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Effect of acute Hepatitis B virus infection on serum C-Reactive protein, zinc and albumin in patients accessing federal medical centre, Keffi, Nasarawa state, Nigeria.

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Abstract

Hepatitis B is an infectious disease that affects the liver. It causes both Acute and chronic illness. In this study, a total of one hundred and eleven (111) samples were collected aseptically and investigated. Eighty-one (81) acute hepatitis B virus (AHBV) positive patients; forty-five (45) males and thirty-six (36) females representing 55.6% and 44.4% respectively. The control individuals were thirty (30) involving an equal number of males and females 15 (50%) each. C-reactive protein (CRP) was measured by fluorescence immunoassay quantitatively while serum zinc (Zn) and albumin (ALB) were determined by standard method and compared with those of healthy individuals. Albumin showed a highly significant reduction between the AHBV-positive patients and control with mean values of 35.61±6.35, 43.61±6.02and $P<0.05$ respectively. Serum zinc level showed no significant difference $p>0.05$. CRP of AHBV patients was significantly higher compared to control individuals, $p<0.05$ and also correlated positively and significantly with zinc $r = 0.0502$, $P = 0.005$. Age shows no significant difference in AHBV infection $P>0.05$. We suggest that serum CRP and ALB measurements should be used as an important tool for the diagnosis, prognosis and management of different types of hepatitis.

Keywords: Hepatitis B virus, Zinc, Albumin, C-reactive protein

Introduction

Background of the Study

Hepatitis B virus (HBV) is a DNA virus, a member of the family Hepadnaviridae. It can result in moderate or asymptomatic infections as well as severe or fulminant hepatitis. It can also result in acute and chronic infections. With a case rate of 0.5% to 1%, acute hepatitis B virus (AHBV) is typically a self-limiting illness characterized by acute inflammation and hepatocellular necrosis [1, 2]. The term "chronic hepatitis B" (CHB) refers to a variety of illnesses caused by a persistent HBV infection. Chronic hepatitis B (CHB) encompasses a spectrum of diseases and is defined as persistent HBV infection. Many studies have shown that trace elements have an important role in metabolic activity and health conditions. Zinc (Zn) plays an important role in the function of the liver. These are hepatic and extrahepatic actions for zinc in the prevention of alcoholic liver injury. Zinc deficiency has been involved in the pathogenesis of a number of clinical findings in chronic liver disease [3]. C - reactive protein (CRP) is a non-specific acute-phase protein synthesized by the liver in response to acute and chronic inflammation and thus represents a molecular indicator of inflammation, infection, trauma and tissue necrosis [4, 5]. C–reactive proteins are associated with HBV replication leading to liver damage and fibrosis in patients with chronic hepatitis B [6] . Albumin (AB) has been shown to be a multifunctional protein with transports Bilirubin besides antioxidant immune-modulatory and oncotic functions. Hypoalbuminaemia is one of the most characteristic traits of chronic liver disease [7].This study is to investigate the effect of hepatitis B virus infection on the inflammatory biomarker C-reactive protein (CRP), serum zinc (Zn) level and albumin (ALB) in patients accessing Federal Medical Centre, Keffi, Nasarawa State Nigeria.

Methodology

One hundred and eleven (111) samples were used for this study. 81 samples were collected from known acute hepatitis B patients who were not on any antiviral treatment prior to the study. Thirty (30) were from the healthy group selected on the basis of no alcohol, no smoking habits, no history of viral hepatitis, and absence of acute or chronic pathology by using a questionnaire and screening for hepatitis B and C used as control.

Collected blood samples were placed in sterile plain plastic and allowed to clot. The blood samples were centrifuged, and the separated serum was stored in plastic vials at -20^{0C}.

Analysis of blood sampleswas determined using standard methods. CRP was assayed using fluoresce quantitative immunoassay. Albumin and Zinc were measured spectrophotometrically with modified bromocresol green while zinc was measured using 5-Bromo-PAPS.

