Original article

Prevalence and risk factors associated with cervical human papillomavirus among women in Kebbi Sate

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ABSTRACT

Human papilloma viruses (HPV) are responsible for the most reported cervical cancer cases in Nigeria. This research was carried out to determine the prevalence and risk factors associated with HPV in Kebbi State. Four hundred and eighty-five (485) cervical specimens were collected using cyto-brushes in a-liquid base cytology (LBV) vials. The samples were screened using ELISA techniques. Socio-demographic data of the participants were obtained using a structured questionnaire. Prevalence of 24(4.95%) HPV infection was established. The study recorded 15(3.09%) and 9(1.86%) women positive for ELISA IgA and IgG antibody screening. A high prevalence of 23(4.74%) was recorded among married and 1(0.21%) among unmarried women. The demographic factors revealed a higher prevalence of 9(1.9%) among women between the ages of 31-35 years. Based on occupation, a prevalence of 2.3% was observed among housewives, 1.4% among civil servants, businesswomen 0.8%, and 0.2% among students and farmers. Educational status revealed higher prevalence among Arabic 2.0%, tertiary 2.0%, and secondary 0.4% and the least was 0.2% from women with primary educational status. Women with 0-5 numbers of children showed higher prevalence (4.3%) and all the women (4.95%) infected were those residing within the urban area of the State. The risk factors associated with the rate of infection revealed 6(1.24%) among pregnant women in their second trimester, STD 6(1.24%), women not vaccinated were 10(2.06%), and few 1(0.21%) woman knew about HPV infection. The rate of HPV infection in the study area is low compared to other parts of the country, there is a need for intense public awareness and implementation of early detection screening, treatment and vaccination to prevent a wide spread of HPV infection in Kebbi and other parts of the country.

Keywords: HPV, Prevalence, ELISA, cervical cancer

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INTRODUCTION

Human Papillomaviruses (HPV) are small non-enveloped icosahedra viruses of approximately 50-60nm in diameter. The genome of papillomavirus is a circular covalently closed double-stranded DNA of about 8kbp [1]. All HPV genes are coded in one of the two (2) DNA strands utilizing the alternative splicing for the individual expression of each gene [2]. The human papilloma virus (HPV) includes more than one hundred (100) different strains some of which are oncogenic (cancer-associated) [3]. HPV are responsible for cervical, breast and penile cancers [4].

The virus is transmitted through intimate skin-to-skin contact; it can be contracted by having vaginal, anal or oral sex with an infected person. Symptoms of HPV infection may develop years after being infected [5]. The HPV-infected pregnant mother can also transmit the virus to her newborn baby during vaginal childbirth, which may result in the baby having warts in the voice box or throat [6]. The estimated incubation period from HPV infection to genital wart development is 2 weeks to 8 months, with the majority of genital warts appearing 2–3 months after an HPV infection (Lulu *et al*., 2020).

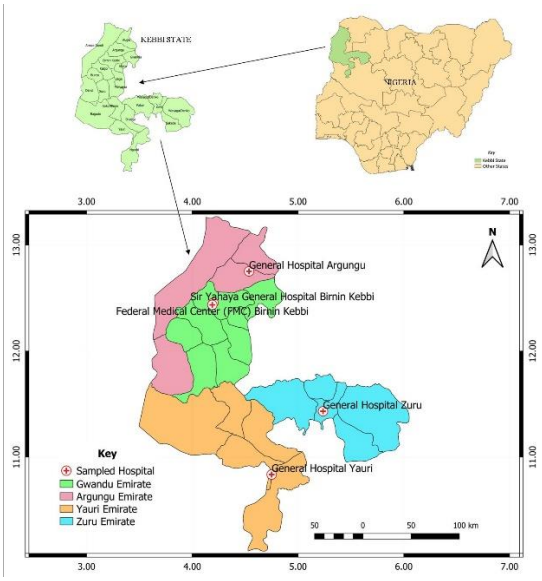
In Nigeria, different HPV prevalence have been reported which ranged from 26.3% in Ibadan, Nigeria [7] to 37% in Abuja [8] and 10% in Port Harcourt [9]. Epidemiological studies have demonstrated that 'low risk' HPV genotypes, mainly types 6 and 11, induce benign genital warts. In contrast, high-risk' genotypes, including HPV-16, -18 and related types, are associated with the development of cervical cancer [10]. Cervical cancer is still one of the most prevalent cancers in the developing world [11]. Thus, early detection of genital infections by these high-risk HPV types would be of value for the prevention of cervical cancer.

Risk factors such as young age, early age (≤15years) at first sexual intercourse, sexual promiscuity and immunosuppressant have been consistently associated with HPV infection in women [12]. The risk increases with an increasing number of recent and lifetime sexual partners. The World Health Organization is leading a global call for the elimination of cervical cancer by the year 2030 in Kebbi State, even though the serotypes of HPV in circulation within the region have not been fully documented [13]. It is on this basis that this study focused on determining the prevalence and demographic risk factors associated with the rate of infection.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Kebbi State, Nigeria. The State is located in the northwestern part of Nigeria between the latitude 12^0 27^0N and longitude 57.8808^0 N and longitude 4^0 1158.2864^0 E. According to the National Population Census (2006), the total population of people in the state is 3,802,500 [14]. The State comprises of 21 Local Government Areas and 4 Emirates; they are Gwandu (with headquarters at Birnin Kebbi), Argungu, Yauri and Zuru. Out of the total population, however, males account for 1,617, 498 (49.9%) while the females are 1,621,130 (50.1%) [14].



