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Low Body Mass Index Does Not Correlate with Hepatitis B Surface Antigen Infection in Female Adolescents

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Authors' contributions

This work was carried out in collaboration between all authors. Authors YI and ELUS designed the study; YI performed the statistical analysis, and wrote the first draft of the manuscript. Authors YI and ELUS managed the analyses of the study as well as literature searches. Authors MAI, AIM, MAL, HU, ARS and KN managed the identification of the disease, and analysis of clinical parameters of study participant. All authors have read and approved the final manuscript.

Original Research Article

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ABSTRACT

Background and Objective: Healthy body weight is an important indicator towards prevention of diseases. In the north western part of Nigeria, there is dearth of data on the prevalence of HBV infection among female adolescents. This study was therefore, carried out to determine the effect of body mass index on the sero-positivity of hepatitis B surface antigen amongst boarding school female adolescent students from a north western geopolitical zone.
Methods: Hepatitis B surface antigen was tested in 192 apparently healthy female adolescent students in boarding secondary schools across the metropolitan area of Kano

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State, Nigeria by parallel diagnostic methods using a Micropoint and EGENS rapid diagnostic test kits (Lot: HBsAg 1301; 1125 USA).
Result: The HBsAg sero-positivity of 41.70% was recorded for the 12-14 and 15-17 years and 16.70% for 18-20 year age groups respectively. Sero-positivity does not significantly (p=0.05) increase with age of the participants. The study revealed that HBV sero-positivity is higher (58.33%) among the underweight (BMI: <18.5) female students, followed by 33.33% in their normal (BMI: 18.5-24.9) and 8.33% in overweight (BMI: 25-30) counterparts. However, no association (r = 0.00) was found between low BMI and HBsAg infection.
Conclusion: This study indicated no association between the incidence of HBsAg infection and the low BMI (underweight) among female adolescents. We recommend a fervent need from government and Non-governmental organisation for mass enlightenment campaign, screening and immunization focusing mainly adolescents to arrest this public health problem.

Keywords: Hepatitis B surface antigen; body mass index; adolescents; sero-positivity; Kano-Nigeria.

1. INTRODUCTION

Hepatitis B virus (HBV) is a serious and common infectious disease of the liver [1]. HBV is the major cause of chronic hepatitis, cirrhosis, and hepato-cellular carcinoma [2]. HBV infection presents a global health problem [3], with 2 billion people infected worldwide and more than 400 million chronic carriers [2]. Globally, it causes about 1.2 million deaths per year due to various complications including chronic hepatitis, cirrhosis, and liver cancer [4,5]. HBV is present in the blood, saliva, semen, vaginal secretions, menstrual blood, and, to a lesser extent, perspiration, breast milk, tears, and urine of infected individuals [6,7,8,9]. The virus is resistant to breakdown making it survive for sometime outside human body; hence, it is transmitted through contact with infected body fluids [8]. HBV infection in Nigeria has remained a public health issue [10], a hyper-endemic area for hepatitis B virus infection, with an estimated 12% of the total population being chronic carriers [11].

BMI is a ratio of a person's weight to height. BMI is commonly used to classify weight as "healthy" or "unhealthy" [12]. Many scientific research studies suggest that weight loss reduces chronic diseases [13]. The adverse impact of obesity on the liver contributes to the development of hepatic steatosis, non-alcoholic fatty liver disease (NAFLD) and non-alcoholic steato-hepatitis [14]. Obesity also reportedly correlates with increased risk of cirrhosis-related death or hospitalization [15], as well as the development of hepato-cellular carcinoma (HCC) [16]. The impact of overweight and obesity on chronic hepatitis B (CHB) is unclear [17]. The relationship between body mass index (BMI) and liver histology in hepatitis B positive has not been well studied [17]. There is little documentation of HBV infection from Nigeria especially amongst school children [18]. Likewise little is known about the prevalence of the disease in the northern-western part of the country. Therefore this study, for the first time, aimed to investigate the association between HBV infection and BMI categorization among secondary school adolescents in the study area.

