

STUDY OF HEPATITIS B VIRUS (HBV)  
INFECTION MARKERS IN KENYAN NEWBORN  
AND SCHOOL CHILDREN FROM NAIROBI  
(URBAN) AREA. //

by

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DECLARATION

I certify that this dissertation is my original work and has not been submitted for a degree in any other University.

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## INTRODUCTION

It is well recognized that viral hepatitis can be caused by Hepatitis A Virus (HAV), Hepatitis B Virus (HBV) and Non A, Non B virus. These infectious agents are immunologically distinct and are spread by different epidemiological means.

Hepatitis B has been extensively studied during the last decade especially in association with chronic liver diseases in the tropics.

Hepatitis B virus is transmitted by:-

- i) transfusion of infected blood or blood products or during percutaneous inoculation by needle of contaminated serum or plasma,
- ii) percutaneous transfer of infected serum or plasma through skin cuts or bruises,
- iii) oral route through infective saliva,
- iv) sexual contact, introduction of infective semen into mucosal surfaces,
- v) indirect contact of serum or plasma via vectors.

Clinical picture of Hepatitis B is variable from asymptomatic often anicteric form to mild - influenza like attack particularly, in infants and children marked by a transient antigenemia to

chronic progressive Hepatitis with cirrhosis as a result. The incubation period of Hepatitis B is characteristically long, ranging from 60 - 180 days (average 90 days).

Hepatitis B is caused by Hepatitis B virus, 42 nm. double-shelled virus originally known as the "Dane particle." At present there are three antigenic systems recognized as serological markers for present or past infection, with HBV.

First system represents Hepatitis B surface antigen (HBsAg) with anti HBsAg- HBsAb. Hepatitis B surface antigen, formerly known as the "Australian antigen" was discovered by Blumberg in 1964 and it is found on the surface of the virus and on the accompanying 22 nm spherical and tubular forms of the same diameter as shown on figure 1. Various subtypes of HBsAg have been described and have been proven to be useful epidemiological markers of HBV infection. HBsAg can be identified in the serum one-two months after exposure and may persist for a variable period, a small number progress to the carrier state with persistent Hepatitis B viraemia. Antibody to HBsAg detectable by itself indicate past infection and immunity to further infection and tend to occur often one to three months after recovery is complete. Future contact with HBV in an immune subject causes anamnestic response to it.



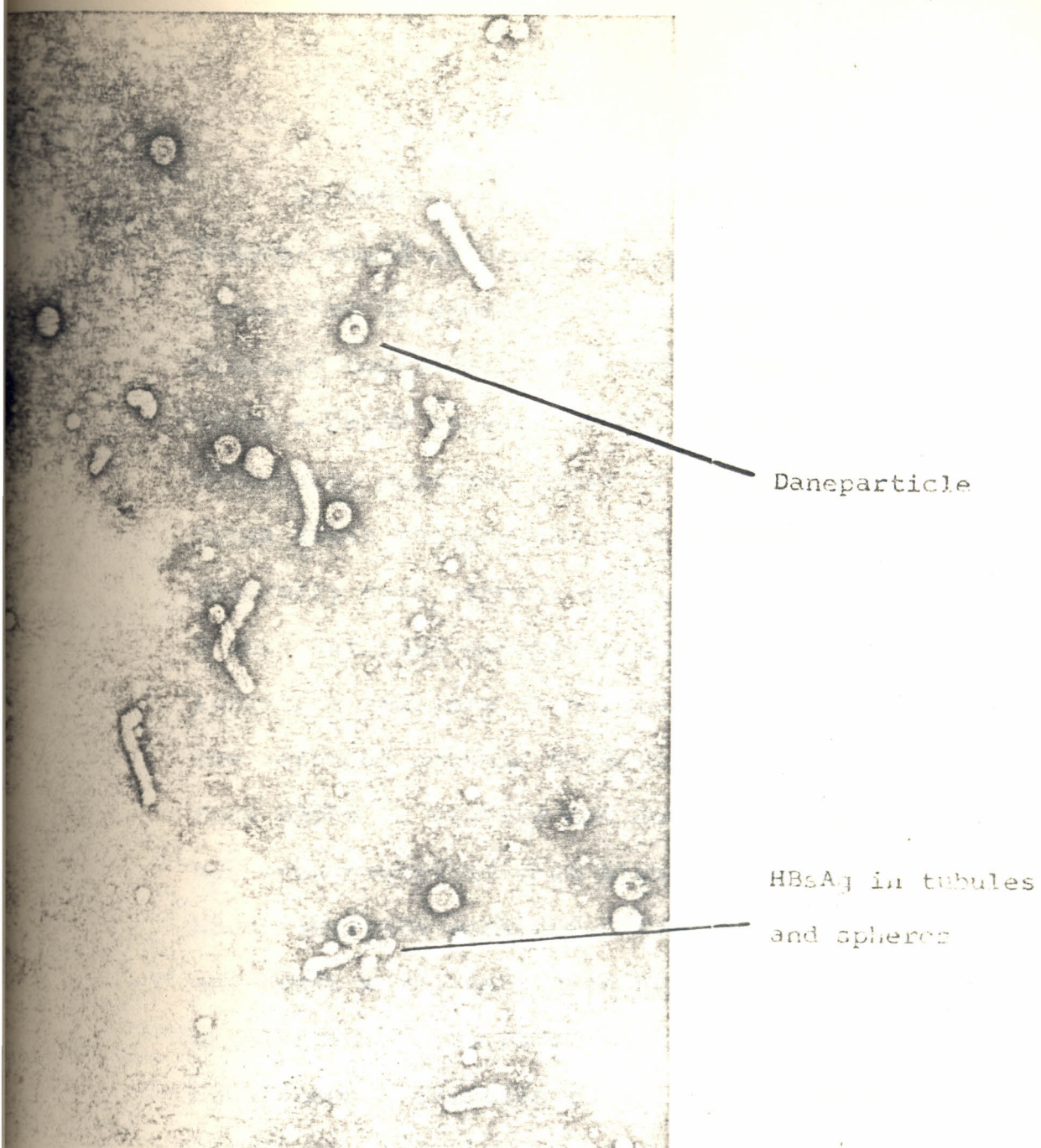


Figure 1: Showing the three morphological forms of HBsAg. The small spheres and tubular structures consist wholly of HBsAg while the double shelled Dane particles have HBsAg on the outer envelope and HBcAg on the core.

