

Estimation of Biochemical Parameters among Typhoid Patients in Gadarif State, Sudan

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Abstract

Typhoid fever is a systemic bacterial infection caused by *Salmonella typhi*, a gram-negative rods bacterium. It frequently affects Liver biochemical tests such as liver enzymes; also, hepatitis can be seen in typhoid fever. But rarely severe hepatic involvement as acute hepatitis is encountered. The aim of the present study is to assess selected of some biochemical changes of typhoid patients by determining the levels of blood urea, Aspartate Aminotransferases (AST), Alanine Aminotransferases (ALT) and serum albumin among typhoid patients. The study was prospective, descriptive case control study, it was conducted in 30 patients with typhoid fever, other 30 samples from volunteers' individuals apparently healthy used as control group. Blood samples were collected from both typhoid patients, volunteers, the liver enzymes tests for both were performed (AST, ALT) and the results were recorded, also another biochemical test were conducted such as blood urea, serum albumin, the results were recorded. The outcome of this study showed there were increase in liver enzymes [AST & ALT] level of serum [(33.32 ± 24.89) U/L, (35.9 ± 24.9) U/L]] among typhoid patients compared with that of the control group [(18.7 ± 8.04) U/L, (23.5 ± 8.49) U/L] respectively, (Figure 1 and 2) and the results of serum albumin & urea showed no significant increase [(3.6 ± 0.44) g/L, (24.96 ± 5.9) mg/dl] in typhoid patients compared with of the control group (3.6 ± 0.36)g/L, (27.53 ± 7.3) mg/dl respectively (Figure 3 and 4). The study concluded that typhoid fever makes significant elevation of liver enzymes (aspartate amino transferase and alanine amino transferase) the serum albumin and blood urea level were not affected by typhoid infection. The study recommended that further research should be done for measurement of other biochemical parameters and Liver enzymes must be regularly checkup in typhoid patients.

Keywords: Biochemical parameters; Typhoid patients

Introduction

Typhoid fever is a life-threatening illness caused by the bacterium *Salmonella typhi* [1]. *S. typhi* is the widest spread pathogen in developing countries and can lead to death, if left untreated [2]. It is a systemic bacterial infection caused by gram negative rods. The

infection is usually acquired through the ingestion of water or food contaminated by the urine or feces of infected carriers [2]. More than one mechanism is responsible for hepatic injury in typhoid fever. Salmonella endotoxin induces consumptive coagulopathy, damage to hepatocytes; arteritis, direct invasion of the hepatocytes by the organisms; immune complexes and consumption of complement are believed to contribute to hepatic insult [3]. In typhoid fever, bacterial endotoxin is not released in to the blood in concentrations sufficient to be detected by limulus test and is not considered to have a dominant role in the pathogenesis. However, this does not preclude the possibility of the release of small quantities of endotoxin into the circulation secondary to leakage from portal blood in the presence of impaired Kupffer cell function and that this may be able transiently to exacerbate symptoms because of the hyper-reactivity to endotoxin [4]. Biochemical alterations of hepatic enzymes suggestive of hepatic damage have been reported in 24% to 87% of cases in various adult series [5]. Abnormal liver biochemical tests are frequent in typhoid fever transaminases may increase up to 2-3 times of normal range. ALT values were approximately two times higher than normal and AST values four times in our patient, with minimal rise in bilirubin values [6].

Aminotransferases Enzymes

Plasma AST and ALT are primarily elevated in inflammatory liver diseases such as viral hepatitis and alcoholic hepatitis [7]. Alanine transaminase produced in hepatocytes very specific marker of hepatocellular injury relatively low concentrations in other tissues so more specific than AST levels fluctuate during the day rise may occur with the use of certain drugs or during periods of strenuous exercise [8]. The concentration of Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) is for detecting hepatocellular injury and may help in monitoring the status of liver. Both enzymes increased in many hepatic diseases and have limited value in differential diagnosis. In general, mechanism relating to association between liver marker and in typhoid fever may reflect elevations in ALT and AST [8].

Plasma Albumin

Albumin is the major plasma protein. Molecular weight is approx 66.3 kDa. It is synthesized exclusively in the liver, normally at a rate of about 120 mg/kg body wt /24h. A falling concentration in chronic liver disease suggests a clinically significant deterioration in liver function [9]. In fact, that albumin has a long biological half-life and albumin level also depend on protein intake [2].