2. MATERIALS AND METHODS

2.1 Study Population

A descriptive cross-sectional study was conducted among female students attending boarding secondary schools within Kano metropolis. Kano State occupies part of northern Nigeria. The global location of the State is between latitude 11º 30º north of the equator and longitude 08º 30º east of the Greenwich Meridian [19]. The objectives of the study were presented to the State Health and Secondary School Management Boards and each school principal in order to obtain their authorizations. A total of one hundred and ninety two students were randomly recruited from the three female boarding schools across the metropolis for participation into the study following their written informed consent.

2.2 BMI and Laboratory Analysis

Height was measured (with the student standing on bare feet) using a non-elastic measuring tape fastened to a vertical rod, to the nearest 0.5 cm. Weight was measured (with the student on bare feet and with light clothing) using an electronic weighing balance, to the nearest 0.1 kg. From the heights and weights got, Body Mass Index (BMI) was calculated using the formula BMI = Weight (kg)/[Height (m^2)] [20,21].

Five (5mls) blood samples were collected by venipuncture using either the antecubital vein or the dorsal vein and dispensed into Ethylene Di-amine Tetra-acetic acid (EDTA) anticoagulant bottles [22] and plasma separated by centrifugation (using a centrifuge machine) at 3000 revolutions per minutes (rpm) for 5 minutes . Parallel tests were carried out on each of the samples to determine the status. For the detection of HBsAg, chromatographic immunoassay based Micropoint® test strip for qualitative detection of HBsAg in plasma/serum/whole blood (relative sensitivity and specificity of > 99% and 97.0% respectively with accuracy of 98.5%) and a rapid test kit – One Step Strip *EGENS*®, USA were used; the tests and result interpretations were done according to the tests kits, manufacturer's specifications. Discordant results were regarded as negative.

2.3 Statistical Analysis

Descriptive analyses of BMI, age and HBV sero-positivity as well as their associations were obtained with Statistical Package for Social Sciences (SPSS) version 15.0 and Instat3 Statistical software for windows.

3. RESULTS

One hundred and ninety two female adolescent students participated in the study; age ranged from 12-20 years (15.90±1.70). Table 1 shows the results for overall HBV sero-positivity among the study population. HBsAg infection was detected in 24 (12.54%) subjects. Prevalence rate was higher in age group 12 to 14 years which was 42 (41.67%) and 15 to 17 years which was 124 (41.67%) respectively as shown in Table 2. HBV sero-positivity does not appear to increase with age of the participants (Table 2) except for the higher age group (18-20 years). The study also revealed that HBV sero-positivity is higher (58.33%) among the underweight (BMI: <18.5) female students, followed by 33.33% in their normal (BMI: 18.5-24.9) and 8.33% in overweight (BMI: 25-30) counterparts (Table 3). However, no association (r = 0.00) was found between low BMI and HBsAg infection.

Table 1. Overall HBV positivity among students

Overall HBV positivity	Number	Percentage (%)
Reactive	24	12.50
Non-Reactive	168	87.50
Total	192	100

Table 2. Age and HBV positivity among students

Age range	Frequency (%)	HBV positivity (%)
12-14	42 (21.90)	41.67[a]
15-17	124 (64.60)	41.67[b]
18-20	26 (13.50)	16.67[c]
	192 (100)	100

Values are presented as percentages, values on the same column of different superscripts are considered not significant.