Second system is Hepatitis B core antigen (HBcAg) found within the core of the virus consisting of specific DNA polymerase and circular double stranded DNA. Antibody to HBcAg - HBcAb appears in the serum during the clinically apparent phase of illness, the titre rises rapidly and then usually falls gradually over several months. Hepatitis B core antibody denotes present or past infection and very high levels are found in the serum of chronic HBsAg carriers, in which free HBsAb is usually not detectable (1). It has been suggested that high titres of HBcAb indicate persistent HBV replication and HBcAb might be detectable even when undetectable amounts of HBsAg are circulated (2). Such chronic carriers together with chronic HBsAg carriers represent a reservoir for Hepatitis B virus as their blood has been shown to transmit Hepatitis B, (3,4). Generally the titres are very low or undetectable in an immune person and fail to respond to future HBV infection.

Third system is Hepatitis B "e" antigen

which is a useful marker of high infectivity of the serum of HBV carriers. They tend to develop active liver disease if e antigen is present.

(Fig. 2 shows relationship between three antigenic systems and their antibodies).

The prevalence of HBsAg in the world varies from region to region. It appears to be related both to the age at which infection is acquired, and to the immunological competence of the host among other factors.

It has been estimated that as many as 5 - 10% of the HBV infection result in chronic carriage of HBsAg. In UK, prevalence of carriers among blood donors is less than 0.2%, in America HBsAg is found in approximately 0.4 - 0.2% of healthy volunteer blood donors (12). The prevalence of HBsAg in the general population in many tropical countries has been found to be higher than in temperate climate.

A variety of test methods for detection of HBsAg has been described, ranging in order of sensitivity from immunodiffusion technique, complement fixation, counter-immunoelectrophoresis, passive haemagglutination to radioimmunoassay (13). Using immunodiffusion method prevalence of HBsAg



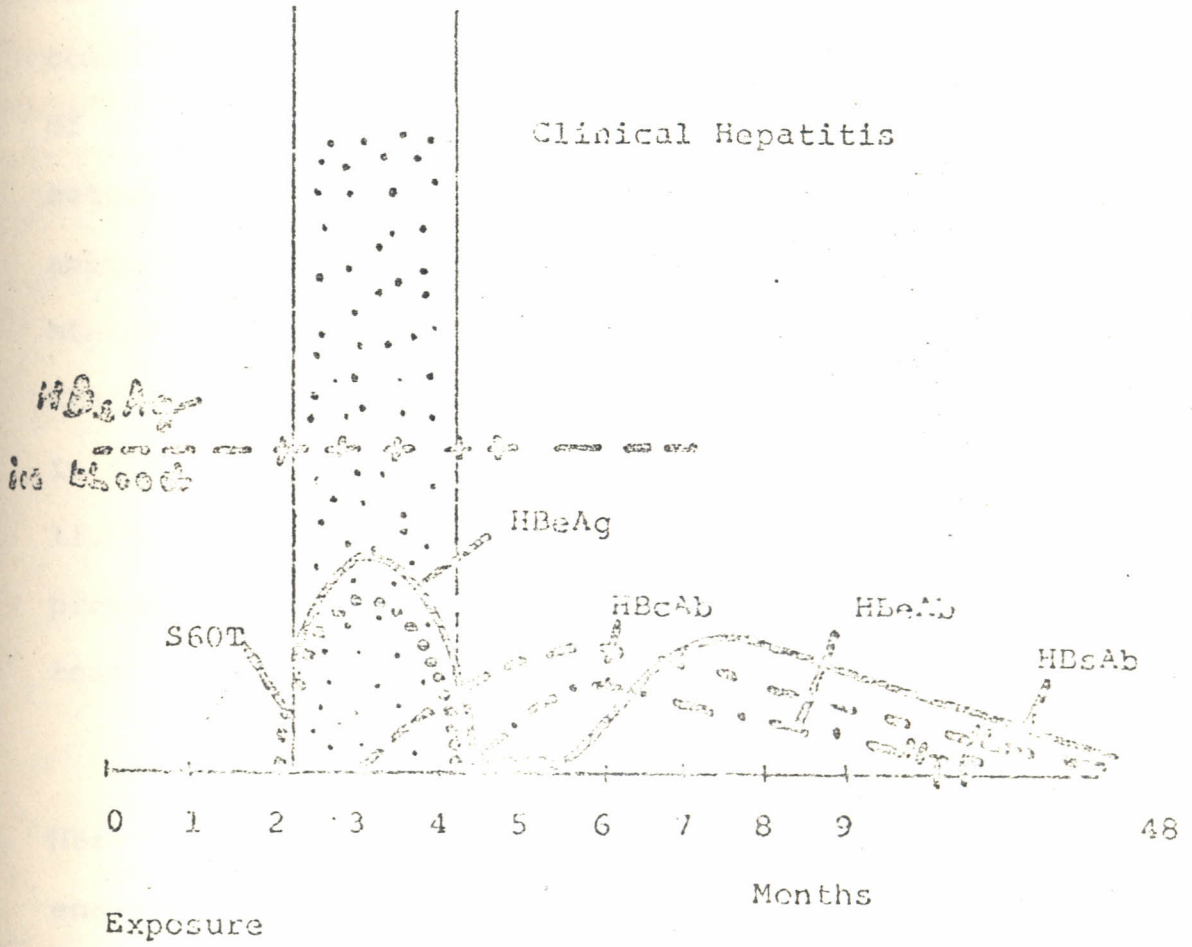


Figure 2: Typical Course of Viral Hepatitis Type B.

Acute Hepatitis type B.

in Kenya was found to be 6.6% among blood donors (13). In Bagshawe's *study conducted among a rural* community of Kenya, HBsAg was detected in 5.1% of samples using counter-immunoelectrophoresis method (14). Study by Wankya which was conducted among the same population as (14) showed even higher figures using more sensitive method (11). HBsAg in this study was detected more frequently in the first decade of life, having accounted for 11.9%. Recent studies among blood donors showed prevalence of HBsAg 7% using haemogglutination test (15).

