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SERO-PREVALENCE OF HUMAN PARVOVIRUS B19 AMONG PATIENTS ATTENDING SOME HOSPITALS IN KANO METROPOLIS, NIGERIA

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ABSTRACT

Background: Human Parvovirus B19 (HPVB19) belongs to the family *Parvoviridae*, causes *Erythema infectiosum*, aplastic crises in persons with blood disorder and prolonged anaemia in immuno-compromised persons. During pregnancy the virus may be transmitted to the foetus which can result in hydrops foetalis, spontaneous abortion or intrauterine foetal death. The study determined the sero-prevalence of IgG antibodies to HPVB19 among patients in Kano metropolis in order to provide information on their immune status and the possible risk factors for acquiring the virus.

Method: The study population comprised 460 patients seen at the outpatient department of two hospitals in Kano whose mean age was 28.8 (range 0 -70) years. Questionnaire was used to obtain data on socio-demography and risk factors. Blood sample was collected from each patient, serum was obtained and analysed for IgG antibodies to HPVB19 by ELISA according to manufacturer's instruction.

Result/Discussions: Sero-prevalence of 41.5% (191/460) was obtained for HPVB19 and seropositivity increased significantly with age with the highest prevalence (51%) recorded among patients ≥ 51 years old while the lowest prevalence was among those < 1 year old ($\chi^2=13.130$, $df=6$, $P=0.04$). Seropositivity was higher in female (42.6%: 98/230) than male patients (40.4%: 93/230) ($p>0.05$). Highest seropositivity was observed among farmers (64.2%:18/28) while the lowest was among retired persons (27.2%:3/11). There was significant association between HPVB19 and level of formal education attained ($\chi^2 =10.363$, $df=4$, $P=0.03$) and number of persons living in a house ($\chi^2 =14.30$, $df=1$, $P=0.00$). There was no association between HPVB19 and marital status ($P=0.3$) and type of residence ($P=0.5$). Blood transfusion (OR=2.0:1; $P=0.08$) and sickle cell anaemia (OR=1.7:1; $P=0.08$) were important risk factors for HPVB19 transmission in this study. Having blood transfusion showed a 2.0 fold risk while having sickle cell showed a 1.7 fold risk of acquiring HPVB19 infection. During the study, 48.2% of women of child bearing age had antibodies to HPVB19 IgG antibodies leaving about 52% still susceptible to the virus.

Conclusion: Sero-prevalence to B19 among patients was low leaving a large proportion of the population especially women in Kano still susceptible to B19 infection.

Keywords: Sero-prevalence, Human Parvovirus B19, Patients, Hospitals, Kano, Nigeria

INTRODUCTION

Human parvovirus B19 (HPVB19) was accidentally discovered during screening of healthy blood donors for hepatitis B (1) and has since then been recognized as an important human pathogen causing significant morbidity and mortality in various patient population groups (2). Immature cells in the erythroid lineage are principal target for human B19 parvovirus. Hence viral replication causes cell death, interrupting red cell production (3).

Parvovirus B19 can be found in the blood and respiratory secretion of infected patients. The virus can be transmitted parentally by blood transfusions, infected blood products, packed red cells from blood collected during the short viremic phase (4) and vertically from mother to foetus (3).

The virus causes *Erythema infectiosum* (fifth disease) in children and is responsible for various clinical manifestations whose characteristics depend on the interplay between the viral properties and the physiological and immune status of the infected individuals (5). Parvovirus B19 virus may cause

transient anaemia amongst healthy adults, aplastic crises in infected persons with an underlying blood disorder and prolonged anaemia in immuno-compromised persons such as AIDS and organ transplant patients. In addition, during pregnancy the virus may be transmitted to the foetus which can result in hydrops foetalis, spontaneous abortion or intrauterine foetal death (IUFD), most commonly during the second trimester of pregnancy (6). However, a persistent infection may be observed in immunocompromised patients unable to produce neutralizing antibodies and to clear the virus leading to chronic B19 carriage with or without anaemia (7). Persistence of infection in the bone marrow has also been reported in immunocompetent individuals with or without symptoms (7).

Though the association between HPVB19 and *Erythema infectiosum* has been established since 1983, there is dearth of information on the prevalence of HPVB19 and associated risk factors in Nigeria especially among individuals in Kano state. The study therefore aimed at determining the sero-prevalence of IgG antibodies to Parvovirus B19 among patients in Kano metropolis in order to

provide information on the immune status of the general population to the virus and possible risk factors for acquiring the virus, with the hope of aiding in the control and spread of this virus.