Map of Kebbi State showing locations of the study Areas

Sample Size Determination

The sample size was determined using the equation below;

$$n = \frac{z^2 p(1-p)}{d^2} \quad [15]$$

where:

n = required sample

z = level of confidence at 95% (standard value of 1.96)

p = known prevalence of the disease 6.8% (which is equal to 0.068) among women in north-west, Nigeria [16]

d = precision or marging of error at 5% (standard value of 0.05)

Therefore the minimum sample size,

$$n = \frac{1.96^2 \times 0.068(1-0.068)}{0.05^2}$$

$$n = \frac{3.8416 \times 0.068(1-0.068)}{0.0025}$$

$$n = \frac{3.8416 \times 0.068(0.932)}{0.0025}$$

$$n = \frac{3.8416 \times 0.068 \times 0.932}{0.0025}$$

$$n = 97$$

Ninety seven (97) samples size were collected from each of the five major hospitals in each emirate of Kebbi State, giving a total of 485 samples.

Study Population

A total of four hundred and eighty-five (485) female genital samples were collected from patients attending the five selected major hospitals in the five Emirates of Kebbi State. One hundred and ninety-four (194) samples were collected from the two major hospitals in Gwandu emirate; Federal Medical Center (FMC) and Sir Yahaya Memorial Hospital (SYMH) Birnin Kebbi. Ninety-seven (97) samples were collected each, from General Hospital Argungu (GHA), Yauri (GHY) and Zuru (MBGHZ). All samples were collected at the Gynecology unit of each hospital based on the responses obtained from the patient's consent forms administered.

Sample Collection

Informed consent was obtained from each patient before the collection of the samples from the patients visiting the selected hospitals. A structured questionnaire was administered and demographic data such as; age, education, symptoms, behavioural and possible risk factors were obtained from each participant. The cervical samples were collected under the supervision of gynaecologist at the maternity clinic of each hospital. Female cervical samples were collected following the method described by Aondona *et al.* (2021) [17]. A speculum was inserted into the vagina and the cervical OS was identified. The central (longest) bristles of the Cyto-Brush were inserted into the endocervical canal and

rotated through five complete (360º) clockwise revolutions. The head of the Cyto-Brush was detached from the stem into the larger opening of the labelled liquid-based cytology (LBC) container containing preservatives and the stem was discarded. The vial was re-caped, and the lid was tightened securely. The labelled vial was placed into a polybag with a complete cytology requisition (including patient and healthcare provider information; and pertinent clinical information). All the specimens collected were transported on ice packs to the Molecular Laboratory at FMC Birnin Kebbi and stored at −20°C for further analysis.

Identification of HPV using ELISA Screening Sandwich Enzyme-Linked Immunosorbent assay (ELISA) screening was done according to the manufacturers' instructions as stated in the operation manual of the HPV-IgA and IgG ELISA kit used and also according to the methods described by Raji *et al.* (2011)[18]. This method helped in detecting the antibody in response to Human papilloma virus (HPV) infections based on denatured recombinant HPV16 and 33 L1, L2, E4, E6 and E7 proteins. Peptide ELISA determined the cervical mucus IgG and IgA antibodies using the 16 and 33 L1 peptides as the target antigen in a standard ELISA. The samples were numbered in sequence in the microplates, two wells served as a negative control, another two wells as positive control and one empty well as blank control (samples and HRP-conjugate were not added in the blank control well). At the analysis, fifty (50µl) stop solution was added to each well to terminate the reaction. The result was read based on a change in color from blue to yellow. The optical density (O.D) was read at 450nm using a microtiter plate reader within 15 minutes after stop solution was added. The results were determined as follows:

Average value of negative control=0.10
Critical value =0.1×0.15=0.25
≤0.25= negative
≥0.25= positive

Samples with an optical density (OD) below 0.25 were said to be HPV-IgA and IgG negative, while samples with an optical density (OD) 0.25 and above was said to be HPV-IgA and IgG positive.

RESULTS

From the Four hundred and eighty-five (485) samples screened, twenty four (24) were found positive, giving a total prevalence of 24(4.95%) among women in Kebbi state, out of the positive samples, 15(2.09%) and 9(1.86%) samples responded to ELISA IgA and IgG antibody. Gwandu Emirate had the highest prevalence of 13(2.68%) and 6(1.24%) from the two major hospitals, followed by Zuru Emirate 2(0.41%) and Yauri 2(0.41%), the least was Argungu Emirate with 1(0.21%) as shown in Table 4.1.

Table 1: Prevalence of HPV infection among women in selected hospital of Kebbi State

Study Area	Hospital	No. of samples	NP for IgA	NP for IgG	Total No. positive	Frequency (%)
Gwandu Emirate	FMC	97	7	6	13	13(2.68)
	SYMH	97	4	2	6	6(1.24)
Argungu Emirate	GHA	97	1	0	1	1(0.21)
Zuru Emirate	MBGHZ	97	2	0	2	2(0.41)
Yauri Emirate	GHY	97	1	1	2	2(0.41)
Total	**5**	**485**	**15(3.09%)**	**9(1.56%)**	**24**	**24(4.94)**

Key: NP (number of positive), HPV (human papillomavirus) and % (percentage), FMC (Federal Medical Center), SYMH (Sir, Yahaya Memorial Hospital), GHA (General Hospital Argungu), MBGHZ (Martha Bamayi General Hospital Zuru) and GHY (General Hospital Yauri)

The socio-demographic data as described in Table 2 shows that the average age of women tested falls between 15 to 60 years and most women between the age group (26-51 years) were infected. 9(1.9%) between the age group of 31-35 years showed the highest prevalence, followed by, 5(1.0) among 26-30 years, 4(0.8%) among age 36-40, 46-50 years 3(0.6%), 2(0.4%) between 41-45 years and the least was 0.2% between 51 to 55 years respectively.