Hepatitis B virus as judged from the high HBsAg prevalence in tropical countries is endemic in these countries. Review of the literature suggests that Hepatitis B infection in early life is a major risk factor in the development of chronic HBsAg carriers (5,6) and vertical transmission of HBV may be one of the contributory factors of the high rate of HBV in the community. Chronic carrier can be in good health, usually detected by screening of blood donors population with no evidence of liver disease. On the other hand they are those healthy carriers who may develop chronic liver disease as chronic persistent hepatitis, active cirrhosis



later in life (7) and there is a firm association with Hepatocellular carcinoma.

Review of the liver diseases in Kenya showed fairly high number of cases of chronic aggressive hepatitis and cirrhosis among the children, which would be among other causes due to viral hepatitis particularly of type B(8). The discovery of the association between hepatitis, chronic liver disease, hepatoma and Australian antigen has enlightened many aspects of this particular disease. Study in the adult cases of chronic liver disease in Kenya showed that chronic persistent hepatitis, chronic aggressive hepatitis, hepatoma were in more than 50% of the cases associated with HBsAg (9). Similar association could play a role in the pathogenesis of chronic liver diseases in Kenyan children. There is evidence that HBV infection is a disease of the paediatric age group in the tropics. While HBsAg studies have been conducted in Kenyan children by Bagshawe and Wankya (10, 11) the study on HBeAb and its relationship to HBsAb has not been studied in Kenya before. The later would really offer some information of transmission rate of the virus in childhood in the Kenyan urban society in non malaria areas and the purpose of this study is to provide this data.

OBJECTIVES

- 1.1 To study the prevalence of Hepatitis B surface antigen (HBsAg), HBsAb, *HBcAb in school children age 6 -15 years* in Nairobi area.
  
- 1.2 To evaluate relationship of serological markers of HBV infection in neonates in comparison with their mothers.

MATERIAL AND METHODS

A. Nairobi school children between the age 6 - 15 were included in the study. Random selection of children from five Nairobi City Council primary schools was done. 5 mls. of venous/ blood from each child was obtained under aseptic conditions between the months of September and October 1980 after receiving a written permission from the parents. The children were examined by the author. Apart from minor ailments all were found to be essentially healthy. A form was given to each child and name, sex, tribe, age, residence, number of children in the family were recorded, profession of the parents or monthly income was obtained. Serum was separated within 24 hours of collection, and after coding

stored at  $-20^{\circ}\text{C}$ .

A total of 279 children were included in the study. All sera were divided according to two age groups 6 - 10 years and 10 years one month-15 years. HBsAg was analysed in 137 sera of the first age group, while only 60 samples were analysed for HBsAb and HBcAb. 142 sera of the second age group were tested for HBsAg, 65 of them were analysed for HBsAb and HBcAb.

B. 37 samples of venous blood was collected from mother-infant pairs during delivery at the Kenyatta National Hospital Maternity during the period between 16th February, 1981 to 15th March, 1981. Mothers were randomly selected and only full term healthy newborn infants were included in the study. 5 mls. of cord blood was collected immediately after delivery of the infant. 5 mls. of maternal venous blood was collected by venepuncture under aseptic conditions. Serum was separated and stored under conditions as for the school children. The mother was interviewed, and her name, tribe, age, sex of newborn, number of children in the family, history of blood transfusion, personal and family history of jaundice were recorded together with history of injection received within the last six months.

All samples were analysed for HBsAg, HBCAb, HBsAb in the Department of Human Pathology, Immunology Section.

- i) HBsAg was tested by Passive Haemagglutination Test (Hepatest, Burroughs, Wellcome) with positive and negative controls. The test uses highly purified antibody isolated from horse antiserum to HBsAg which are readily bound to tanned turkey erythrocytes to yield a "sensitised cell suspension that will agglutinate in the presence of HBsAg.
- ii) HBsAb was tested by Radioimmunoassay (AUSAB, ABBOT LABORATORIES) using a "sandwich principle," a solid phase radioimmunoassay technique. Plastic beads coated with human Hepatitis B surface antigen are supplied in the kit to which test serum is added. Antibody, if present, is fixed to the solid phase antigen. When antigen tagged with  $^{125}$  is added it binds to antibody on the bead creating a radioactive antigen - antibody - antigen "sandwich". All samples including positive and negative controls were counted by a gamma scintillation counter as per instructions of the calculation s, the higher the counts per minute, the higher the



positivity for the HBsAb in the test sample once the cut off line is calculated.

iii) HBcAb was tested by a competitive Radioimmunoassay (CORAB, ABBOT LABORATORIES) in which a constant amount of anti-HBc<sup>125</sup> competes with the test serum for binding sites on beads coated with HBcAg. The proportion of radioactive anti HBc bound to the bead is inversely proportional to the concentration of anti-HBc in the test specimen. Radioactive HBcAb is counted in a gamma scintillation counter, the lower the counts per minute (C.P.M.) obtained, the greater was the positivity of the test sample after the cut off line is determined.

Results:

Table I: Shows the total number of children tested in the different age groups and sex for various HBV infection markers.

Table I: THE TOTAL NUMBER OF CHILDREN TESTED  
FOR VARIOUS HBV INFECTION MARKERS  
ACCORDING TO SEX AND AGE GROUP.

Age Group in years	Total No. Tested for HBsAg		Total No. Tested for HBcAb HBsAb	
	Sex		Sex	
	Male	Female	Male	Female
6 - 7	14	17	7	8
7 - 8	18	22	7	8
8 - 9	20	18	8	9
9 - 10	8	20	5	8
10 - 11	24	15	6	8
11 - 12	9	15	4	8
12 - 13	15	15	7	7
13 - 14	14	8	7	6
14 - 15	17	10	5	7
Total	139	140	56	69

A total of 279 children were examined for HBsAg. Out of these 137 in the 6 - 10 years age group and 142 above the age of 10 - 15. 60 children between the age of 6 - 10 years were tested for HBsAb and HBcAb. 65 children were tested for HBsAb, HBcAb from between the age 10 - 15.

