

**A study of the Biochemical and Haematological parameters in Patients of Typhoid Fever**

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**Received 27 February 2016; Accepted 23 January 2017**

**Abstract**

Many studies have indicated several biochemical and/ or haematological parameters that are involved in developing the risk of typhoid fever such as hepatic dysfunction, central nervous system complications, cardiovascular complications, leucopenia and neutrophils leukocytosis. The aim of this study was to evaluate the relation between biochemical and haematological parameters. Total 47 subjects were studied, 19 healthy individuals and 28 typhoid patients (aged 15-60 years old). Levels of Monocyte, Lymphocytes, total White Blood Cells (WBC), Haemoglobin concentration (Hb), Packed Cell Volume (PCV), Platelet count (PLT), Red Blood Cells (RBC), Uric acid, total Serum Bilirubin (TSB), Blood Urea (B.Urea) and serum enzyme activity: Aspartate transaminase (AST), Alanine transaminase (ALT), Alkaline phosphatase (ALP) and Creatine Kinase (CK). Results showed that ALT, AST, ALP, TSB, S.Uric acid, B.Urea and RBC were higher in patients compared with control while CK, Hb, PCV, WBC, Monocyte, Lymphocyte and PLT were lower in patients compared with control.

**Conclusion:** correlation between haematological and biochemical parameters could be afford and thereby serves as indications for more reliable and diagnosis aid of the infection with typhoid fever which could changes the necessary antibiotic therapy .

**Key words:** Thyphoid fever ,Haematological parameters, Monocyte, Lymphocytes, WBC, Hb, PCV, PLT, RBC, S.Uric acid, TSB , B. Urea, AST, ALT, ALP, CK.

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دراسة العلاقة بين الدالات الكيميائية الحيوية والدموية عند مرضى حمى التاييفويد

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الخلاصة

أوضحت العديد من الدراسات ان الإصابة بحمى التاييفويد تؤدي الى تغيرات في الدالات الكيميائية الحيوية و (او) الدموية على سبيل المثال اعتلال وظائف الكبد، تعقيدات في الجهاز العصبي المركزي، تعقيدات في الجهاز الوعائي القلبي، نقصان في عدد كريات الدم البيض و ارتفاع مستويات كريات الدم البيض العذلة . هدفت الدراسة الحالية الى تقييم العلاقة بين الدالات الكيميائية الحيوية والدموية. تضمنت الدراسة 47 عينة منها 28 مريضا بحمى التاييفويد (بعمر 15-60 سنة) وكذلك 19 عينة من الاصحاء بوصفهم المجموعة الضابطة. قيست مستويات الخلايا الاحادية (Monocytes)، الخلايا اللمفاوية (Lymphocytes)، العدد الكلي لكريات الدم البيضاء (WBC)، تركيز الهيموكلوبين (Hb)، حجم الخلايا المرصوصة (PCV)، عدد الصفيحات (PLT)، كريات الدم الحمراء (RBC)، حامض اليوريك، بيلروبين المصلي الكلي (TSB) وانزيمات المصل: اسبارتيت ترانس امينيز (AST)، الانين ترانس امينيز (ALT)، الفوسفاتيز القاعدي (ALP) والكرياتين كينيز (CK). بينت النتائج ان مستويات AST، ALT، ALP، TSB، GOT، S. Uric acid، B. Urea و RBC في المرضى كانت عالية مقارنة بالاصحاء بينما كانت مستويات CK، Hb، PCV، WBC، Monocytes و Lymphocytes و PLT كانت اوطأ عند المرضى مقارنة بالاصحاء.

**الاستنتاج:** العلاقة الترابطية بين الدالات الكيميائية الحيوية والدموية يمكن ان تعطي دلالات تساعد في تشخيص موثوق به للإصابة بحمى التاييفويد والتي يمكن ان تغير ضرورة العلاج بالمضادات الحيوية.