Table 2: Prevalence of HPV infection in accordance with patient's age

S/N	Age Range	Sample screened	HPV Positive (%)	Prevalence (%)
1	15-20	66	0	0.00
2	21-25	56	0	0.00
3	26-30	49	5	1.0
4	31-35	96	9	1.9
5	36-40	97	4	0.8
6	41-45	51	2	0.4
7	46-50	27	3	0.6
8	51-55	22	1	0.2
9	56-60	21	0	0.00
10	**Total**	**485**	**24**	**4.95**

p- value ≤0.005, n=485

Key: %-percentage, HPV-human papilloma virus

The result of prevalence of HPV infection among married and unmarried women in Kebbi state as shown on Table 3, revealed a High HPV positive frequency and percentage occurrence of 23(4.74%) among married women and 1(0.2%) for unmarried women, given a total of 24(4.95%) as described on Table3.

Table 3: Prevalence of HPV among married and unmarried women in Kebbi State

Age Range	Number of Patients			No. of Positive		Frequency/ (%)
	No. women	Married	Unmarried	Married	Unmarried	
15-20	63	32	31	0	0	0(0.0)
21-25	63	53	10	0	0	0(0.0)
26-30	54	49	5	1	0	1(0.2)
31-35	101	93	8	4	0	4(0.8)
36-40	101	98	3	8	1	9(1.9)
41-45	38	38	0	5	0	5(1.0)
46-50	22	22	0	3	0	3(0.6)
51-55	22	22	0	2	0	2(0.4)
56-60	21	21	0	0	0	0(0.0)
TOTAL	**485(100%)**	**428**	**57**	**23(4.74%)**	**1(0.2%)**	**24(4.95)**

p- value ≥0.005, n=485

Key: %-percentage post-positive, neg-negative, HPV-human papilloma virus, no-number

Based on the result of the prevalence of HPV infection in accordance to occupation as shown on table 4, high prevalence of 2.3% was observed among house wives, followed by 1.4% among civil servant, business women 0.8%, and the least was 0.2% among student and famers with an insignificant p-value of >0.05 (Table.4)

Demographic Factors Associated with the Prevalence of HPV infection in accordance to Educational status of women in Kebbi State as described on Table 5, revealed that majority of women infected with HPV are women with Arabic (2.0%) knowledge, 2.0% among tertiary, 0.4% from secondary and the least was 0.2% from women with primary educational status (Table 4) .

Table 4: Prevalence of HPV Infection in accordance with Occupation and Education

Marital status	No. screened	No. Positive	Prevalence (%)
Students	20	1	0.2
Civil servant	150	7	1.4
Farmer	43	1	0.2
Business	54	4	0.8
House wife	218	11	2.3
Total	**485**	**24**	**4.95**
Educational status			
Primary	55	1	0.2
Secondary	122	2	0.4
Tertiary	224	10	2.0
Arabic	84	11	2.3
Total	**485**	**24**	**4.95**

p-value ≤0.005 n=485

Key: %-percentage, HPV-human papilloma virus

The results of the marital status revealed a higher prevalence of 4.7% of HPV infection among married women with a low prevalence of 0.2% observed from the unmarried as shown on Table 5. Women with 0-5 numbers of children had 4.3% rate of HPV infection whereas, 0.6% was observed from women with 6-9 children. All the women (4.95%) infected are those residing within the urban area of the State.

Table 5: Prevalence of HPV Infection in accordance marital status, number of children and settlement

Marital status	No. screened	No. infected	Prevalence (%)
Married	423	23	4.7
Divorce	55	1	0.2
Engaged	5	0	0
Widowed	2	0	0
Total	**485**	**24**	**4.95**
No. children			
0-5	294	21	4.3
6-9	68	3	0.6

11-15	110	0	0.0
16-19	13	0	0.0
Total	**485**	**24**	**4.9**
Settlement			
Urban	385	24	4.95
Rural	100	0	0.0
Total	**485**	**24**	**4.95**

p-value >0.005, n=485

Risk Factors Associated with the Prevalence of HPV infection as described on Table 6 revealed the following; the prevalence among polygamous married women were 14(2.9%), monogamous married women were 10(2.0%), pregnant women in their second trimester were 6(1.2%) whereas the non-pregnant women 18(3.7%) showed higher prevalence. The STD associated with HPV revealed that about 6(1.24%) were HIV positive with insignificant p-value of (>0.05).Women observed with clinical symptoms of vulvar wart were 7(1.4%), vaginal wart 2(0.4%), discharge and bleeding 3(0.6%), pain 3(0.6%) and itching 1(0.2%) respectively. There was an insignificant p-value of (>0.05). Only about 1(0.2%) of the women have knowledge of HPV infection and 1(0.2%) have a family member with skin wart with an insignificant p-value of (>0.05).

