The frozen specimens were properly thawed and mixed before testing commenced. Multiple freeze-thaw cycles of the sera were avoided. Prior to testing, frozen specimens were brought to room temperature slowly and mixed gently.

2.7. Laboratory Analysis

2.7.1. Detection of serum anti-HSV-2 IgG and IgM antibodies

Serum anti-HSV-2 IgG and IgM antibodies were detected using a $NADAL^R$ HSV-2 IgG/IgM Rapid Antibody Test Cassette supplied by Bulgarian Company for Biotechnology, Sofia, Bulgaria according to the manufacturer instruction.

2.8. Interpretation of results

2.8.1. Positive Result

In addition to the presence of the Control "C" line, if only the IgM "M" line is developed, the test indicates the presence of IgM anti-HSV-2 in the specimen. The result is positive or reactive. In addition to the presence of the Control "C" line, if only the IgG "G" line is developed, the test indicates the presence of IgG anti-HSV-2 in the specimen. The result is positive or reactive. Also in addition to the presence of the Control "C" line, if both the "M" and the "G" lines are developed, the test indicates the presence of both IgM and IgG anti-HSV-2 in the specimen. The result is positive or reactive.

2.8.2. Negative Result

If only the "C" line is present, the absence of any pink color in both the test lines (M and G) indicates that no anti-HSV-2 antibodies are detected in the specimen. The result is negative or non-reactive.

2.8.3. Invalid Result

If no control "C" line is developed, the assay is invalid regardless of the pink color in the test bands as indicated. A total absence of color in either regions or only one color band appearing on the test region indicates procedure error and/or the test reagent has deteriorated. If this occurs, the assay is repeated with a new device.

2.9. Data Analysis

Data obtained from the serum antibody screening, as well as from the questionnaires were entered into Microsoft Excel. Statistical analysis was carried out using SPSS-18.0 (Statistical Packages for Social Scientists-version 18.0) statistical program. Chi-Square, Two-way Anova Analysis and Turkey-Kramer Multiple Comparisons Test was used to test for significant differences between the prevalence rate of anti- HSV-2 IgG and IgM antibodies, while significant risk factors associated with the seroprevalence of HSV-2 infection was determined with simple logistic regression analysis.

3. Results

A total of 150 female students' participants took part in the study; the seropositive of HSV-2 IgG and IgM antibody were 3.3% and 2.6% respectively. The frequency of occurrence of HSV-2 IgG antibody in relation to the Age was high among age 26-30 years (100%) and least among 21-25 years (2.0%). In relation to study Level the highest was among 100 level (4.5%) and lowest was among 300 levels (2.7%) and in relation residence of the study participants the highest among those that is off campus (3.6%) as given in Table1.

Table 1 Frequency of occurrence of Herpes Simplex Virus Type 2 IgG antibody in relation to the age, study level, and Residence of the study participants

Characteristics	Category	No. of serum samples examined N (%)	Positive for HSV-2 IgG N (%)	P-Value	X2
Age (Years)	16-20	101	3 (2.9)	0.100	29.274
	21-25	48	1 (2.0)		
	26-30	1	1 (100)		
	Total	150	5 (3.3)		
Study Level	100	22	1 (4.5)	0.904	1.324
	200	19	0 (0.0)		
	300	37	1 (2.7)		
	400	57	2 (3.5)		
	500	15	0(0.0)		
	Total	150	5 (3.3)		
Residence	Outside school hostel	110	4 (3.6)	0.0479*	0.1404
	In school hostel	40	1(2.5)		
	Total	150	5 (3.3)		

P>0.05 is considered statistically not significant

The frequency of occurrence of HSV-2 IgM antibody in relation to the Age was high among age 16-20 years (2.9%) and least among was 21-25 years (2.0 %). In relation to level of study the highest was among 200 levels (10.5%) and lowest was among 300 levels (2.7 %) and in relation residence of the study participants the highest among those that is in school hostel (5.0%) as given in Table 2.

Table 3 shows the co-occurrence of HSV-2 IgG and IgM antibody the total prevalence was 1.3%. In relation to age the highest occurrence was among age 26-30 years (100%). In relation to level of study 100 levels recorded highest (4.5%) and the lowest was 300 levels (2.7%). In relation to Residence those that reside off campus recorded the highest (1.8%) as given in Table3.