**الكلمات المفتاحية:** حمى التاييفويد، الدالات الدموية، اسبارتيت ترانس امينيز، الانين ترانس امينيز، الفوسفاتيز القاعدي، الكرياتين كينيز، حامض اليوريك، بيلروبين

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### **Introduction**

Typhoid fever is widely recognized as a major public health problem in developing countries. Incidence of typhoid fever has been established as approximately as 22 million cases with at least 200,000 death occurring annually [1-3]. Typhoid fever is caused by *Salmonella Enteric a Serovar Typhi*, a gram-negative bacterium [4]. The organism is transmitted by the fecal- oral route; thus the disease is often associated with poor sanitation and hygiene [3,5]. Typhoid fever manifests with fever, headache, abdominal pain, gastrointestinal symptom like anorexia, nausea, vomiting, constipation. The common signs like abdominal tenderness may develop [6]. Both clinical entities, myopathy and hepatitis are usually diagnosed by serum enzymes such as Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), alkaline phosphatase (ALP) and Creatine phosphokinase (CK). AST is elevated in myopathy as well as hepatitis, whereas ALT and CK are relatively specific for liver and muscle respectively [7]. It is generally accepted that typhoid fever are associated with leucopenia and this is serves as a diagnostic aid [8], the total white blood cell is low and anemia may be involved [9]. It has been stated that neutrophils leukocytosis is a feature of complicated typhoid fever and that lymphopenia is associated with typhoid because of typhoid fever, specific mediators released by cells which act on bone marrow to increase proliferation of neutrophils [10]. Tissue invasion by micro-organism is accompanied by substantial stimulation of neutrophils granulopoiesis which account for increase in neutrophils counts in the blood [11]. The aim of the present study was to establish a correlation between hematological parameters and serum enzymes levels in typhoid fever.

### **Materials and Methods**

A total of 28 blood samples were collected from patients aged between 15 to 60 years old with a clinical approved of typhoid fever by physicians in Central Tikrit Hospital, sample collocated in the period from march till September 2014 and 19 apparently healthy control individuals. Blood samples were collected from patients with a clinical suspicion of typhoid fever and screened for the presence of *S.typhi* infection in Widal test [12]. The blood sample was drained on the first day of management at the same time with blood culture sample collection. The

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blood sample analyzed for various hematological parameters including red blood cells (RBC), hemoglobin concentration (Hb), total white blood cells(WBC), packed cell volume (PCV), platelet count (PLT), Lymphocytes and Monocytes [13]. Biochemical evaluation included serum enzyme activities (AST, ALT, ALP, CK) and Uric acid: all evaluated by using commercially available kit (RANDOX, UK) and Total serum Bilirubin (TSB) by using (Biolabo reagents, France) kit. All tests were performed in triplicate following strict external and internal quality control protocol.

**Statistical analysis:**

All values were expressed as the Mean  $\pm$ SD . Data were analyzed using Minitab program vr14 with t-test for comparison of variable. A probability value of  $p < 0.05$  was considered to be statically significant.

**Results and Discussion**

Alteration in some biochemical and in hematological parameters have been investigated and reported in typhoid fever infection [9-19]. It is necessary to include hematological and biochemical investigation in the diagnosis of typhoid infection so as to detect early complication associated with acute typhoid infection. This helps to intensively care for the patient and prevent death that may results from such complications. This study examined the effect of typhoid fever on some biochemical and hematological indices. Table (1) shows that significantly high ( $p \leq 0.001$ ) in the level of ALT of patients ( $12.32 \pm 1.42$ U/L) compared with control ( $6.68 \pm 2.87$ U/L) and in the level of AST for patients ( $14.91 \pm 2.21$ U/L) compared with control ( $6 \pm 1.15$ U/L). No significant increase ( $p > 0.001$ ) was observed in the levels of ALP in patients ( $47.0 \pm 11.0$ Mmol/L) compared with control ( $45.6 \pm 10.1$ Mmol/L). Many organs other than gastrointestinal tract may be involved in typhoid fever. Hepatic involvement is one of the earliest reported complications of typhoid fever [14] , hepatic dysfunction detected by clinical and/or biochemical parameters was noticed in as many 64% of typhoid fever cases. Liver enzymes ALT, AST and ALP were used for evaluation of hepatic involvement during typhoid

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fever [20], the frequency of elevated serum enzyme was 52%, 100% and 22% [21] respectively. The level of CK for patients ( $83.0 \pm 23.1$  Mmol/L) compared with control ( $84.3 \pm 18$  Mmol/L) indicates no significant increase. The incidence of cardiac involvement in typhoid is variable [21-22], Myopathy can cause severe myoglobinuria and elevated CK was found in 60% of typhoid fever patients [21].