Table 6: Prevalence of HPV infection among women according to Risk Factors

S/N	Factors	Demographic Data	No. of Patients	No. of infected Frequency (%)	p- value
1	**Marriage type**	Polygamous	320	14(2.9)	
		Monogamous	165	9(1.9)	>0.05
2	**Pregnancy**	First	0	0(0.0)	
		Second	6	6(1.2)	
		Third	0	0(0.0)	
		Non-pregnant	479	18(3.7)	
3	**STD**	HIV	6	6(1.2)	
	Clinical Symptoms	Vulvar wart	7	7(1.4)	>0.05
		Urethral metal wart	0	0(0.0)	
		Vaginal wart	2	2(0.4)	
		Discharge/bleeding	14	3(0.6)	

		Pain	18	3(0.6)	
		Bleeding on defecation	40	3(0.6)	
		Itching/blood in urine	2	1(0.2)	
4	**Vaccination**	Knowledge of HPV	10	1(0.2)	>0.05
		Family members with skin wart	1	1(0.2)	
		HPV vaccination	0	0(0.0)	

p- value >0.005, n = 485

DICUSSION

Prevalence of HPV infection among women in selected hospital of Kebbi State

This research was carried to ascertain the prevalence of HPV infection among women in Kebbi State, Nigeria; to provide an update on HPV-related cervical cancer in the region. Four hundred and eighty-five 485 (100%) female cervical samples were screened. Prevalence of 24(4.95%) was established among women in Kebbi State. Out of the positive samples, 15(3.09%) and 9(1.86%) samples were positive for ELISA IgA and IgG antibody screening.

This research recorded Low prevalence of HPV infection compared to other findings; a prevalence of 26.3% was reported among cytologically normal women in Ibadan Nigeria (Thomas *et al.* 2004), and about 21.6% in Okene, Nigeria [19]. A prevalence of 14.7% was obtained by Gage *et al.* (2012) [20], 19.6% in western Nigeria [21] and a higher prevalence of 37% obtained in Abuja, Nigeria [8], furthermore, 51 (17.3%) individuals were positive for HPV DNA in south-west Nigeria [22], Ezebialu *et al.* (2020) [23] reported a prevalence of 19.4% and the highest prevalence of 81.82% was reported in Lagos, Nigeria [24]. The differences in prevalence among the various research may be influenced by the study population, age group studied, socio-cultural behavior, environment and variations in assays, which lead to the discrepancy of the rate of HPV infection within and outside the country.

Based on this research, IgA has the highest prevalence compared to IgG. This may be because IgA is an antibody that is found in the mucous membrane. HPV-IgA antibody is designed to detect the present infection, while IgG is designed to detect previous infection by HPV and are usually of higher affinity in blood and extracellular fluid [25]. More so, the low percentage by IgG might be because majority of the women have not been previously infected nor received the HPV vaccine. According to findings by Costa *et al.* (2020) [26]; IgG antibodies were significantly more detected in the serum of vaccinated women, while the IgA was found in greater quantities in cervical samples from those infected by the virus.

Prevalence of HPV infection in accordance with patient's age

This study recorded HPV infection among married women at sexually active age group. Women between the ages of 26 to 55 tested positive. Higher prevalence was observed between age 31-35, and the least was 51-55 years. Chi-square revealed a significant difference between HPV infection and the different groups with a p-

value of ≤0.005 (Table2). This is in line with the findings of Clarke *et al*. (2021) [27] who reported that HPV prevalence was significantly higher in Blacks aged 21–24 years (50.2%) and 30–34 years (30.2%) among whites. Contrary findings by Van *et al*. (2015) [28] reported that women under 25 years old have the highest HPV prevalence, which rapidly declines in women in their 30s and 40s. This therefore suggest that the high rate of infection within this age group (26-45 years) reiterates the fact that women exposed to unprotected sex at an early age might have more chances of coming in contact with HPV. Since HPV infection persist over time, this explains the higher rate of infection within this age group. Also, the immunity factor could play a role in the high rate of infection within this age group. Since cervical cancer develops more frequently in women over the age of 35 [29], the assumption is that HPV infection first appears in younger age and then gradually spreads over time. The high rate of HPV infection among women between the ages of 35 and 45 may be due to a weakening immune system. Middle-aged women who continue to be chronic HPV carriers are now regarded as being at high risk for developing cervical cancer [30]. The variation in prevalence of HPV in accordance to age is well documented and appears to largely reflect differences in sexual behavior across regions [31].

Prevalence of HPV among married and unmarried women in Kebbi State

High prevalence of 23(4.74%) among married women and low 1(0.21%) among unmarried women was recorded (Table 3) in this study. chi square analysis revealed a strong correlation between marital status and the prevalence of HPV infection. Women within the study area are likely to be exposed to sexual activities after marriage as the tradition demands; this explains why a high rate of sexual activity is a major contributor to the spread and escalation of HPV infection among young women (14-17 years) in the study area. The high level of divorce and remarry culture of both men and women in Kebbi State might be another contributing factor to the high prevalence observed. This agrees with Nejo *et al*. (2018) [32] findings, who reported a higher prevalence of HPV among the married (61 %) over the unmarried (39 %).

Prevalence of HPV Infection in accordance with Occupation and Education

Women who worked as public officials had a greater risk of HPV infection. However, this study recoded higher prevalence of HPV among house wife. Majority of women infected are those with low level western educational status, followed by women at tertiary level of education, with the least observed among those at primary level. Chi square analysis (p-value ≤0.005 n=485) showed there was no connection between women's occupation and HPV infection (Table 4). The high prevalence of HPV among women with low level of education and tertiary level of education might be due to unprotected sexual intercourse with an infected partner with multiple sex partners. According to McBride and Singh, (2018) [33], most people with high educational status tend to have better quality of health. This is comparable to findings in other studies [34, 25, 36] where high educational status was a significant determinant of good health awareness, behavior and practice.