Ethical approval

Ethical clearance was obtained from the ethics committee of Federal Medical Centre, Keffi, Nasarawa State Nigeria,(NHREC/20/12/2012). Informed consent was also obtained from each subject confidentiality and privacy were ensured.

Results

Table 1: Socio-demographic study of AHBV-positive patients and control

	Control Patients GROUPS (n = 30)	HBV Positive GROUPS (n = 81)
Gender		
Male	15 (50.0%)	45 (55.6%)
Female	15 (50.0%)	36 (44.4%)
Age Group		
18-27 Years	4 (13.3%)	22 (27.2%)
28-37 Years	8 (26.7%)	28 (34.6%)
38-47 Years	13 (43.3%)	25 (30.8%)
Above 48 Years	5 (16.7%)	6 (7.4%)

Table 1. The age group demonstrated in this study ranges from 18 to 53 years.

Table 2: Comparison of Albumin, Zinc and C-Reactive protein in AHBV-positive patients and control individuals

Parameters	Control Patients *(n = 30)*	AHBV-Positive Patients *(n = 81)*	*P* value
ALB(g/L)	43.15 ± 6.02	35.61 ± 6.35	0.000
Zinc(µmol/L)	14.36 ± 3.92	13.63 ± 5.28	0.493
CRP(mg/L)	8.79 ± 3.50	31.59 ± 13.95	0.000

KEY
ALB = Albumin
CRP = C – Reactive Protein
Values are represented as Mean ±SD
P<0.01 – Highly Significant
P<0.05 –Significant
P>0.05 – Not Significant

Table 2: Albumin was significantly lower while CRP was significantly higher than their control counterparts.

Table 3: Relationship between Age and AHBV patients in relation to the measured parameters

Age	ALB(g/L)	Zinc(µmol/L)	CRP(mg/L)
18-27 years	34.10 ±5.56	12.59±4.89	28.37±13.63
28-37 years	36.68±5.80	13.74±5.44	32.37±13.56
38-47 years	36.09±7.29	14.80±5.50	32.63±15.28
48 years & above	34.15±7.67	12.07±5.05	35.52±11.48
p-value	0.485	0.459	0.617

Figure in mean ± Standard deviation
KEY: ALB – Albumin, CRP- C-Reactive protein, Zn – Zinc.

Table 3. It was observed that Albumin, Zinc and C- Reactive protein concentration of AHBV atients was not affected by the age group(p>0.05).

Table 4: Association between Gender and the Acute HBV Positive Patients

Parameters	GENDER		χ^2	P-value
	Male	Females		
ALB * Gender				
Low	16 (35.6%)	13 (36.1%)		0.011
Normal	29 (64.4%)	23 (63.9%)	6.531	
ZINC * Gender				
Low	14 (31.1%)	12 (33.3%)	10.383	0.001**
Normal	31 (68.9%)	24 (66.7%)		
CRP * Gender				
Normal	2 (4.4%)	0 (0.0%)	73.198	0.000**
Severe	43 (95.6%)	36 (100.0%)		

χ^2 : Chi-square values, ** Significant (P<0.01)

Table 4.The result showed there was a relationship between sex and AHBV-positive patients. Zn and CRP levels in both males and females were highly significant, p = 0.001 and p = 0.000 respectively. However, there was no significant association with albumin level (p> 0.05).

Table 5: Association between Age group in relation to measured parameters and the AHBV Positive Patients

Parameters	AGE GROUP				χ^2	p-value
	18-27 Years	28 – 37 Years	38 – 47 Years	48 Years & Above		
ALB * Age						
Low	10 (35.5%)	8 (27.6%)	7 (24.1%)	4 (13.8%)	4.678	0.197
Normal	12 (23.1%)	20 (38.5%)	18 (34.6%)	2 (3.8%)		
ZINC * Age						
Low	11 (42.3%)	8 (30.8%)	4 (15.4%)	3 (11.5%)	7.249	0.064
Normal	11 (20.0%)	20 (36.4%)	21 (38.2%)	3 (5.5%)		
CRP * Age						
Normal	1 (50.0%)	1 (50.0%)	0 (0.0)	0 (0.0)	1.320	0.724
Severe	21 (26.6%)	27 (34.2%)	25 (31.6%)	6 (7.6%)		

χ^2 : Chi-square values.