MATERIALS AND METHODS

The cross sectional study was conducted between July and October 2009 in two hospitals in Kano state; Hasiya Bayero Paediatric Hospital and Aminu Kano Teaching Hospital. The ethical review boards in these hospitals approved the study and informed consent was obtained from parents/caregivers as well as patients before inclusion. The study group comprised 460 patients whose mean age was 28.8 (range 0-70) years. Each enrolled patient had a serum specimen tested for the presence of anti-parvovirus IgG antibodies by enzyme-linked immunosorbent assay (Institut Viron/serion GmbH Wurzburg, Germany). Demographic information and data on possible risk factors were collected from the patients using structured questionnaires prior to sample collection. Data obtained from the questionnaires and the result from the sample analysis were entered into spread sheet and analysed using the SPSS version 15.0. Prevalence rates of B19 IgG antibodies were compared with the parameters by chi-square test. *P* values < 0.05 were considered significance at 95% Confidence Interval (CI).

RESULTS

The sero-prevalence of IgG antibodies to HPV B19 in the two hospitals is shown in Table 1. The sero-prevalence of B19 IgG antibodies increased from 25.0% (1/4) in children to 51% (24/47) in adults (*P* =

0.04). The 460 patients in the study were equally distributed between male and female. Though sero-prevalence was higher in female patients than male patients, the difference observed was not statistically significant (*P*=0.3). There was no significance difference in the sero-prevalence of the antibodies by marital status though prevalence was higher among married compared to unmarried patients. Level of formal education was significantly associated with presence of antibodies to the virus with the highest prevalence observed among those without formal education (44%: 64/145) while the lowest was among those with tertiary education (33%:26/78). There was a significant association between infection with parvovirus and occupation of patients (*P*=0.02). Farmers had the highest prevalence (64%:18/28) of antibodies to Parvovirus compared to retirees with the lowest (27.2%: 3/11).

The result was analysed according to type of house patients live in and the highest prevalence of 45% (90/200) was recorded among patients living in family compound house while the lowest (28.5%: 14/49) was recorded amongst patients who live in duplex type of residential houses. The difference observed was not statistically significant (*P*=0.5). Further analysis of the results showed that parvovirus infection was significantly associated with the number of persons living in a house; with patients living in houses with more than 5 persons having the highest prevalence (51.8%: 99/191) while those living in houses with less than 5 persons had the least (34.2%: 92/269).

TABLE 1: SERO-PREVALENCE OF HPV B19 IGG ANTIBODIES AMONG PATIENTS 0-70 YEARS OLD ATTENDING SOME HOSPITALS IN KANO METROPOLIS

Hospital	Number Screened	Number Positive (%)	95%CI
AKTH	368	158 (42.9)	37-48
HBPH	92	33 (35.8)	26-46
Total	460	191 (41.5)	37-46

$\chi^2=1.513$, *df* =1, *p*=0.2

Key: AKTH = Aminu Kano Teaching Hospital; HBPH =Hasiya Bayero Paediatric Hospital

Some possible risk factors that might be associated with transmission of HPV B19 infection among the population was analysed (Table 3). The results of this study showed that history of transfusion is an important factor for acquiring infection with HPV B19. There was a 2- fold risk of getting infected among those who have had transfusion (95% CI =0.8-4.6, OR =2.0) though the difference was not statistically significant ($\chi^2=2.917$, *df*=1, *P*=0.08). Others risk factors such as pregnancy, sickle cell anaemia and organ transplantation were not significantly associated with Parvovirus B19 with highest prevalences of 41.5%, 54.5% and 100% and lowest prevalences 41.5%,40.9% and 41.4% (*P*=0.9,*P*=0.2, *P*=0.2) respectively.

The result was further analysed according to age group of the female patients and it was observed that women within age group 31-40 years had the highest prevalence of HPV B19 IgG (55%: 27/49) and the lowest prevalence was recorded among women in age group 10-20 years (38%: 13/34) (Table 4). The results showed that 170 (73.9%) of the 230 female patients studied were of child bearing age and HPV B19 IgG antibodies was detected among 48.2% (82/170) of these women. Among the women of child bearing age, 41/170(24%) were pregnant and only 17/41(41.5%) of them had antibodies to HPV B19 which leaves about (24/41) 58.5% of those pregnant still susceptible to HPV B19 infection.