Table 4 shows some of the risk factors associated with Herpes simplex virus Type 2 IgM and IgG antibodies seropositive among the study participants. In relation to knowledge of HSV-2 infection the participants with no knowledge of HSV-2 recorded the highest IgG 4.5% and 3.4% with IgM. In relation to history of STI participants with history of STI recorded highest in IgG (23.5%) and IgM (2.7%). Base on HIV status those that do not know their status recorded highest 4.5% both IgG and IgM. Base on sharing of underwear those that said no recorded highest in IgG 3.4% and IgM 2.7%. In relation to sharing sanitary facilities participants that share sanitary facilities recorded highest IgG 5.7% and IgM those that don't share sanitary recorded highest 3.0%. Those that engage in unprotected sex participants that had unprotected sex recorded highest 4.8% IgG and IgM those that used protection recorded highest 3.8%. Participants with 1-2 sex partners recorded highest of IgG 13.1% and participants with 3-5 sex partners recorded 16.6% of IgM. Those that changed sex partners recorded highest IgG 9.0% and those that did not change sex partners recorded highest IgM 3.7%.

Participants that have sex intercourse 1-2 times a week had highest IgG 18.1% and IgM 9.0% as shown in Table 4 respectively.

Table 2 Frequency of occurrence of Herpes Simplex Virus Type 2 IgM antibody in relation to the age, study level, and Residence of the study participants

Characteristics	Category	No. of serum samples examined	Positive for HSV-2 IgM N (%)	P-Value	Pearson Chi-Square
Age (Years)	16-20	101	3 (2.9)	0.997	1.994
	21-25	48	1 (2.0)		
	26-30	1	0 (0.0)		
	Total	150	4 (2.6)		
Study Level	100	22	1 (3.7)	1.000	4.613
	200	19	2 (10.5)		
	300	37	1 (2.7)		
	400	57	0 (0.0)		
	500	15	0 (0.0)		
	Total	150	4 (2.6)		
Residence	Outside school hostel	110	2 (1.8)	0.997	10.338
	In school hostel	40	2 (5.0)		
	Total	150	4(2.6)		

P>0.05 is considered statistically not significant

Table 3 Frequency of co-occurrence of Herpes Simplex Virus type 2 IgG and IgM antibodies in relation to the age, study level of residence of the study participants

Characteristics	Category	No. of serum samples examined	No. positive for both HSV-2 igG & IgM no.(%)
Age (Years)	16-20	101	1 (0.9)
	21-25	48	1 (2.0)
	26-30	1	0 (100)
	Total	150	2 (1.3)
Study Level	100	22	1(4.5)
	200	19	0 (0)
	300	37	1 (2.7)
	400	57	0 (0.0)
	500	15	0 (0)
	Total	150	2 (1.3)
Residence	Outside school hostel	110	2 (1.8)

| | In school hostel | 40 | 0 (0) | |
| | Total | 150 | 2 (1.3) | |

P>0.05 is considered statistically not significant

Table 4 Risk factors associated with Herpes simplex virus Type 2 IgM and IgG antibodies seropositive among the study participants

Characteristics	Responses	Number of Participants	HSV-2 IgG Positivity N (%)	HSV-2 IgM Positivity N (%)	Odd Ratio (OR)
Knowledge of HSV-2	Yes	62	1 (1.6)	1 (1.5)	0.621
	No	88	4 (4.5)	3 (3.4)	
	Total	150	5 (3.3)	4 (2.6)	
History of STI	Yes	17	4 (23.5)	4(2.7)	0.016*
	No	133	1 (0.7)	0 (0.0)	
	Total	150	5 (3.3)	4 (2.6)	
HIV Status	Positive	0	0 (0.0)	0(0.0)	0.026*
	Negative	128	4 (3.1)	3(2.3)	
	Not known	22	1 (4.5)	1(4.5)	
	Total	150	5 (3.3)	4(2.6)	
Sharing of underwear	Yes	5	0 (0)	0 (0)	0.728
	No	145	5 (3.4)	4 (2.6)	
	Total	150	5 (3.3)	4 (2.6)	
Sharing Sanitary facilities	Yes	52	3(5.7)	1 (1.9)	2.125
	No	98	2 (2.0)	3 (3.0)	
	Total	150	5 (3.3)	4 (2.7)	
Engage in unprotected sex	Yes	62	3 (4.8)	1 (1.6)	0.857
	No	88	2(2.2)	3 (3.4)	
	Total	150	5 (3.3)	4 (2.6)	
Number of Sexual Partners	None	106	0 (0)	2 (1.8)	227.178
	1-2	38	5 (13.1)	1 (2.6)	
	3-5	6	0 (0.0)	1 (16.6)	
	Total	150	5 (3.3)	4 (2.6)	
Changed sex partners recently	Yes	44	4 (9.0)	0 (0)	0.022*
	No	106	1 (0.09)	4 (3.7)	
	Total	150	5 (3.3)	4 (2.6)	
Number of sexual Intercourse per week	None	136	3 (2.2)	3 (2.2)	3.907
	1-2	11	2 (18.1)	1 (9.0)	
	3-5	3	0 (0)	0 (0)	
	Total	150	5 (3.3)	4 (2.6)	