Prevalence of HPV Infection in accordance marital status, number of children and settlement

Women with 0-5 numbers of children had 4.3% rate of HPV infection whereas, 0.6% was observed from women with 6-9 children with insignificant difference of p-≥0.005 (Table. 5). This is comparable to a study by Azua *et al*. (2015) [37] who reported that women who had two or more children had a higher infection rate. This could be due to hormonal changes during pregnancy that lower immunity as well as recurrent childbirths that expose the ectocervix, making it easier for the virus to adhere and spread. However, it was also noted that women with high parity (three or more births) made up 83.7% with high risk HPV [38, 39]. The number of children (parity) and the rate of HPV infection is insignificant in this study. According to American Cancer Society (2020) [40], Multi-parity, or giving birth more than once, has been linked with a higher risk for cervical cancer in women with an HPV infection. Hence, the more children a woman gives birth to, the greater her risk for cervical cancer. However, there isn't a specific number of births that increases the risk.

Based on this study, women infected with HPV, resides within the urban area of the State. Living in urban area may be a predisposing factor to HPV due to vast ethnicity among people living in cities and high level of sexual activity among urban women, as sex hawking is a common business among some women living in the urban area of the state, thereby, distributing sexually transmitted disease to various sexual partners. Similar study by Baloch *et al.* (2016) [41]. Revealed a Prevalence of women 23/54 among rural women and higher HPV infection rate of (31/54) among urban women. The study indicated an insignificant relationship between the HPV infection rate and women residing in the urban area (P= ≥0.05).

Prevalence of HPV infection among women according to Risk Factors

Risk Factors Associated with the Prevalence of HPV infection was higher among polygamous than the monogamous married women. Chi squre showed insignificant difference with P= ≤0.05. Nejo *et al*. (2018) [32] also recorded insignificant prevalence of HPV among polygamy (P-value: 0.027). Pregnant women in their second trimester were observed with low prevalence (P= ≥0.05) while the non-pregnant women showed higher prevalence (P= ≤0.05) with HPV infection. Contrary to Manga *et al.* (2015) [42] who recorded Risk factor, at first pregnancy with insignificant p- value of ($X^2 = 10.554$; $p = 0.005$).

The STD associated with HPV in this research is low, however there is a strong relationship p-value of (P=>0.05) between HPV and STD. This might be due to the fact that this study covered all interested patients without restriction to only patients suffering from specific STD compared to other findings by Dimie *et al*. (2013) [43] who recorded prevalence of about three 3(11.5%), from 26 HPV sero-positive patients with clinical evidence of anogenital and facial warts. higher percentage of STIs (224/468 (41.2%) was also recorded by Adeyemi *et al*. (2022) [44]. More so, Jude *et al*. (2021) [45] reported that HPV infections was higher among HIV+ (53.6/22.6%) than among HIV- women. Another study by Ashaka *et al*. (2022) [46] recorded higher percentage of STD (3.94) over this research. The differences observed might be due to sample size and environmental factors, social, and cultural differences of the study populations. Lagos is a commercial area, highly populated with people from various part of the country compared to Kebbi.

Majority of the women in Kebbi have no knowledge of HPV infection and only few reported to have a family member with skin wart. This may be because most of the women in Kebbi have not been vaccinated with HPV vaccine, and are not aware of the risk and severity of the disease. Study by Ohihoin, *et al.* (2022) [47], recorded genital warts odds ratio (OR = 7.5), abnormal vaginal discharge (OR = 2.20) and multiple sexual partners (OR = 2.30). According to Rodriguez-Cerdeira *et al*. (2012) [48], the presence of abnormal vaginal discharge could also be indicative of bacteria vaginosis. There are some evidence to suggest that Bacteria vaginosis could be associated with a greater risk of being positive for high-risk HPV. In this study, Chi square showed relationship between HPV and wart prevalence with an insignificant difference of $p = \geq 0.005$.

CONCLUSION

This study established prevalence of 4.95% on HPV infection among female patients in Kebbi State. ELISA IgA had the highest positive results compared to IgG, with the total prevalence of HPV infection among women responding to IgA and IgG being 15(3.9%) and 9(1.86%, respectively. For the risk factors associated with the infection, there was no significant relationship between the rate of STD 6(1.24%) and HPV infection at p-value of >0.05. Pregnant women in their second trimester showed 6(1.24%) rate of infection. All the women were not vaccinated with only about 10(2.06%) of the women who had knowledge of HPV infection and 1(0.21%) had a family member with skin wart. The rate of HPV infection in the study area is low compared to other parts of the country, there is need for intense public awareness and implementation of early detection screening, treatment and vaccination to prevent a wide spread of HPV infection in Kebbi and other parts of the country.

Author's contribution

Kuta, F. A and Adabara, N.U. Conceptualized and designed the study. Jabaka R.D participated in field/bench work and data collection. Shittu, O. K. performed the data analysis and interpreted the data. Jabaka, R. D., prepared the first draft of the manuscript, reviewed by Adabara, N.U. All authors contributed to the development of the final manuscript and approved its submission

Disclosure of conflict of interest

None

Ethics Approval and Informed Consent

Ethics approval for this study was obtained from the Kebbi State Health Research Ethics Committee and Federal Medical Center Birnin Kebbi Health Research and ethics committee with the Registration number; 'KSHREC Reg.no. 106:65/2021 and FMC/BK/HP/045/P/517/V.IV/010. All participants were duly informed of the objectives of the study and the protocol for sample collection. All participants signed an inform consent form. Participation was voluntary.