Table 3. BMI according to HBV positivity among students

BMI Range	Frequency (%)	HBV Positivity (%)
<18.5 (underweight)	82 (42.70)	58.33
18.5-24.9 (normal)	98 (51.00)	33.33
25-30 (overweight)	10 (5.20)	8.33
30-40 (obesity)	2 (1.00)	-
Total	192	100

4. DISCUSSION

This study shows that adolescents do contact HBV as reported earlier [23]. Findings from this study showed the HBV sero-prevalence of 41.67% in 12-14 and 15-17 years study population; which may give an indication of trend of the infection amongst the mean age group. Hence, Kano metropolis is endemic to HBV infection. Also, Nigeria is holoendemic area to HBV with carrier rate of 15 to 37% [34]. This prevalence also corroborates previous studies from other geopolitical zones of Nigeria [2,11,24]. Study participants within the 15-17 year age group had highest frequency (64.60%) in our study. This clearly presents the secondary school age period for most of the female students privileged to acquire western education in the study area, and agrees with the previous findings [23,24,25] who also reported higher prevalence amongst similar age groups. In addition, it has been reported [26] that, in countries of low hepatitis B virus (HBV) endemicity, infection occurs mainly in adolescents and young adults (15-34 years old). Our study also documented that sero-positivity does not significantly increase with age of the participants. This indifference between age and HBV tally with earlier reports [2,25,27]. However, some studies conducted in Nigeria corroborated the increasing prevalence with age [18,28,37].

The overall HBV sero-positivity of 12.50% recorded in this study is higher than the 4.1%, 6.8%, 11.50% and 12.4% respectively, reported in children and adolescents from Abakaliki, a south eastern; Kaduna State, a north-central; Ekiti-State, a south-western and Niger Delta regions of Nigeria [11,24,25,35]. However, the overall sero-positivity is lower than 47.20% and 20% reported among primary school pupils in Borno State, a north eastern part of Nigeria [18] and among blood donors from Benue, a north central part of Nigeria [29]. The probable reason for the higher sero-positivity may be that the study area; boarding

secondary schools are places where students develop the habit of sharing sharp objects, like toothbrushes, combs and other utensils among themselves; hence, every likely hood contracting the disease. It has been reported that unsafe use of sharp instruments and sexual contact are important routes of HBV transmission [36]. In our study, HBV sero-positivity is higher (58.33%) among the underweight (BMI: <18.5) study participants; indicating the spate of malnutrition in the study area. Malnutrition results in immuno-compromised state of the body which favors proliferation of infectious agents. This may also indicates lack of concrete programs (i.e. awareness on nutritional guidelines, routine immunizations and public hygiene issues) to combat HBV infection within the study area. BMI was divided into four categories according to the WHO cut-off points with corresponding interpretations (<18.5 kg/m^2, underweight; 18.5 to 24.9 kg/m^2, normal weight; 25.0 to 29.9 kg/m^2, overweight; $\geq$30.0 kg/m^2, obese respectively) [30]. It has been reported earlier that high prevalence observed in underweight female subjects of the study area, underwent a progressive decrease with an increase in age [31]. However, the high sero-positivity amongst the underweight subjects, as observed in this study, clearly exclude low BMI as a sole risk factor for contracting HBV but did not contradict the association of higher BMI with increased risk of HBV infection or other forms of liver diseases as reported earlier [17,32,33].