Table (1) also revealed no significant increase in TSB in patients ( $0.632 \pm 0.166$  mg/L) compared with control ( $0.542 \pm 0.161$  mg/L), S. Uric acid in patients ( $256.6 \pm 64.2$   $\mu$ mol/L) compared with control ( $233.6 \pm 54.2$   $\mu$ mol/L), B. Urea for patients ( $4.79 \pm 1.18$  mmol/L) compared with control ( $4.57 \pm 1.04$  mmol/L), Hb for patients ( $13.11 \pm 2.34$  gm/dL) compared with control ( $13.27 \pm 1.28$  gm/dL), PCV level in patients was ( $28.98 \pm 7.06$ %) compared with control ( $41.25 \pm 4.07$ %), RBC level in patients was [ $(4.620 \pm 0.946) \times 10^6$  mL] compared with control [ $(4.537 \pm 0.552) \times 10^6$  mL], WBC in patients [ $(6.16 \pm 2.62) \times 10^3$  mL] compared with control [ $(8.31 \pm 3.08) \times 10^3$  mL], Monocytes for patients ( $3.08 \pm 1.08$ ) compared with control ( $3.66 \pm 1.36$ ), Lymphocytes for patients ( $19.15 \pm 5.16$ ) compared with control ( $20.80 \pm 5.14$ ) finally PLT for patients [ $(226.6 \pm 41.8) \times 10^3$ ] compared with control [ $(245.4 \pm 48.3) \times 10^3$ ].

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**Table(1): Mean  $\pm$ SD of biochemical and hematological parameters of patients and controls.**

Parameters	Mean $\pm$ SD		P .value
	Patients (n=28)	Control (n=19)	
ALT (U/L)	12.32 $\pm$ 1.42	6.68 $\pm$ 2.87	0.0001
AST (U/L)	14.91 $\pm$ 2.21	6 $\pm$ 1.15	0.0000
ALP (Mmol/L)	47.0 $\pm$ 11.0	45.6 $\pm$ 10.1	0.66
CK (Mmol/ L)	83.0 $\pm$ 23.1	84.3 $\pm$ 18	0.82
TSB (mg/L)	0.632 $\pm$ 0.166	0.542 $\pm$ 0.161	0.070
S. Uric acid ( $\mu$ mol/L)	256.6 $\pm$ 64.2	233.6 $\pm$ 54.2	0.20
B. Urea (mmol/L)	4.79 $\pm$ 1.18	4.57 $\pm$ 1.04	0.50
Hb (gm/d L)	13.11 $\pm$ 2.34	13.27 $\pm$ 1.28	0.77
PCV %	28.98 $\pm$ 7.06	41.25 $\pm$ 4.07	0.17
RBC x 10 <sup>6</sup> mL	4.620 $\pm$ 0.946	4.537 $\pm$ 0.552	0.71
WCB x 10 <sup>3</sup> mL	6.16 $\pm$ 2.62	8.31 $\pm$ 3.08	0.018
Monocytes	3.08 $\pm$ 1.08	3.66 $\pm$ 1.36	0.12
Lymphocytes	19.15 $\pm$ 5.16	20.80 $\pm$ 5.14	0.48
PLT x 10 <sup>3</sup>	226.6 $\pm$ 41.8	245.4 $\pm$ 48.3	0.27

Table (2) shows strong correlation in patients between Monocytes and Uric acid (- 0.458), PLT and CK, ALT (0.230, 0.452) respectively, RBC and WBC (-0.022) , Uric acid and ALP, AST (-0.095, -0.110) respectively, Uric acid and ALP, ALT (-0.095, -0.110) respectively, B. Urea and CK (-0.069), finally between ALP and AST (-0.064) compared with control. In conclusion typhoid fever is associated with many complications such as intestinal profanation, paralytic ileus, hepatitis, cholecystitis and peritonitis. Central nervous system complications described are encephalopathy, meningitis, chorea, intracranial hemorrhage, acute renal failure and glomerulonephritis. Cardiovascular complications include myocarditis and peripheral circulatory failure. Hematological complication include disseminated intravascular coagulation and bone marrow suppression [4]. As a result of these complication, Hematological subcutaneous abscess, subphrenic abscess and cutaneous ulcers and biochemical parameters could be afford correlation and thereby serves as indications for more reliable and diagnosis aid of the infection which could changes the necessary antibiotic therapy [9].