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REFERENCES

1. Ramas,V., Mirazo, S., Bonilla, S., Ruchansky, D and Arbiza, J (2018). "Analysis of human papilloma virus 16 E6, E7 genes and Long Control Region in cervical samples from Uruguayan women," *Journal of Gene Medicine*. 654. 103–109.
2. Chee Kai Chan, Gulzhanat Aimagambetova, Talshyn Ukybassova, Kuralay Kongrtay and Azliyati Azizan (2019). "Human Papilloma virus Infection and Cervical Cancer: Epidemiology, Screening, and Vaccination—Review of Current Perspectives", *Journal of Oncology* 2019 October. Doi:10.1155/2019/3257939.
3. Lulu Yu,Vladimir Majerciak andZhi-Ming Zheng (2022). HPV16 and HPV18 Genome Structure, Expression, and Post-Transcriptional Regulation. *International Journal of Molecular Science* 23(9) 4943.
4. Laura C. Kidd., Sharon Chaing., Juan Chipollini., Anna R. Giuliano., Philippe E. Spiess., and Pranav Sharma (2017). Relationshilp between penile cancer-implications for prevention and treatment. *Journal of Translational Andrology and Urology* 6(5) 791–802.
5. Montgomery, M. P., Dune, T., Shetty, P. K. and Shetty, A. K. (2015) "Knowledge and Acceptability of Human Papillomavirus Vaccination and Cervical Cancer Screening among Women in Karnat aka, India," *Journal of Cancer Education* 30(1) 130–137.
6. Lulu Yu,Vladimir Majerciak andZhi-Ming Zheng (2020). HPV16 and HPV18 Genome Structure, Expression, and Post-Transcriptional Regulation. *International Journal of Molecular Science* 23(9) 4943.
7. Thomas, J O., Herrero R., Omigbodun A.A., Ojemakinde K., Ajayi I.O., Fawole A., Oladepo O., Smith J.S., Arslan A., Muñoz N., Snijders P.J.F., Meijer C.J.L.M., and Franceschi S (2004). Prevalence of papillomavirus infection in women in Ibadan, Nigeria: a population-based study. *Britain journal of cancer* 90(3) 638–645.
8. Akarolo-Anthony, S.N., Famooto, A.O., Dareng, B.O., Olaniyan, O.B., Offiong, R., Wheeler, C.M. and Adebamowo, C.A. (2014). Age-Specific Prevalence of Human Papillomavirus Infection among Nigerian Women. *BMC Public Health*. 14, 656-662.

9. Kennedy N., Walker A., Berry S., Duncan S., Farquarson F., Louise P et al. (2016). The impact of different DNA extraction kit and laboratories upon the assessment of human gut microbiota composition by 16S rRNA gene sequencing PLoS ONE. 9:e88982.

10. Chen Z, Schiffman M, Herrero R, DeSalle R., Anastos K., Segondy M., Sahasrabuddhe V.V., Gravitt PE, Hsing A.W, Chan PKS, Burk RD (2018). Classification and evolution of human papillomavirus genome variants: Alpha-5 (HPV26, 51, 69, 82), Alpha-6 (HPV30, 53, 56, 66), Alpha-11 (HPV34, 73), Alpha-13 (HPV54) and Alpha-3 (HPV61). *Virology* 2018;516:86–101.
11. Andrew W., Hahn, M.D., David H and Spach, M.D (2018). Human papilloma virus infection. CDC/national STD curriculum, version 2.14.3-std-3-AWS (CDC-RFA-PS14-140704CONT17).
12. Auwal Idris Kabuga., Ahmad Nejati., Amanuel Godana Arero., Somayeh Jalilvand., Talat Mokhtari-Azad., Shirin Shahbazi Sighaldeh., Umma Hassan Wali., Shohreh Shahmahmoodi., Mohamed E El Zowalaty.(2020). Papillomavirus Recovered from the Uterine Cervix of Nigerian Women: A Systematic Review and Meta-Analysiswas carried (2020). *Asian Pacific Journal of Cancer Prevention* 21 (10) 2837-2846.

13. Lawal IK, Suleiman AK, Bagudu Z, Kanmodi KK, Abdulsalam GA, Olakunle OS(2021). Planning and advocating for cervical cancer prevention in Kebbi State, Nigeria: Learning points for the global call to eliminate cervical cancer. *International Journal of Gynaecological Obstetrics* 152 (1) 26-31.
14. Yahaya, T., Doherty, V., F;Akinola, O.S., and Shamsudeen, A (2018): Heavy Metal Profiles And Microbial Counts Of Selected Sachet Water Brands In Birnin Kebbi Metropolis, Nigeria. *Ife Journal of Science* 21 (1) 229-234.
15. Jaykaran Charan and Tomoghna Biwas (2013). How to calculate sample size for different study design in medical research. *Indian journal of psychological medicine* 35(2) 121-126.
16. Anthony Uchenna Emeribe., Idris Nasir Abdullahi., Maisie Henrietta Etukudo., Idongesit Kokoabasi Isong., Anthony Ogbonna Emeribe., Justin Onyebuchi Nwofe., Chikodi Modesta Umeozuru., Buhari Isa Shuaib., Odunayo Rahmat Oyetola Ajagbe., Amos Dangana., Bibiana Nonye Egenti and Peter Elisha Ghamba (2021). The pattern of human papillomavirus infection and genotypes among Nigerian women from 1999 to 2019: a systematic review, *Annals of Medicine* 53(1) 945-960.
17. Aondona P.Y., Kuta F.A., Abalaka M. E and Adabara N. U. (2021).Phylogenetic Analysis of Human Papilloma Virus Isolated from Women in Abuja, Nigeria. *Central European Journal of Experimental Biology* 9(2) 1-4