5. CONCLUSION AND RECOMMENDATIONS

This study indicated no association between the incidence of HBsAg positivity and the low BMI (underweight) among female adolescents. We recommend a fervent need from government and Non-governmental organisations for mass enlightenment campaign, screening and immunization focusing mainly adolescents to arrest this public health problem.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ganem D, Schneider RJ. Hepadnaviridae: The virus and their replication. Knipe DM, et al. eds. Fields Virology, 4th ed. Philadelphia, Lippincott Williams and Wilkins. 2001;2923-2969.
2. Komas NP, Baï-Sepou S, Manirakiza A, Léal J, Béré A, Faou AL. The prevalence of hepatitis B virus markers in a cohort of students in Bangui, Central African Republic. BMC Infectious Diseases. 2010;10:226.
3. Forbi JC, Vaughan G, Purdy MA, Campo DS, Xia G, Ganova-Raeva LM, et al. Epidemic History and Evolutionary Dynamics of Hepatitis B Virus Infection in Two Remote Communities in Rural Nigeria. PLoS ONE.2010;5(7):e11615. doi:10.1371/journal.pone.0011615.
4. Hou J, Liu Z, Gu F. Epidemiology and prevention of hepatitis B virus infection. Int J Med Sci. 2005;2:50-57.
5. Michielsen PP, Francque SM, Van Dongen JL. Viral hepatitis and hepatocellular carcinoma. World J Surg Oncol. 2005;3:1-18.
6. Lindsley TK, Skoutelis A, Bassaris H. Control of Hepatitis B Virus Infection in Third World Countries. Journal of Transfies Medical Review. 1990;4(3):187–190.
7. Otegbayo JA, Fasola FA, Abja A. Prevalence of hepatitis B surface antigens, risk factors for viral acquisition and serum transaminase among blood donors in Ibadan, Nigeria. Tropical Gastroenterol. 2003;24(4):196-197.
8. Lavanchy D. Hepatitis B virus epidemiology, disease burden, treatment, and current and emerging prevention and control measures. Journal of Viral Hepatitis. 2004;11(2):97–107.
9. Agbede OO, Iseniyi JO, Kolawole MO, Ojuawo A. Risk factors and seroprevalence of hepatitis B surface antigenaemia in mothers and pre-school age children in Ilorin, Nigeria. Therapy. 2007;4(1):67-72.
10. Eke AC, Eke UA, Okafor CI, Ezebialu IU, Ogbuagu C. Prevalence, correlates and pattern of hepatitis B surface antigen in a low resource setting. Virology Journal. 2011;8:12.
11. Ugwuja E, Ugwu N. Seroprevalence of Hepatitis B Surface Antigen and Liver Function Tests among Adolescents in Abakaliki, South Eastern Nigeria. The Internet Journal of Tropical Medicine. 2010;6(2).
12. Nutrition Insights. Body Mass Index and health. A Publication of the USDA Center for Nutrition Policy and Promotion. 2000;6.
13. NIH/NHLBI. Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults. U.S. Department of Health and Human Services, Public Health Service. 1998.
14. Shoelson SE, Herrero L, Naaz A. Obesity, inflammation, and insulin resistance. Gastroenterology. 2007;132:2169-80.
15. Ioannou GN, Weiss NS, Kowdley KV, Dominitz JA. Is obesity a risk factor for cirrhosis-related death or hospitalization? A population-based cohort study. Gastroenterology. 2003;125:1053-9.
16. Chen CL, Yang HI, Yang WS, Liu CJ, Chen PJ, You SL. Metabolic factors and risk of hepatocellular carcinoma by chronic hepatitis B/C infection: a follow-up study in Taiwan. Gastroenterology. 2008;135:111-21.
17. Lee I, Huang Y, Chan C, Huo T, Chu C, Lai C, et al. Impact of body mass index and viral load on liver histology in hepatitis B e antigen-negative chronic hepatitis B. Clinical Nutrition. 2011;30:647-652.