Table 2: THE PREVALENCE OF HEPATITIS B ANTIGEN  
AMONG SCHOOL CHILDREN FROM NAIROBI AREA.

Age (Years)	Sex	Number Tested	Number Positive	%
6 - 10	Males	60	2	3.3
	Females	77	4	5.2
	Total	137	6	4.3
10- 15	Males	79	5	6.3
	Females	63	2	3.2
	Total	142	7	4.9
All Ages	Males	139	7	5.0
	Females	140	6	4.3
	Total	279	13	4.6

Table 2 gives the results of HBsAg in the different age groups and sex. Out of 279 school children tested 13 cases were positive for HBsAg which gives prevalence of 4.6%. In the age group 6 -10 years, HBsAg was found more frequently in females than males. On the other hand between the age group 10 - 15 and in all ages the prevalence of HBsAg was higher in males than females.

Table 3: POSITIVE CASES OF HBsAg ACCORDING TO TRIBE

Tribe	Number Tested	HBsAg+
Kikuyu	129	6(4.6%)
Luo	49	2(4.0%)
Luhya	45	3(6.6%)
Kamba	22	1(4.5%)
Others	34	1(2.9%)
Total	129	13(4.6%)

Tribal distribution of HBsAg is shown on table 3. The highest prevalence was among Luhya tribe 6.6% but statistically it is not significant ( $p > 0.05$ ). Table 4 and 5 shows results and interrelationship between various HBV infection markers tested on 60 school children between the age group 6-10 years. Two males cases were positive for HBsAg (3.3%), both of them have detectable HBcAb, one with high titres. One child came from a middle social class family with 3 siblings, the other case came from a low social class family with 6 children, HBcAb was detectable in 18(30%) school children in the same age group, among them 2(3.3%) children had HBcAb as a sole marker of



HBV infection detectable, one of them with high titres. Of the additional 14 HBcAb positive sera associated with HBsAb, 8 had high titres.

HBsAb was detectable in 24 (40%) children from the same age group, none of them was associated with HBsAg. HBsAb as a sole marker of HBV infection was detectable in 10 samples (16.7%). 8(13.3%) children had high titres of HBsAb all of them were associated with HBcAb. There was no significant difference between the prevalence of various HBV infection marker and sex distribution. 32(53.4%) children had no detectable markers of HBV infection between the age group 6-10 years.

Table 4 and 5:

HBV MARKERS AND INTERRELATIONSHIP OBSERVED  
IN THE AGE GROUP 6 - 10 YEARS

Sex	Number Tested	HBcAb+	HBSAb+
Female	33	9(27.2%)	11(33%)
Male	27	9(33.3%)	13(48.0%)
Total	60	18(30%)	24(40%)

Sex	Number Tested	HBsAg+ HBcAb+ HBsAb-	HBcAb+ HBsAg- HBsAb-	HBcAb+ HBsAb+ HBsAg-	HBsAg- HBcAb- HBsAb+	No HBV Markers
F	33	0	1(3%)	8(24.2%)	3(9.1%)	21(63.7%)
M	27	2(7.4%)	1(3.7%)	6(22.2%)	7(26%)	11(40.7%)
Total	60	2(3.3%)	2(3.3%)	14(23.3%)	10(16.7%)	32(53.4%)

Table 6 HBV MARKERS IN THE AGE GROUP 10 - 15 YEARS

Sex	Number Tested	HBcAb+	HBsAb+
Female	36	10(27.7%)	14(38.8%)
Male	29	11(37.9%)	12(41.3%)
Total	65	21(32.3%)	26(40%)

Table 7: INTERRELATIONSHIP OF HBV MARKERS IN  
THE AGE GROUP 10 - 15 YEARS

Sex	Number Tested	HBsAg+ HBcAb- HBsAb-	HBcAg+ HBcAb+ HBsAb-	HBcAb+ HBsAg- HBsAb-	HBcAb+ HBsAb+ HBsAg-	HBsAg- HBcAb- HBsAb+	No Markers
Female	36	1(2.7%)	0	2(5.5%)	8(22.2%)	6(16.7%)	19(52.8%)
Male	29	0	2(6.9%)	0	9(31%)	3(10.4%)	15(51.7%)
Total	65	1(1.5%)	2(3.1%)	2(3.1%)	17(26.2%)	9(13.8%)	34(54.3%)

Table 6 and 7 illustrate results and interrelationship of various HBV infection markers tested on 65 school children between the age cohort of 10 - 15 years. Two sera were positive for HBsAg association with high titres of HBcAb. Both came from a family of 10 children with low social economic status. One female case had HBsAg detectable alone in the serum as an evidence of past or current HBV infection. There were 6 children in her family with low social economic status. In the above age group HBcAb was detectable in 21(32,3%) school children, among them 2(3.1%) children had HBcAb as a sole marker of HBV infection, both of them with low titres. Of the additional 17 HBcAb positive sera associated with HBsAb 8 had high titres. 26(40%) children from the same age group had HBsAb detectable. 11(17%) of the children had high titres of which 9 were associated with HBcAb. HBsAb as a sole marker of HBV infection was detectable in 9(13,8%) samples, 2 with high titres. 34(52,3%) children had no detectable markers of HBV infection from the age group 10-15 years.



Table 8: COMPARISON OF VARIOUS MARKER OF HBV INFECTION IN NAIROBI SCHOOL CHILDREN OF TWO AGE GROUPS.

Age group	Number Tested	HBsAg+	HBsAg+	HBcAb+	HBcAb+	HBsAb+	No markers
		HBcAb+	HBsAb-	HBsAb-	HBsAb+	HBsAg-	
		HBsAb-	HBsAb-	HBsAg-	HBsAg-	HBcAb-	
6-10	60	2(3.3%)	0	2(3.3%)	14(23.3%)	10(16.7%)	32(53.4%)
10-15	65	2(3.1%)	1(1.5%)	2(3.1%)	17(26.2%)	9(13.8%)	34(52.3%)
Total	125	4(3.2%)	1(0.8%)	4(3.2%)	31(24.8%)	19(15.2%)	66(52.8%)

Table 8 shows the comparison of various markers of HBV infection of two age groups. Statistically there was no significant difference between the two tested age groups ( $P < 0.05$ ) when individual markers were analysed. Out of 125 children tested for three markers of HBV infection 66 children (52.8%) had no markers of HBV infection demonstrable. Comparison of HBV markers and the size of family is shown on the table 9. Statistically there was a difference in size of family affecting HBV markers at  $P > 0.01$  for all markers.