Urea

Urea is major nitrogenous end product of protein and amino acid catabolism, produced by liver and distributed throughout intracellular and extracellular fluid [10]. Urea formation is influenced by a number of factors such as liver function, protein intake and rate of protein catabolism [11]. Clinically significant renal disease in typhoid fever is uncommon event and spectrum of renal complication includes mild to severe glomerulonephritis to acute renal failure [5]. The objective of study was to assess some biochemical parameters of typhoid patients in Gadarif State, Sudan by determining the levels of blood urea, aspartate aminotransferases, alanine aminotransferases and serum albumin among patients with typhoid fever.

Materials and Methods

The study was prospective, descriptive case control study, it was conducted in Khartoum teaching hospital, Khartoum state, Sudan, and ethical clearance was obtained from healthy authorities. The privacy and confidentiality were ensured. Data was kept secret and used only for the research. Participation is voluntary and the patient has the right to withdraw at any time. 30 samples were collected from patients with typhoid fever; other 30 samples from volunteers' individuals apparently healthy used as control group, after approval of informal consent from patients, volunteers. Blood samples were collected from both typhoid patients, volunteers, the liver enzymes tests for both were performed (Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT)) and the results were

recorded, also another biochemical test were conducted such as blood urea, serum albumin, the results were noted. The results were analyzed by using the computer program SPSS, were presented in figures. Relationships was being considered use independent t- test with P level <0.05 being significant.

Results

The result of liver enzyme (AST) in typhoid cases compared to control individuals

The statistical analysis for the result of liver enzyme (AST) is shown in Figure 1 which revealed a significant ($p < 0.01$) increase in mean (\pm) standard deviation of serum (AST) level (33.32 ± 24.89) U/L in typhoid patients compared with that of the control group (18.7 ± 8.04) U/L.

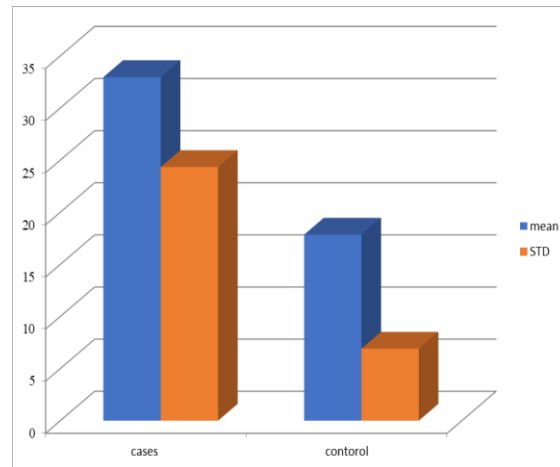


Figure 1: Shows the mean (\pm) standard deviation of serum aspartate aminotransferase by u/l in typhoid cases and control group.

The result of liver enzyme (ALT) in typhoid cases compared to control individuals

The statistical analysis for the result of liver enzyme (ALT) is shown in Figure 2 which revealed a significant ($p < 0.01$) increase in the mean (\pm) standard deviation of serum (ALT) level (35.9 ± 24.9) U/L in typhoid patient compared with of control group (23.5 ± 8.49) U/L.

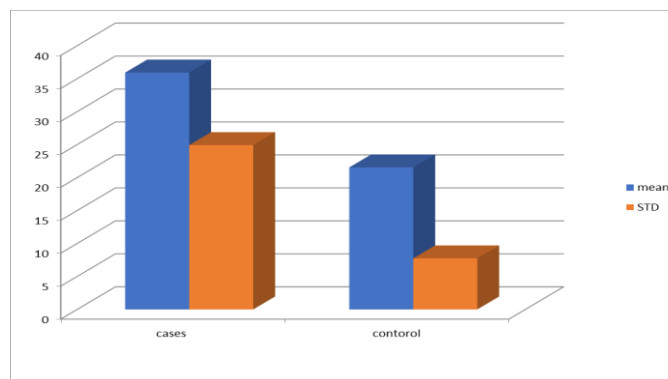


Figure 2: show the mean and standard deviation of serum alanine aminotransferase by U/L in typhoid cases and control group.

The result of serum albumin in typhoid cases compared to control individuals

The statistical analysis for the result of serum albumin showed in Figure 3 revealed no significant differences in mean value of albumin in typhoid patients (3.6 ± 0.44) g/L compared with mean of the control group (3.6 ± 0.36) g/L.