Medical Checkup/ Lab test	Less often	114	4 (3.5)	4 (3.5)	0.978
	Often	27	0 (0)	0 (0)	
	More often	9	1 (11.1)	0 (0)	
	Total	150	5 (3.3)	4 (2.6)	

*OR <0.5 is considered statistically significance

4. Discussion

The overall prevalence of HSV-2 IgG and IgM antibody in the studied population was 3.3% and 2.6% and this is in agreement with the studies earlier reported by [10,11], but is not in agreement with studies reported by Mohamed *et al*. [12], who reported higher prevalence rate among female students. Also this finding is lower than study reported by Hayatudeen *et al*. [13] and Stephenson-Famy and Gardella [14] among apparently healthy individuals (73.5%) in Nigeria.

Majority of the participants affected belonged to 16-20 yrs age group showing affectation was in the young adult population, this observation differs with studies reported by Nwadike *et al.* [15] the highest at the 30-32 yrs age group. This indicate that this age group maybe the most active sexual group in the study population.

The level of study had no significant relationship with HSV-2 prevalence. This study revealed a higher prevalence of HSV-2 IgM for those with no 200 levels (100%) than those in other study levels. Our finding agrees with [16], who found a higher HSV-1 infection in people of low education in Nigeria.

Also, the frequency of co-occurrence of both HSV-2 IgG and IgM antibodies in this current study (1.3%) was extremely lower than the 31.5% reported by Agyemang-Yeboah *et al.* [17], among women attending routine cervix care clinic in Ghana. The differences in the prevalence rates reported in this study and those of other previous studies might be due to differences in the sensitivity and precision of the diagnostic methods employed, cultural/socio-economic status, as well as the geographical locations of the study participants.

This study showed no significant association between knowledge of HSV-2, sharing of underwear and sharing sanitary facilities, those that have no knowledge of HSV-2 had the highest prevalence of IgG (4.5%) and IgM (3.4%) while those that share sharing sanitary facilities had the highest IgG (5.7%). But there was a significant association between those that have history of STI and knowing their HIV Status.

The findings of this study indicated high prevalence of HSV infection in subjects who were exposed to sex early and those with multiple sex partners agrees with work done in United States [18] among sex workers, which reported prevalence of 66% for HSV-2 respectively. In contrast, a lower seroprevalence of 34% for 20% HSV-2 were recorded in Syria among the prostitutes and bar girls who are considered to be the high risk group [19]. These findings demonstrate that the high prevalence of HVS infection in most part of the world may result from early exposure to sex and multiple sex partners as observed in this study. However, it is noteworthy that in the present study those who had early exposure to sex and those who had multiple sex partners were not at greater risk of HSV infection compared with those who had late exposure to sex and those with single sex partners.

Seronegative individual should avoid unprotected oral-genital contact with an HSV seropositive partner and conventional sex with a partner having a genital infection. These considerations underscore the importance of educating female student and their partners about preventing the acquisition of HSV infection.

5. Conclusion

This study has established that the prevalence of HSV-2 IgG/IgM anti-bodies among female student of faculty of Natural and Applied Science, Nasarawa State University, Keffi Nigeria was low. The study indicates a considerable risk of acquiring primary or recurrent HSV-2 infection. Identifying those at the highest risk is an appropriate initial step before the design of intervention strategies. Consequently, intervention strategies will be harnessed and implemented to reduce the risk of transmission of the infection.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest among of the authors.

Statement of ethical approval

The ethical approval was obtained from South Atlantic Petroleum (SAPETRO) Medical Centre Nasarawa State University Keffi.

Statement of informed consent

Informed consent was obtained from all individual participants included in this study.

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