Table 5. It was observed that albumin, Zinc and CRP did not have an association with the age group of the studied subject as it was generally not significant (p > 0.05).

Table 6: Correlation of AHBV- Positive Patients, control and measured parameters (Serum CRP, Zn and ALB)

AHBV Positive Vs Control Patients		ALB Control	Zinc Control	CRP Control
ALB(g/L)	*r value*	-.124	-.170	-.024
	p-value	.513	.370	.900
Zinc(µmol/L)	*r value*	-.057	.344	-.194
	p-value	.765	.063	.304
CRP(mg/L)	*r value*	.260	0.502**	-.182
	p-value	.165	**.005**	.335

**. Correlation is significant at the 0.01 level (2-tailed).
Significant p values in ***bold***

Table 6: The C-reactive protein (CRP) correlated positively and significantly with Zinc (r = 0.502; p = 0.005).

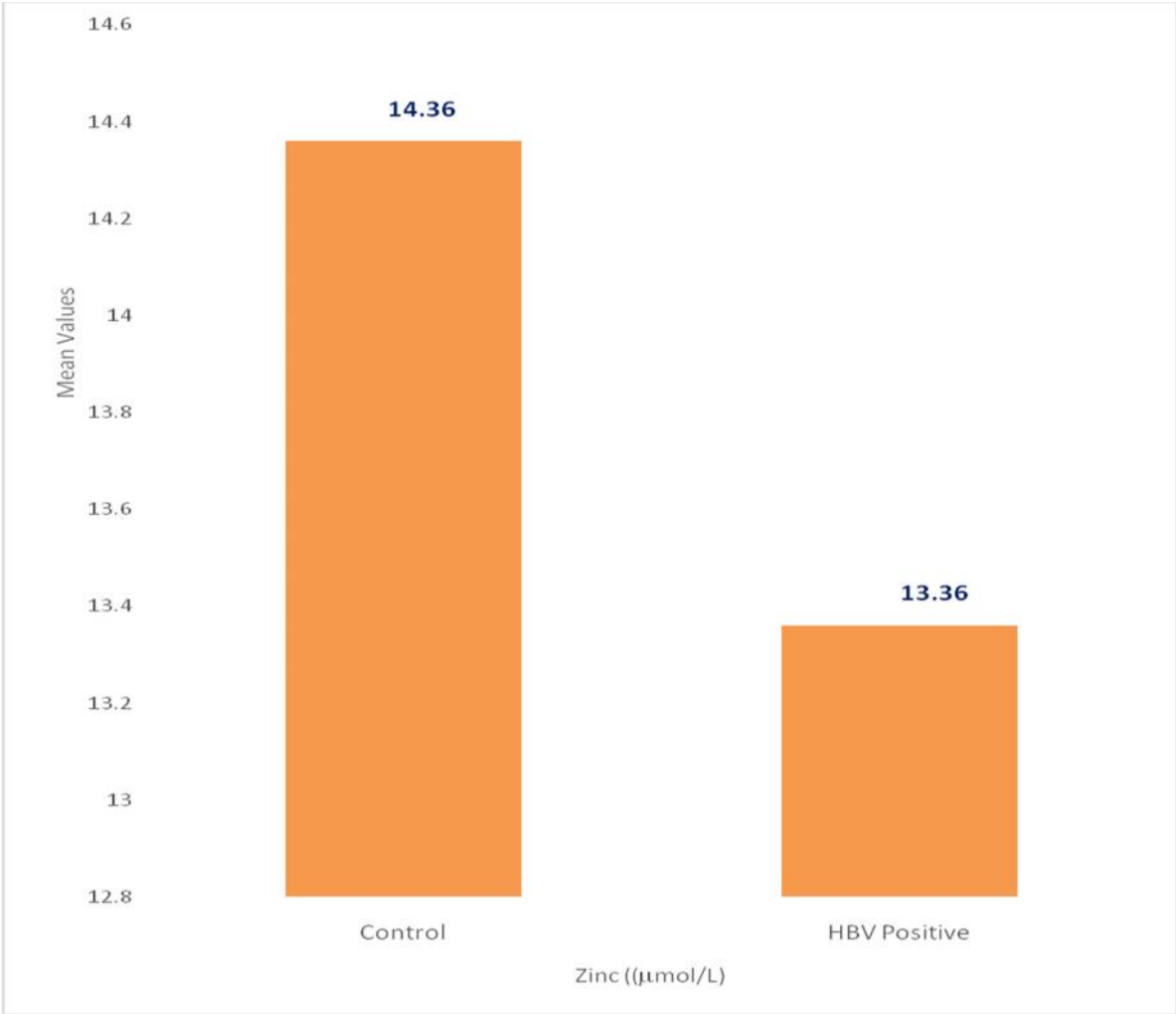

Figure 1. Barchart showing the Mean plot of AHBV Positive Patients and Control Patients of Zinc

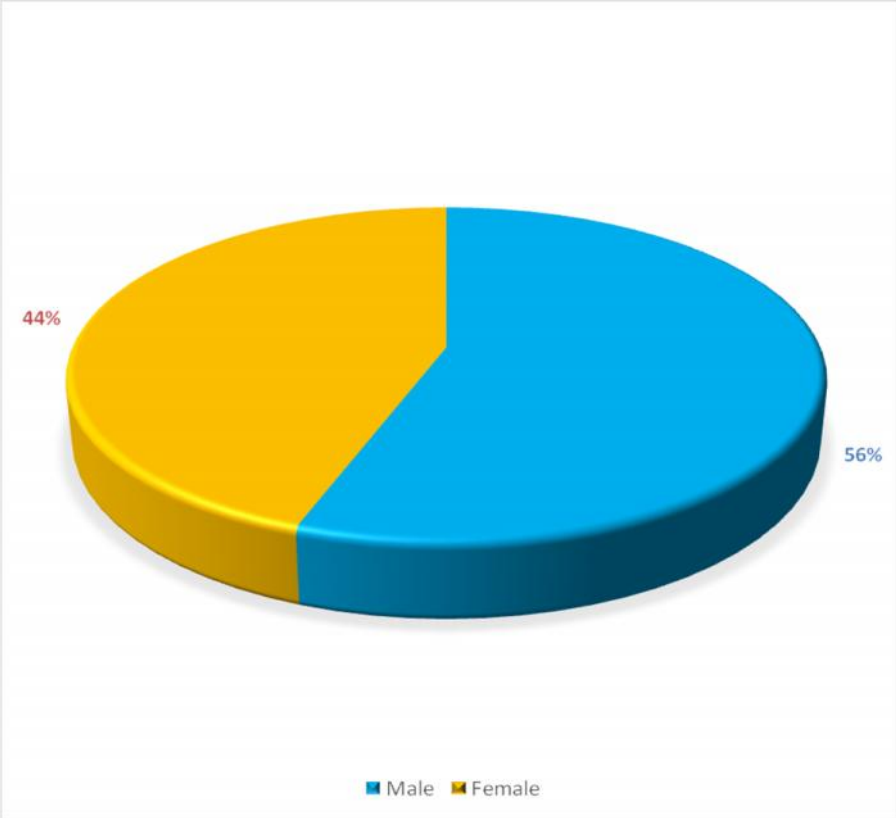

Figure 2. Pie chart showing the Percentage of AHBV Positive Patients with regard to their Gender