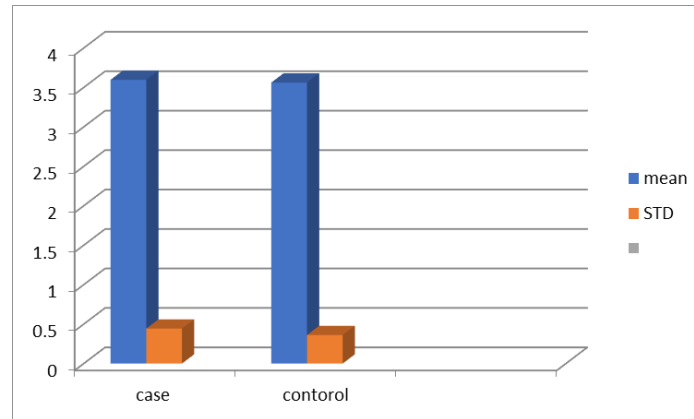


Figure 3: Shows the mean (\pm) standard deviation of serum albumin level by g/l in typhoid cases and control group.

The result of blood urea in typhoid cases compared to control individuals

The statistical analysis for the result of blood urea is shown in Figure 4 it revealed no significant differences in mean value of blood urea in typhoid patients (24.96 ± 5.9) mg/dl compared with the control group of (27.53 ± 7.3) mg/dl urea level.

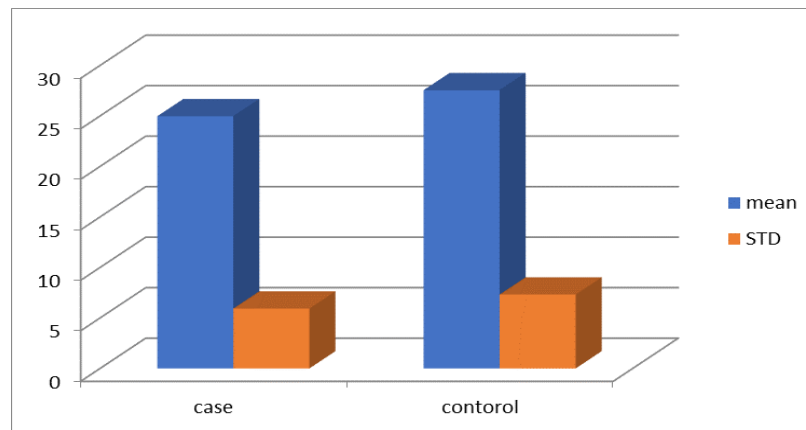


Figure 4: Show the mean (\pm) standard deviation of blood urea by mg/dl in typhoid cases and control group.

Discussion

In this study it was found that there was significant elevation of liver enzymes (AST $P < 0.01$) (ALT $P < 0.01$) in typhoid patients compared to control (uninfected individuals), similar result was found by Najlaa Abdulameer et al. [12] in 2020 that there was a significant increase ($P < 0.05$) occurs in the serum level of liver enzymes ALP, ALT and AST with mean value (130 ± 9.8 , 31.4 ± 5.9 , 26.8 ± 4.2 IU/l), respectively compared with control group [12]. High level of liver enzymes was also reported in patients suffering from typhoid fever in many studies [13-15]. Haleem et al. [16] in 2017 demonstrated the correlation between liver enzymes and disease progression, and concluded that among liver enzymes, ALP showed a higher level in typhoid status compared to malaria and dengue [16]. In the present study there was no significant differences observed in mean and standard deviation of serum albumin level in typhoid patients (3.6 ± 0.44) g/l and control individuals (3.6 ± 0.36) g/l, another study was conducted in Pakistani in 2012 showed a contrast result that Serum albumin was found to be low in typhoid infected patients [2]. In this study there was no significant difference in the mean and standard deviation of urea in typhoid patients (24.96 ± 5.9) mg/dl and the control group (27.53 ± 7.3) mg/dl. A similar study was carried out in 2019 by Ozougwu et al. [17] showed that none of the patients had significant renal dysfunction except in nine patients whose blood urea level was mildly elevated which returned to the reference range with hydration

and treatment of typhoid fever [17]. Clinically significant renal disease in typhoid fever is uncommon event and spectrum of renal complication includes mild to severe glomerulonephritis to acute renal failure [2].

Conclusions and Recommendations

The study concluded that typhoid fever makes significant elevation of liver enzymes (aspartate amino transferase and alanine amino transferase) the elevation of these enzymes could be due to liver injury by salmonella endotoxin. The serum albumin was not affected by typhoid infection it could be depend on protein intake. Also, no significant change was observed in the level of blood urea, this could be due to the fact that kidneys were not target of the Salmonella Typhi bacteria, and renal disease due to toxin in typhoid fever is uncommon. The study recommended that further research must be done in this topic for measurement of other biochemical parameters, liver enzymes must be regularly checkup in typhoid patients.

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