18. Raji N., Sadeghizadeh M., Tafreshi K. N., and Jahanzad E (2011). Detection of human Papillomavirus 18 in cervical cancer samples using PCR-ELISA (DIAPOPS).Iranian Journal of Microbiology 3(4) 177–182.
19. Schnatz, P.F., Markelova, N.V., Holmes, D., Mandavilli, S.R. and O'Sullivan, D.M. (2008). The Prevalence of Cervical HPV and Cytological Abnormalities in Association with Reproductive Factors of Rural Nigerian Women. *Journal of Women's Health*. 17(2) 279-285.
20. Gage, J.C., Ajenifuja, K.O., Wentzensen, N.A., Adepiti, A.C., Eklund, C., Reilly, M., Hutchinson, M., Wacholder, S., Harford, J., Soliman, A.S., Burk, R.D. and Schiffman, M. (2012). The Age-Specific Prevalence of Human Papillomavirus and Risk of Cytologic Abnormalities in Rural Nigeria: Implications for Screen-and-treat Strategies. *International Journal of Cancer*.130(9) 2111-7.
21. Ezechi, O.C., Ostergren, P.O., Nwaokorie, F.O., Ujah, I.A.O. and Pettersson, K.O. (2014). The Burden, Distribution and Risk Factors for Cervical Oncogenic Human Papillomavirus Infection in HIV Positive Nigerian Women. *Virology Journa,* 11(5) 4-7
22. Yewande T. Nejo., David O. Olaleye and Georgina N. Odaibo (2019). Molecular characterization of genital human papilloma virus among women in Southwestern, Nigeria. PLoS ONE 14(11) 1-6.
23. Ezebialu, C., Ezebialu, I., Ezeifeka, G. , Nwobu, R. , Okani, C. and Chukwubuike, C. (2020) Prevalence of Cervical Human Pappillomavirus Infection in Awka, Nigeria. *Journal of Biosciences and Medicines* 8(3) 37-47.
24. Ashaka, O.S., Omoare, A.A., James, A.B., Adeyemi, O.O., Oladiji, F., Adeniji, K.A., Okunade, K.S and Agbede, O.O (2022). Prevalence and Risk Factors of Genital Human Papillomavirus Infections among Women in Lagos, Nigeria. *Tropical. Medicine and Infectious Disease* 7(11) 386.
25. Joanne, M. Willey., Linda M. Sheerwood and Christopher, J. Woolverton (2011). Direct contact disease. Presscott's microbiology, eighth edition, mcgrow hill companies, New York, pp. 921-922.
26. Costa Ana Paula., Paulo César Giraldo., Ricardo Ney Cobucci., Márcia Lopes Consolaro., Raquel Pantarotto Souza., Luanda Barbara Canário., Paula Renata Machado., Rand Randall Martins., Pedro Vieira Baptista., José Eleutério Jr., and Ana Katherine Gonçalves (2020). Cross-Protective IgG and IgA Antibodies against Oncogenic and Non-Oncogenic HPV Genotypes. *Asian Pacific journal of cancer prevention* (APJCP). 21(9). 2799-2804.
27. Clarke MA, Risley C, Stewart MW, Geisinger KR, Hiser LM, Morgan JC, Owens KJ, Ayyalasomayajula K, Rives RM, Jannela A, Grunes DE, Zhang L, Schiffman M, Wagner S, Boland J, Bass S, Wentzensen N (2021). Age-specific prevalence of human papillomavirus and abnormal cytology at baseline in a diverse statewide prospective cohort of individuals undergoing cervical cancer screening in Mississippi. *National library of medicine*, Cancer Medicine 2021 Dec; 10(23) 8641-8650.

28. Van Aardt M.C., Dreyer G., Richter K.L and Becker P (2015). Human papillomavirus-type distribution in South African women without cytological abnormalities: a peri-urban study. *South African Journal of Gynecological Oncology* 5(2) 21–27.

29. **Adam, E., Berkova, Z., Daxnerova, Z., Icenogle, J., Reeves, W. C., and Kaufman, R. H.** (2000). Papillomavirus detection: demographic and behavioural characteristics influencing the identification of cervical disease. *American Journal of Obstetric Gynaecology* 182(2) 257-264.

30. Herrero , R., Hildesheim, A., Bratti, C., Sherman, M. E., Hutchinson, M., Morales, J., Balmaceda, I., Greenberg, M. D., Alfaro, M., Burk, R. D., Wacholder, S., Plummer, M. & Schiffman, M. (2000). Population-based study of human papillomavirus infection and cervical neoplasia in rural Costa Rica. *Journal of National Cancer Institutes* 92 (6) 464-74.

31. *Smith, J. S, Melendy, A., Rana, R. K. and Pimenta, J. M. (2008). Age-specific prevalence of infection with human papillomavirus in females: a global review. Journal of Adolescent Health. 43(4) 5-25.*

32. Nejo Y.T., Olaleye D.O and Odaibo, G.N (2018). Prevalence and Risk Factors for Genital Human Papillomavirus Infections Among Women in Southwest Nigeria. Arch Basic Applied Medicine 6(1) 105–112.