Table 9: COMPARISON OF HBV MARKERS AND THE SIZE OF FAMILY.

a) 4 Siblings of less.

Age group	Number Tested	HBsAg+	HBsAb+ HBcAb+	HBcAb+	HBsAb+
6-10	23	1	7	0	2
10-15	11	0	2	1	0
Total	34	1(2,3%)	9(26,5%)	1(2,9%)	2(5,8%)

b) Siblings Over 4.

Age group	Number Tested	HBsAg+	HBsAb+ HBcAb+	HBcAb+	HBsAb+
6-10	33	1	7	1	7
10-15	55	3	14	1	9
Total	88	4(4.5%)	21(23,9%)	2(2,3%)	16(18,2%)

Not indicated 1 case of HBsAb )  
 ) +  
 HBcAb )

1 case of HBsAb+

1 case of HBcAb+

Table 10: HBV MARKERS IN MOTHERS AND THE INTERRELATIONSHIP OF VARIOUS HBV INFECTION MARKERS OBSERVED IN 37 MOTHERS.

Number Tested	HBsAg+	HBcAb+	HBsAg+ HBcAb+	HBsAb+	HBsAg-	HBsAg-	HBcAb+
				HBcAb+	HBcAb+	HBcAb-	HBsAg+
37	1(2,7%)	22(59.4%)	22(59.4%)	18(48.6%)	3(8.1%)	4(10,8%)	1(2,7%)

Table 10 indicates that 37 mothers were tested for various HBV infection markers. One case was positive for HBsAg (2,7%). The prevalence of HBcAb was 59.4%. 3 cases (8,1%) had high titres of HBcAb as a sole marker of HBV infection. Out of 18(48,6%) cases positive for HBcAb in association with HBsAb 14(37,8%) cases had high titres of HBcAb. HBsAb was detectable in 22(59,4%) cases. 11(30%) mothers had high titres of HBsAb, out of them 10 cases in association with HBcAb. All mothers had negative history for past viral hepatitis, denied contact with a person suffering from viral hepatitis. Mothers' age and parity did not show any influence on the results. Infants of all 37 mothers shared same HBcAb and HBsAb profiles with the exception of 2 cases of HBsAb as a sole marker, one case of HBcAb as a sole marker



and one case of HBcAb associated with HBsAb.

However, HBsAg was detectable in 1(2.7%) mother but cord blood was negative for the same antigen although infant shared HBcAb with his mother.

## DISCUSSION

The high prevalence of HBsAg in the general population in many tropical countries is now well documented. The prevalence of HBsAg among healthy African school children from Nairobi area in this study was 4.6% by using haemagglutination test. The above test is a simple highly sensitive method slightly less sensitive than radioimmunoassay (16). For the same age group Bagshawe's and Wankya's results were much higher. Both studies were done in rural communities, in case of Bagshawe by a relatively insensitive method but the latter study used the most sensitive method available for HBsAg detection (14, 11). However, the sample tested in Wankya's study was very small. If the figures represent the prevalence of chronic carriers state of the children living in rural area (Machakos District) and those in an urban environment (Nairobi) it indicates that probably urban environment and living conditions are better than those in an rural areas and therefore less favourable for HBV transmission. Other factors as transmission of HBV by insect vectors needs to be considered, since HBsAg has been detected in wild mosquitoes in Kenya (17). Study carried out by Bagshawe showed no association between malaria and the presence of hepatitis B antigen, although malaria epidemic was present the time of their study (14). Nairobi data could be comparable to school children from Nyanza district

where prevalence of HBsAg was found to be 5% by using haemagglutination method (18). A study from South Africa showed a significant difference of the prevalence of HBsAg in rural communities (15.5%) than in the urban population 7.4% (19).

Table 11: THE PREVALENCE OF HBsAg IN KENYAN AND SOUTH AFRICAN CHILDREN

Author	Test Group	Method Counter	No. Tested	Age Group	HBsAg %
Bagshawe (14)	Machakos District (rural)	Counterimmuno-electrophoresis	296	5-9	6.4
	"	"	179	10-14	7.9
Wankya (11)	Machakos District (rural)	Radioimmunoassay	14	5-9	28.6
	"	"	13	10-14	15.4
Bowry (18)	School children from Nyanza District (rural)	Passive Haemagglutination	40	8-15	5.0
*Ojwang	Nairobi School children (urban)	Passive Haemagglutination	137	6-10	4.3
	"	"	142	10-15	4.2
Vos (19)	rural population S. Africa	haemagglutination inhibition	177	2-3	10.0
	" <i>rural</i>	"	329	5-10	20.0

\* Data present Study

Tribal distribution in this study did not show a significant difference on the positivity rate of HBsAg. There was no statistically significant difference between sexes in this study although several other workers have observed male preponderance in HBsAg carriers. Blumberg observed a higher frequency of HBsAg in males than in females for almost all the carrier population tested (20). Bagshawe et al also found antigen more frequently in all ages in males than females (14). On the other hand in the study from Ibadan, Nigeria out of 413 healthy school children aged between 4 and 21 years the overall prevalence rate for HBsAg was 6.7% by electrophoretic immunoprecipitation method and there was no statistical difference between the sexes (21).

The prevalence of HBsAg and the size of family was statistically significant at  $P > 0.01$ . Bagshawe et al found a higher prevalence among siblings of large families which was 8% as for the sibling group of 4 or less the prevalence of HBsAg was 3.9% (10). A pilot survey carried out in New York City on intrafamilial spread of asymptomatic hepatitis



B found that there is a familial aggregation and segregation of hepatitis B, prevalence of HBsAg appear to increase with family size (22). They suggested that environmental and genetic factors could be involved..