18. Bukbuk DN, Bassi AP, Mangoro ZM. Sero-prevalence of hepatitis B surface antigen among primary school pupils in rural Hawal valley, Borno State, Nigeria. Journal of Community Medicine and Primary Health Care. 2005;17(1):20-23.
19. Wikipedia. Available: http://www.onlinenigeria.com/map.gif.2012.
20. Ejike ECCC, Ugwu EC, Ezeanyika LUS. Physical Growth and Nutritional Status of a Cohort of Semi-Urban Nigerian Adolescents. Pakistan Journal of Nutrition. 2010;9(4):392-397.
21. Yunusa I, Atiku MK, Pali AB. Incidence of Malaria, Haemoglobin level and Body Mass Index variations among Adolescents in Kano metropolis, Nigeria. Biological and Environmental Sciences Journal for the Tropics. 2011;8(2):10-104.
22. Buseri FI, Siaminabo IJ, Jeremiah ZA. Reference values of hematological indices of infants, children, and adolescents in Port Harcourt, Nigeria. Pathology and Laboratory Medicine International. 2010;2:65–70.
23. Ladapo TA, Onifade EU, Lesi AE, Lesi OA. Successful Treatment of Hepatitis B virus associated nephrotic syndrome with oral lamivudine in a Nigerian child: A case report. J. Trop. 2011;1-2.
24. Ndako JA, Nwankiti OO, Echeonwu GON, Junaid SA, Anaele O, Anthony TJ. Studies on Prevalence and Risk Factors for Hepatitis B Surface Antigen among Secondary School Students in North-central, Nigeria. Sierra Leone Journal of Biomedical Research. 2011;3(3):163-68.
25. David OM, Oluduro AO, Ariyo AB, Ayeni D1, Famurewa O1. Sero-epidemiological survey of hepatitis B surface antigenaemia in children and adolescents in Ekiti State, Nigeria. Journal of Public Health and Epidemiology. 2012;5(1):11-14.
26. Meheus A. Risk of hepatitis B in adolescence and young adulthood. Vaccine. .1995;13 Suppl 1:S31-4.
27. Okonko IO, Okerentugba PO, Akinpelu AO. Prevalence of HBsAG among Attendees of ARFH Centre in Ibadan, Southwestern Nigeria. American-Eurasian Journal of Scientific Research. 2012;7 (3):100-105.
28. Sirisena ND, Njoku MO, Idoko JA, Isamade E, Barau C, Jelpe D, *et al*. Carriage rate of hepatitis-B surface antigen (HBsAg) in an urban community in Jos, Plateau State, Nigeria. Niger Postgrad. Med J. 2002;9(1):7-10
29. Alao O, Okwori E, Egwu C. Audu F. Seroprevalence of Hepatitis B Surface Antigen among Prospective Blood Donors In An Urban Area of Benue State. The Internet J. Hematol. 2009;5:2.
30. Klein S, Wadden T, Sugerman HJ. AGA technical review on obesity. Gastroenterology. 2002;123:882-932.
31. Atiku MK, Yunusa I. Body Mass Index Variations among Adolescents from Kano Metropolis, Nigeria. Bayero Journal of Pure and Applied Sciences. 2009;2(2):102-104.
32. Yu M, Shih W, Lin C, Liu C, Jian J, Keh-Sung T, Chien-Jen C. Body-Mass Index and Progression of Hepatitis B: A Population-Based Cohort Study in Men. J Clin Oncol. 2008;26:5576-5582.
33. Hourigan LF, Macdonald GA, Purdie D, Whitehall VH, Shorthouse C, Clouston A, Powell EE. Fibrosis in Chronic Hepatitis C Correlates Significantly With Body Mass Index and Steatosis. Hepatology. 1999;29(4):1215-1219.
34. Bojuwoye BJ. The burden of viral hepatitis in Africa. West Afr. J. Med. 2007;16(4):198-203.
35. Alikor EA, Erhabor ON. Seroprevalence of hepatitis B surface antigenaemia in Children in Tertiary Health Institution in Niger Delta of Nigeria. Nig. J. Med. 2007;16(3):250-251.
36. Kurbanov F, Tanaka Y, Mizokami M. Geographical and Genetic Diversity of the Human Hepatitis B Virus. Hepatol. Res. 2010;40(1):14-30.

37. Ezegbudo C.N, Agbonlahor DE, Nwobu GO, Igwe CU, Agba MI, et al. The seroprevalence of hepatitis B surface antigen and human immunodeficiency virus among pregnant women in Anambra State, Nigeria. Department of Internal Medicine Shiraz E-Medical J. 2004;5(2):1-8.

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