Discussion

Zinc plays a key role in numerous biochemical and physiological processes. The oxidative stress induced by zinc deficits contributes to inflammation of the hepatic cell (hepatitis) and also to the failure of eliciting the acute-phase response as a shield against viruses and toxic substances [8]. In this research, it was observed that serum zinc concentration showed a slightly lower level in AHBV-positive patients when compared with control individuals, with no significant difference $p>0.05$ as shown in a bar chart. This discovery is not in agreement with normally reported zinc deficiency in HBV patients. Wessels, *et al.*, [9] reported a decrease in serum zinc levels in patients with HBV infection. Our observation could be a result of environmental factors, the degree of liver cell damage and the nutritional status of the patients involved. The majority of reports in patients with acute hepatitis found variable degrees of zinc deficiencies [10, 11] while others reported either unchanged [12, 13] or increased serum zinc levels [14]. The study revealed that the serum albumin of AHBV patients was significantly lower than that of control individuals ($p<0.05$). The hypoalbuminaemia seen in these patients could be the resultant damage to the parenchyma cells resulting from acute HBV infection. This corresponds with the result of [15] that HBV infection affects the liver and leads to low albumin synthesis as well as increases the transaminase which is a liver damage marker. The analysis of difference using a t-test between the positive and the negative of serum CRP as a marker in acute HBV infection predicted a highly significant difference in positive AHBV patients when compared with control individuals($p<0.05$). The high increase in CRP of AHBV patients is a strong indication of the host's immune response to the virus infection. This strongly agreed with other authors' findings. Sponton, & Ashworth[16] found a higher value of CRP in HBV patients which could be a result of poor host immunity to HBV. As a result, this could lead to reduced infection control by the body and provoke the production of inflammatory cytokines as well as CRP. Hao, *et al.*, [17] reported a high significant serum level of CRP in patients with HBV infection, liver cirrhosis, hepatocellular carcinoma and oncogenesis caused by HBV.

This result also corresponded with [18, 19]. In addition, this study revealed a positive correlation between CRP and zinc (r = 0.502, p = 0.005) while albumin correlated negatively with CRP (r = -0.124, p = 0.370) meaning there is no relationship between albumin and C-reactive protein (Table 4.6). The demographic distribution demonstrated in the pie chart showed the number of males 45(55.6%) infected with AHBV were more than the female 36(44.4%) counterparts from our random samples. This agrees with the finding of [20], in their research androgen and estrogen pathways were identified to play opposite regulations of HBV transcription by targeting viral enhancer 1 at the molecular level. They added that sex hormones may be involved in the immune response of the host to HBV infection and the subsequent progression of associated liver disease. Furthermore, the prevalence rate of AHBV was high among the age group 28-37 years as compared to the control groups in Table 1. This may be attributed to social cultural practices and lifestyles demonstrated among these groups. Generally, the research revealed that the effect of acute hepatitis B virus infection on Zn, ALB, and CRP depends on the hepatic injury which is determined by the degree of virus replication, the strength of host immunity response and the nutritional status within the setting.

Conclusion

The effect of acute HBV infection on serum CRP as a marker of inflammation showed a wide variation. Zinc abnormalities at the onset of the disease displayed reduced levels but were not significant with control while albumin predicted hypoalbuminaemia indicating hepatocytes damage. The resultant parameters (CRP & ALB) levels are reliable biochemical markers for diagnosis, prognosis and management of acute HBV infection.

Recommendations

From the study, the searcher recommended that:

* Serum CRP and albumin should be added to other parameters used for investigating, treating, monitoring and management of HBV-infected patients.

* Enlightenment campaign could be carried out to reduce the effect of HBV infection.
* Early diagnosis can help the patients to receive appropriate care and to avert a liver disease crisis.
* Mass immunization of children and adults at risk will reduce the transmission rate.
* Antiviral drugs should be made available for those already infected.

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