33. McBride Kimberly R., Singh Shipra. H (2018). Predictors of Adults' Knowledge and Awareness of HPV, HPV-Associated Cancers, and the HPV Vaccine: Implications for Health Education and Behavior: *The official Publication of the Society for Public Health Education* 45(1) 33-36.

34. Okunowo A.A., Daramola E.S., Soibi-Harry A.P., Ezenwankwo ., Kuku J.O., Okunade K.S and Anorlu R.I (2018). Women's knowledge of cervical cancer and uptake of Pap smear testing and the factors influencing it in a Nigerian tertiary hospital. *Journal of Cancer Research Practice*. 5(3). 105-11.

35. Roik E.E., Sharashova E.E., Nieboer E., Kharkova O.A., Postoev V.A and Odland J.Ø (2017). Knowledge about human papillomavirus and prevention of cervical cancer among women of Arkhangelsk, Northwest Russia. PloS ONE 12(12) 45-46.

36. Fokom Domgue J, Chido-Amajuoyi OG, Yu RK, Shete S. (2019). Beliefs about HPV Vaccine's Success at Cervical Cancer Prevention Among Adult US Women *Journal of the National Cancer Institute*.cancer spectrum. 3(4) 6-7

37. Azua, T. E., Orkaa, P. Y. and Ega, R. A. I. (2015). Prevalence of Human Papilloma Virus (HPV) Infection among Pregnant Women attending Antenatal Care at General Hospital, Minna-Nigeria. *Journal Microbiology and Biotechnology Research* 5 (3) 38-44.

38. Fadahunsi, O. O., Omoniyi-Esan, G. O., Banjo, A. A. F., Esimai, O. A., Osiagwu, D., Clement, F., Adeteye, O. V., Bejide, R. A. and Iyiola, S. (2013). Prevalence of High-Risk Oncogenic Human Papillomavirus Types in Cervical Smears of Women Attending Well Woman Clinic in Ile Ife, Nigeria. *Gynecology and Obstetrics* 3(6) 6-7.

39. Nyengidiki, T. K., Durugbo, I. and Bassey, G. (2016). Risk factors and distribution of oncogenic strains of human papilloma virus in women presenting for cervical cancer screening in Port Harcourt, Nigeria. *The Pan African Medical Journal.* 23:85.
40. American Cancer Society (2020). Cancer Facts & Figures 2020. Atlanta: American Cancer Society; 2020.
41. Baloch Z., Yuan T., Yindi S., Feng Y., Tai W., Liu Y., Liu L., Zhang A., Wang B., Wu X., and Xia X (2016). Prevalence of genital human papillomavirus among rural and urban populations in southern Yunnan province, China. Brazilian journal of medical and biological research. 49(6): e5254.
42. Manga M. M ., Adeola Fowotade., Yusuf Mohammed Abdullahi., Aliyu Usman El-nafaty., Danladi Bojude Adamu., Hamidu Umar Pindiga., Rasheed Ajani Bakare and Abimbola Olu Osoba (2015). Epidemiological patterns of cervical human papilloma virus infection among women presenting for cervical cancer screening in North-Eastern Nigeria. *Infectious Agents and Cancer* 10(39) 015-35.
43. Dimie Ogoina., Bolanle Olufunke Musa and Geoffrey Chukwubuike Onyemelukwe (2013). Human papilloma virus (HPV) infection is associated with HIV-1 infection and AIDS in HIV-infected adult patients from Zaria, Northern Nigeria. *The Pan African Medical Journal* 15(38) 2349-2350.
44. Adeyemi A. Okunowo., Fadekemi O. Gabriel-Raji., Salimat A. Yusuf-Awesu., Rukayat O. Salawu-Giwa., Oluwaseun E. Familusi (2022). Predictors of Knowledge of Human Papillomavirus Infection and Its Related Diseases: A Study of Women in a Nigerian Tertiary Institution. *Asian Pacific Journal of cancer care* 7(2) 219-230.
45. Jude Ogechukwu Okoye, Chukwudi Amaechi Ofodile and Oluwaseun Kelechi Adeleke and Okechi Obioma (2021). Prevalence of high-risk HPV genotypes in sub-Saharan Africa according to HIV status: a 20-year systematic review. National library of medicine, national center for biotechnology information. 43: e2021039.
46. Ashaka, O.S.; Omoare, A.A.; James, A.B.; Adeyemi, O.O.; Oladiji, F.; Adeniji, K.A.; Okunade, K.S.; Agbede, O.O (2022). Prevalence and Risk Factors of Genital Human Papillomavirus Infections among Women in Lagos, Nigeria. *Tropical. Medicine and Infecteous Disease*. 7(11). 386.
47. Ohihoin, A. , Okwuraiwe, P. , Musa, A. , Olorunfemi, G. , Onwuamah, C. , Ige, F. , Amoo, O. , Audu, R. , Okogbo, F. , Daniyan, B. , Swende, T. , Onyemelukwe, G. , Daru, H. , Usman, H. , Shittu, O. , Musa, J. , Ezechi, O. and Ujah, I. (2022) Prevalence and Predictors of High-Risk HPV in Nigeria. *Advances in Infectious Diseases* 12(4) 745-757.
48. Rodriguez-Cerdeira, R.C., Sanchez-Blanco, E. and Alba, A. (2012) Evaluation of Association between Vaginal Infections and High-Risk Human Papillomavirus Types in Female Sex Workers in Spain. ISRN *Obstetrics and Gynecology*. . 2012; 2012:240190. doi: 10.5402/2012/240190.