TABLE 2: SOME SOCIO-DEMOGRAPHIC FACTORS ASSOCIATED WITH HPV B19 IGG AMONG PATIENTS IN SELECTED HOSPITALS IN KANO METROPOLIS

Variable	No. of patient	No. positive (%)	p-value
Age (Years)			
<1	4	1 (25.0)	0.04
1-10	91	24 (26.3)	
11-20	59	23 (38.9)	
21-30	103	47 (45.6)	
31-40	97	44 (45.4)	
41-50	59	28 (47.5)	
≥51	47	24 (51.0)	
Gender			
Male	230	93 (40.4)	0.3
Female	230	98 (42.6)	
Marital Status			
Married	253	115 (45.4)	0.06
Single	207	76 (36.7)	
Formal educational level			
None	145	64 (44.0)	0.03
Primary	93	40 (43.0)	
Secondary	144	61 (42.4)	
Higher	78	26 (33.0)	
Occupation			
Civil Servant	58	19 (32.8)	0.02
Unemployed	94	32 (34.0)	
Self employed	50	27 (54.0)	
Farmer	28	18 (64.2)	
Fulltime Housewife	82	41 (50.0)	
Artisan	31	12 (38.7)	
Student	63	22 (34.9)	
Retired	11	3 (27.2)	
Others	43	17 (39.5)	
Type of residence			
Single room	8	3 (37.5)	0.5
Room and parlour	47	21 (44.7)	
1-3Bedroom	156	63 (40.3)	
Family compound	200	90 (45.0)	
Duplex	49	14 (28.5)	
No of persons living in a house			
≤5	269	92 (34.2)	0.00
>5	191	99 (51.8)	

Key: Mean age = 28.8; S.D = 1.6; Others = Unskilled labourers, bike riders.

TABLE 3: SOME POSSIBLE RISK FACTORS ASSOCIATED WITH HPV B19 AMONG PATIENTS ATTENDING SOME SELECTED HOSPITALS IN KANO METROPOLIS

Variable	No of patient	No.Positive (%)	p-value	OR	95%CI
History of transfusion					
No	430	183 (42.5)	0.08	1	0.8-4.6
Yes	30	8 (26.6)		2.0	
Pregnancy					
No	419	174 (41.5)	0.9	1	0.5-1.9
Yes	41	17 (41.5)		0.9	
Organ transplant					
No	459	190 (41.4)	0.2	1	0.9-1.0
Yes	1	1 (100)		0.9	
Sickle cell Disease					
No	438	179 (40.9)	0.2	1	0.7-4.1
Yes	22	12 (54.5)		1.7	

KEY: HPV B19=Human Parvovirus B19, OR=Odds ratio

TABLE 4: DISTRIBUTION OF HUMAN PARVOVIRUS B19 ANTIBODY AMONG WOMEN OF CHILDBEARING AGE ATTENDING SOME SELECTED HOSPITALS IN KANO METROPOLIS

Age group (yrs)	No. Screened	No. Positive	Percentage (%)	95% CI
10-20	34	13	38	23-54
21-30	57	28	49	36-61
31-40	49	27	55	41-68
41-50	30	14	46.7	30-63
Total	170	82	48.2	

DISCUSSION

The overall prevalence rate of HPVB19 IgG antibody determined in this study was 41.5%. This was slightly higher than the prevalence of 39.5% reported in Jos (2) and lower than the prevalence of 85.4% reported from Zaria (8) other studies reported 60-70% from developed countries such as England (9) but higher than 16.2% reported in Singapore (10). These discrepancies could be due to differences in the specificity and sensitivity of the assays used.

Several studies in different regions of the world have identified different socio-demographic variables like age, gender, socio-economic status and environmental conditions as risk factors for acquisition of parvovirus B19 infection. For example, age has been consistently shown to be a major predictor of anti-parvovirus B19 IgG seropositivity (11,12,13).

This was also demonstrated in this study where seropositivity significantly increased with age; with a gradual increase in seropositivity from patients <1 year old through ≥ 51 years old. The present study, the first in Kano to assess HPV B19 IgG sero-prevalence amongst patients, shows that by age 20 about 40% of the population have been infected by HPV B19.

Parvovirus B19, seropositivity is a synonym of immunity, the increase in seroprevalence with age means that, the proportion of individuals susceptible to parvovirus B19 decreases with age (14). This increasing seropositive rate with increasing age is consistent with the work of Girei in Jos (2) and reports from other countries (11, 5, 15). However, the results contrast that of Ujo and colleagues whose study reported that seropositivity did not increase with age (8). This discrepancy could be due to the fact their study was carried out in children with sickle cell disease whereas this study was carried out among all kinds of patients in the general population aged from 0-70 years.