Almeida et al in 1971 described a new antigenic system of the core of Hepatitis B Virus (HBcAg) (23). In 1973, Hochnagle et al described a complement fixation test for HBcAg and found antibody to core antigen during acute attack of Hepatitis B infection (1). They suggested that HBcAb first appears two to five months after appearance of HBsAg, titres of HBcAb eventually fall to the low levels after recovery from Hepatitis B. However, in chronic carrier state, titres remain high, suggesting a continuous viral replication in the liver (1). Further studies in the following years indicated that a test for HBcAb may be a sensitive indicator of persistent viral replication even when sub-detectable amounts of HBsAg are circulated (2). It was suggested that HBcAb as a sole marker of infection of HBV in high titres may indicate a chronic carrier state and blood such a donor can be infective if given to a non immune person (2,21, 3,4). In this study HBcAb was

detectable in 31.2% of the school children for the overall group by radioimmunoassay technique (25) and out of these 16 children (13%) had HBcAb in high titres in association with HBsAb. These figures are extremely high when compared to the general prevalence of 1 - 4% in caucasians blood donors (26). However, it is in keeping with findings of Bowry et al who found the prevalence of HBcAb in Kenyan volunteer blood donors to be 52% (15). Studies on chronic liver diseases (27) by Kojima and associates suggests that high levels of HBcAb even in the absence of HBsAg in the serum is associated with viral replication in the liver. Moreover some of these patients demonstrated HBsAb in the serum as well. However, whether the same applies for the healthy children from this study one cannot say, because in order to obtain these data liver biopsy is required. The prevalence of HBcAb as a sole marker of HBV infection in Europe and USA is 0.1% - 0.4% as compared to 4% of Kenyan volunteer blood donors (15). African school children from Nairobi had HBcAb as a sole marker of HBV infection in 3.2% out of 125 children tested.

On the other hand HBsAb by itself indicate past infection and immunity to further infection. As data from this study indicate among the Nairobi school children by the age of 15 years 15% is already immune as 19 children had HBsAb as a sole marker of HBV infection detectable. Out of 125 children 52.8% had not been exposed to HBV and therefore are still susceptible to hepatitis B virus infection. In a similar study from Nigeria 11 children out of 61 (18%) had HBcAb detectable by Radioimmunoassay (RIA) as a sole marker of HBV infection by the age of two and evidence of HBV infection during infancy was detected in 28% (28). However, since HBsAb test was using relatively insensitive technique as compared to RIA some of them may have HBsAb of low titre. These figures are very high and suggest that HBV is endemic in some tropical countries including Kenya. Hepatitis B virus infection in childhood could be the mechanism by which HBV is maintained in the community (29).

Table 12: PREVALENCE OF VARIOUS MARKERS OF HBV INFECTION  
IN THREE DIFFERENT POPULATION FROM NAIROBI AREA

Test Group	No Tested	Age Groups in years	Sex		HBsAg+	HBcAb+	HBsAb+	HBsAg- HBcAb- HBcAb+	HBsAg- HBcAb- HBsAb-	HBsAg- HBcAb- HBsAb+
			M	F						
* Children from Nairobi area	51	1 - 5	29	22	0	3(6%)	3(6%)	2(4%)	1(2%)	0
** School children from Nairobi	125	6-15	55	69	13/279 4.6%	39/125 31.2%	50/125 40%	4/125 3.2%	16/125 13%	13/125 10.4%
*** Volunteer Blood donors from Nairobi area	104	15-30	85	19	7(7%)	52(52%)	57(57%)	4/4%	10(10%)	11(10.6%)

\* Bowry : Unpublished data (18)      HBsAg tested by haemagglutination test (Hepatitis, Wellcome).

\*\* Data of present study

\*\*\* Bowry et al in press (15)      HBcAb tested by radioimmunoassay - Abbott COFAB.

.. Very high titres of HBcAb.      HBsAb tested by radioimmunoassay - Abbott AUSAB.

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Table 12 shows the prevalence of various markers of HBV infection in three different population groups from Nairobi area. From this results it is obvious that in Nairobi, African community is exposed to HBV infection early in childhood, increasing significantly during the school age group and between the age 6 - 15 years there is a high rate of active transmission of the HBV (15%) even in the so called healthy children population as judged from high titres of HBsAb. This figure increases to about 20% between the age group 15 - 30 years as indicated by Bowry from the study on Kenya volunteer blood donors (15). Maximum transmission seem to occur when the children are starting to go to primary school. It is most likely that factors like sanitary facilities, poor hygienic conditions, close contact could contribute towards the transmission of HBV among this particular urban community. As the sample was collected from different primary schools, a recent outbreak of HBV infection in a school is unlikely to be responsible for the results. From this study one can make an observation that Kenya is among the countries where HBV infection is also endemic among urban population. It appears as judged

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from the figures of high titres of HBcAb in association with high titres of HBsAb that children population is unable to get rid of virus as such, viral replication is going on at the same time as immunity which is not enough to eradicate the infection.

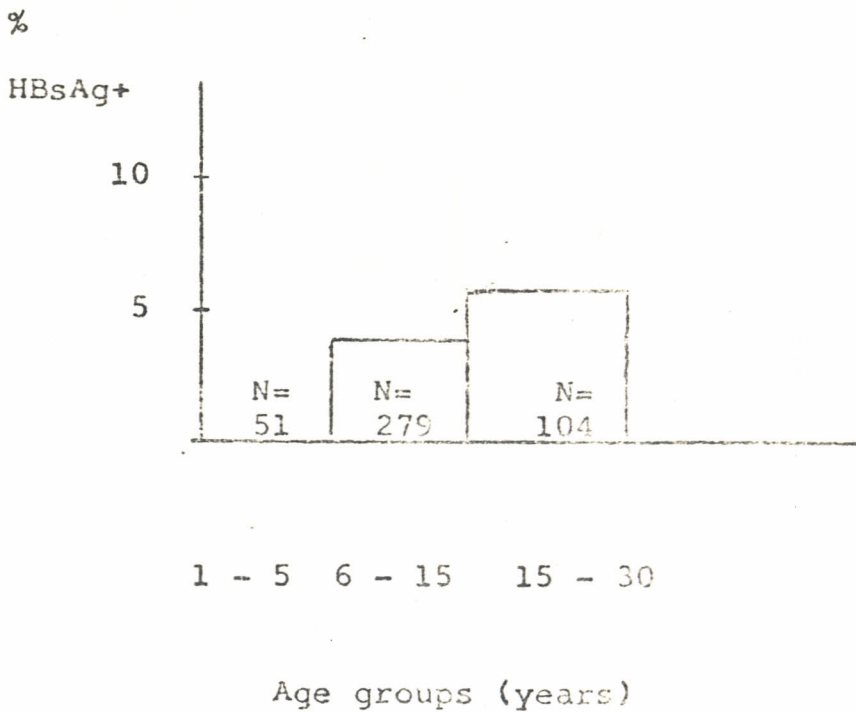


Figure 3: AGE (AS PERCENTAGE) OF HEPATITIS B ANTIGEN IN DIFFERENT POPULATION FROM NAIROBI AREA.

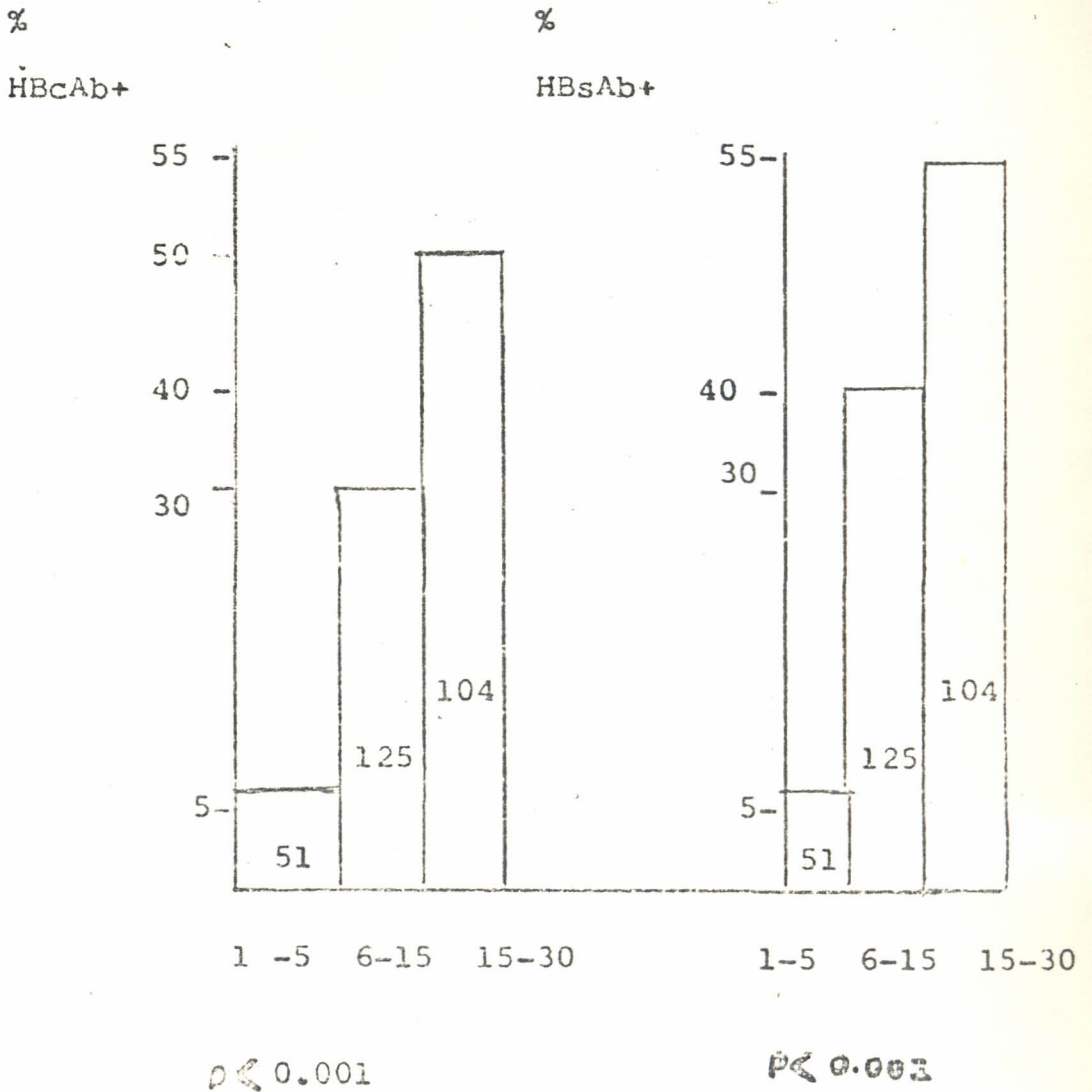


Figure 4: AGE (AS PERCENTAGE) OF HBcAb AND HBsAb IN DIFFERENT POPULATION FROM NAIROBI AREA.



Figures 3 and 4 show age (as percentage) of various markers of HBV infection in three different population groups from Nairobi area. There was no statistically significant difference among the three age groups in the prevalence of HBsAg but as for HBsAb and HBcAb between the 1 - 5 age group the difference was significant at  $p < 0.001$  level.

Gerety and associates suggested in 1974 that children more frequently become chronic carriers following infection with Hepatitis B virus than adults (29). They observed that the risk of becoming a HBsAg carrier appears to be uniform among children ranging in age from one month to 15 years. Children usually experience milder infection, frequently clinically unrecognized (30). Vertical transmission of the HBV from mother to infant at birth has been proposed as leading to a chronic HBsAg carrier state in the infant (31). HBV transmission from mother to infant occurs more frequently when the mother had acute hepatitis B near delivery (31 - 35). In one study the most common response of neonates to HBV exposure was chronic hepatitis B with prolonged if not indefinite HB antigenemia (32). The rate of transmission of the hepatitis