The prevalence of 51% among age group >51 years found in this study is similar to 50% reported in India (15) and slightly lower than 55% reported in Malaysia (11) for the same age group. This difference could be attributed to dwindling immune response in the elderly, as a result of the natural decay of antibodies with time, which probably account for the lower seropositivity seen in the age group 51 years and above (11) as the antibodies could have decreased to a level beneath the detection limit of the test used in this study.

This study however has not demonstrated any association between gender and seropositivity of parvovirus as the difference in the prevalence rates was not significantly different between male and female patients. Overall a

slightly higher seropositivity was observed in female patients than in male patients, which is in agreement with the findings of Ooi *et al* in Malaysia (11), Salimi *et al* in Iran (5) and Girei *et al* in Nigeria (2).

Marital status did not affect the prevalence of the virus in this study. No statistically significant difference in the positivity was evident among the married patients and the unmarried individuals. This was also observed in India where the prevalence in married donors was not statistically different from the unmarried as transmission of the virus is not through sexual route.

The relationship between socio-economic status and health outcome is well known (13). Higher positivity found among farmers, bike riders and unskilled labourers could be explained by their poor living conditions such as poor housing, overcrowding and low educational levels. This finding conforms to work of Kishore *et al.*(15) among blood donors in India where high positivity was observed among unskilled labourers. Higher prevalence among these occupational groups was attributed to outdoor activities which could lead to more exposure and thus contact with infectious agents (15). High positivity observed in this study among full time housewives could also be due to the fact that women are always in contact with children both at home and outside the home. This finding does not conform to the work of Ujo *et al.* (8) who did not find any association between occupation and HPVB19 among parents of children in their study.

In this study it was observed that lower educational levels and overcrowding predispose to Parvovirus infection. Studies have indicated that education, to some extent compensates the effects of poverty on health, irrespective of the availability of health facilities (15). In this study the highest prevalence was observed among those without formal education and lowest among the highly educated. The finding is consistent with findings of Kishore and colleagues on blood donors in India who also reported higher prevalence among illiterates, low educated group and lowest among the highly educated group (15).

The seroprevalence of parvovirus was significantly higher among patients who lived in houses with more than five people. This finding is in close agreement with reports of Alao and colleagues (13) who reported higher parvovirus B19 prevalence rate in Jos among children who lived in crowded dwellings which was attributed to overcrowding in urban areas. Overcrowding is very common in urban areas where most people live in highly compacted areas with little or no ventilation. This occurrence is common in a populous

country like Nigeria where there is usually an influx of people from the rural areas to the urban areas. Overcrowding leads to a higher and faster spread of infection through the respiratory route (15) and HPVB19 is transmitted primarily through respiratory secretions and saliva. Therefore, in crowded environments such as daycare centers, kindergartens and schools transmission of the virus from infected to non-infected individuals is probable (16, 17).

History of transfusion, sickle cell anaemia, being pregnant and organ transplant, showed no significant association. is acutely infected (13). The prevalence among pregnant and those without pregnancy coincides with the overall prevalence of 41.5% obtained from the study. Though the only organ transplant patient tested positive, number in the group was too small to draw any conclusion. There may be other factors apart from those studied which contribute to transmission of the virus.

In this study, almost half (48.2%) of the women of reproductive age defined as women from 10-50 years old (18) had IgG antibodies to HPVB19. This finding shows that over half (52%) of women within this age group in the study are still susceptible to parvovirus B19 infection which poses a

Higher prevalence observed among the non transfused group is in agreement with the work of Ujo and colleagues (8) who also found higher prevalence among this group, though a 2 fold risk was observed with respect to blood transfusion in this study. Although significant association was not established, higher prevalence was observed among those with sickle cell anaemia disease. Secondary attack rates of between 50 to 60% have been reported in families with more than one child with sickle cell anaemia when one child

public health problem. This result is similar to 47% obtained in a study in Brazil (19). Parvovirus infection during pregnancy can cause severe foetal anaemia as a result of foetal erythroid progenitor cell infection with a shortened half-life of erythrocytes, causing high output cardiac failure and subsequently non-immune hydrops foetalis (16, 17).

In conclusion, the findings in this study confirmed the presence of human parvovirus B19 in Kano state and seroprevalence rate comparable with those found in various countries in the world. Seroprevalence to HPVB19 among patients was low leaving a large proportion of the population in Kano still susceptible to HPVB19 infection.

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