B surface antigen from asymptomatic carrier mothers to their infants is less frequent (35). The figures reported by many authors varies from 0 to 40% (36,37 38,43). Vertical transmission of HBsAg in Taiwan constitutes an important route of infection to maintain HBV in general population (38). Studies indicate that transmission may occur either in the antepartum, intrapartum or postpartum periods. 37 mothers from this study tested for HBV infection markers had HBsAg detectable in one (2.7%) mother. HBsAg in the cord blood of the neonate was non reactive by a passive haemagglutination method although the infant shared cord antibody with its mother in high titres. Since 106 to 108 particles of HBsAg/ml. can be present in a sample non-reactive by RIA, transplacental (vertical) transmission cannot be ruled out by a negative HBsAg test on cord serum. Okada and associates failed to detect HBcAg in any of 70 cord blood from HBsAg positive mothers although 8 of 11 of these infants became chronically infected with HBV (39). One mother from this study who had HBcAb in high titres and the cord serum lacked HBcAb may have been in the acute stage of the disease when HBcAb is present as IgM antibody. On two

other occasions when the neonate did not share HBsAb with their mother titres were low by radioimmunoassay. HBeAb and HBsAb was detectable in 22(59.4%) mothers each. These figures are comparable to Kenyan volunteer blood donors which were predominantly males. Three mothers (8,1%) as compared to 4(4%) of blood donors could represent the so called "subdetectable levels" of HBcAg carriers who have HBeAb in high titres as a sole marker of HBV infection and have HBsAg at too low levels to be detected even by the most sensitive, currently available methods (2). Hoofnagle and associates suggested that this type of carrier might also be infectious (3). 18 mothers had evidence of unequivocal B virus infection with both HBsAb and HBeAb present in the tested sera. 14(37,8%) mothers had high titres of HBeAb out of total 37 mothers tested which is much higher than 10% in blood donors.

It is obvious that HBsAb in these mothers is ineffective in terminating pre-existing viral replication which is still going on. HBsAb in high titres was demonstrated in 11(30%). This figure is very high and demonstrates a very high rate of active transmission of the HBV among adult healthy population. HBsAb as the sole marker of

HBV infection was observed in 4(10,8%) mothers and indicates immunity to HBV.

It has been well documented that chronic liver diseases such as liver cirrhosis, chronic persistent hepatitis, primary hepatocellular carcinoma are associated more frequently with HBsAg than the controlled groups of patients. Bowry in Kenya found HBsAg in more than 50% in association with chronic liver disorders (9). Studies on familial clustering of HBsAg- positive hepatocellular carcinoma, cirrhosis and chronic hepatitis suggest vertical transmission as the possible route of infection (40). If this type of transmission is prevented eventually the number of carriers and the long term effects of HBV infection would be reduced. From the study done by Tabor et al in Nigeria is evident that prevention of HBV infections in countries where HBV is prevalent will require intervention at an early age (28). They found one or more serological markers of hepatitis B in serum samples from 29 of 61 (48%) Nigerian children between 6 months and 2 years of age (28).

At present there are two possible ways of preventing transmission of HBV from infected mother to their children. Hepatitis B immune globulin (HBIG) contains HBsAb of high titres (generally greater than 1 : 100,000 by passive haemagglutination) prepared from donors pools preselected for HBsAb has efficiency in the prevention of hepatitis B from 40 - 70%. This protection obtained by passive immunization usually lasts for 6 months. In clinical study by Reeiah et al in 1979 HBIG has been used to prevent HBV infection in 21 children of HBsAg carrier mothers effectively compared to 5 untreated children who became HBsAg positive (41). Active immunization with HBV vaccines has been under intensive research for the last 10 years. In the absence of successful propagation of HBV in vitro, the plasma of asymptomatic chronic carriers of HBsAg serves as the source material for all HBV vaccines at the present time. HBV vaccines have been mostly used in chimpanzees and a formalin treated hepatitis B vaccine was used in high risk hemodialysis settings in France (42). It is essential to prepare effective but safe vaccines



which could be used to prevent HBV infection in newborn infants especially in areas of high prevalence. Elimination of the HBsAg chronic carriers state in these countries is essential since they represent a great public health problem.

CONCLUSION

1. The prevalence of HBsAg in Nairobi healthy School children of the age group 6 - 10 years was 4.3%. A total of 137 children were tested for this antigen by passive haemagglutination technique. HBcAb by using RIA accounted for 30% in the same age group. A total of 60 children were tested for HBcAb and HBsAb which was found in 40% by using RIA. The prevalence of HBcAb as a sole marker of HBV infection was observed in 3.3% for the Nairobi school children between the age group of 6 - 10 years.
2. The prevalence of HBsAg in Nairobi healthy school children of the age group 10 - 15 years was 4.9%. In this age group 142 children were tested for HBsAg by using passive haemagglutination technique. The prevalence of HBcAb for the same age group was 32.3% out of 65 children tested. The prevalence of HBsAb for the age group of 10 - 15 years was found to be 40% for 65 children tested. The prevalence of HBcAb as a sole marker of HBV infection among the 65 school children tested was 3.1% between the age of 10-15 years.
3. The prevalence of HBsAg for the overall group of 279 children tested was 4.6%. The prevalence of HBcAb for the whole group of 125 children tested

was 31.2%. HBcAb as a sole marker of HBV infection for the whole group of 125 children tested accounted for 3.2%.

4. The prevalence of HBsAg in mothers was 2.7%. In total 37 mothers were tested by using passive haemagglutination method for this antigen. The age ranged from 15 - 40 years.

The prevalence of HBsAb and HBcAb among the same group was 59.4% by using RIA. The prevalence of HBcAb as the sole marker of HBV infection was 8.1%.

5. In Kenya African Urban School Children Population, there is a high rate of active transmission of HBV (15%) even in the so called healthy children. Maximum transmission occurs after the age of 5 years, therefore factors like sanitary facilities, poor hygienic conditions, close contact could contribute towards the high transmission of HBV among urban school children community.

6. Figures from this study suggest endemic spread of HBV in Kenyan Urban Population.

#### RECOMMENDATIONS

1. Clinical studies on HBV infection are highly desired to shed some light on the severity of clinical HBV infection in our children.
2. Longitudinal studies with follow-up of positive cases over many years to observe the long term effects of the HBV infection in Kenya children.
3. To determinate vertical transmission rate of HBV infection in Kenyan children.
4. Further research is required to determinate whether genetic and what immunological factors play role in perpetuating the high prevalence of HBV among Kenyan community.



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