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**Table (2): correlation coefficient between biochemical and haematological parameters with typhoid fever.**

Parameters	Patients
Monocytes & PCV	0.022
Monocytse & U.acid	-0.458
Monocytes & TSB	0.156
Monocytes & CK	-0.053
Lymphocytes & PLT	-0.037
Lymphocytes & RBC	0.138
Lymphocytes & B.Urea	0.293
Lymphocytes & GPT	0.255
PLT & WBC	0.050
PLT & U.acid	0.237
PLT & B.Urea	0.151
PLT & Hb	0.024
PLT & TSB	-0.091
PLT & CK	0.230
PLT & ALP	0.007
PLT & GOT	0.452
PCV & RBC	0.594
PCV & TSB	-0.075
PCV & GOT	-0.291
RBC & WBC	-0.022
RBC & CK	-0.056
RBC & GOT	-0.309
WBC & GOT	-0.049
U.Acid & TSB	0.092
U.Acid & ALP	-0.095
U.Acid & GPT	-0.110
B.Urea & TSB	0.255
B.Urea & CK	-0.069
Hb & TSB	-0.026
Hb & GPT	-0.015
Hb & GOT	-0.237
TSB & CK	-0.001
TSB & GPT	-0.182
TSB & GOT	-0.051
ALP & GOT	-0.064

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**References**

1. Hayat, A.S.; Shaikh, N. and Ahmed Shah S.I.; Typhoid fever: Evaluation of typhoid (IGM) in early and rapid diagnosis of typhoid fever. *Professional Med J* 2011;18(2):259-264.
2. Crump, J.A. and Mintz, E.D.; Global trends in typhoid and paratyphoid fever. *Clin Infect Dis*.2010; 50(2):241-246.
3. Chalya, P.L.; Mabula, J.B.; Koy, M.; Kataraihya, J.B.; Jaka, H.; Mshana, S.E.; Mirambo, M.; Mchembo, M.D.; Giiti, G. and Gilyoma, J.M.; Typhoid intestinal perforation at a university teaching hospital in Northwestern Tanzania: A surgical experience of 104 cases in a resource-limited setting. *World Journal of Emergency Surgery* 2012;7:4
4. Zaki, S.A. and Karande, S.; Multidrug-resistant typhoid fever: a review *J Infect Dev Ctries* 2011;5(5):324-37.
5. Yu, H.R.; Jiunn. M. S.; Kao, P.H.; Ho, C.K.; Eng, Y.H. and Yi-Chuan, H. ; Typhoid Fever in Southern Taiwan: A Medical Center Experience. *Pediatr Neonatol* 2008 49: 116-120.
6. Wongsawat, J.; Pancharoen, C. and Thisyakorn, U; Typhoid fever in children: experience in King Chulalongkorn Memorial Hospital. *J Med Assoc Thai* 2002;85(12):1247-1250.
7. Scheig, R.; Evaluation of tests used to screen patients with liver disorders. *Prim Care* 1996; 23 :551-60.
8. Gorbach, S.L.; Bartlett, J.G. and Blacklow, N.R; 2004, "Infectious Disease", Lippincott Williams & Wilkins; chap.15, p159.
9. Dangana, A.; Ajobiwe, J. and Nuhu, A.; Haematological changes associated with *Salmonella typhi* and *Salmonella paratyphi* in humans. *International Journal of Biomedical and Health Sciences* 2010;6 ( 4 ):219-222
10. Hoffbrand, A. V.; Mitchell, L. and Edward, G. D.; (1996) *Postgraduate haematology* 4th ed Oxford University Press Inc, New York. pp. 219-222.
11. Firkin, F.; Chesterman, C. C.; Pennington, D. and Rush, B.; 1989, White cells. In: de-Gruchy *Clinical Haematology in Medical Practice* 5th ed Blackwell Scientific Publications, London. pp. 216 – 222.



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12. Pang, T. and Puthuchery, S.D.; Significance and value of the Widal test in the diagnosis of typhoid fever in an endemic area. *J Clin Pathol.* 1983 April; 36(4): 471–475.
13. Dacie, J.V. and Lewis, S.M.; 2001 “practical Haematology” 9th ed, Churchill Livingstone, Edinburgh.
14. Kayode, O.T.; Kayode, A.A.A. and Awonuga, O.O.; Status of selected Hematological and Biochemical parameters in Malaria and Malaria-typhoid Co-infection. *J bio Sci* 2011; 11(5): 367-373.
15. Adegoke, S.A.; Ayoola, O.O. and Oseni, S.B.A.; Acute disseminated encephalomyelitis in two Nigerian children with typhoid fever, *Niger J Paed* 2012; 39(3): 140-143.
16. Shamim, A.; Shamim, A. and Hussain, B.; Study of Biochemical changes and elevated levels of enzymes in *Salmonella typhi* infected patients in Pakistani population, *Int J Bio* 2012; 16(1): 33-42.
17. Okafor, A.I.; Haematological alterations due to typhoid fever in Enugu Urban-Nigeria. *Mal J Microbiol* 2007; 3(2): 19-22.
18. Retief, F.P. and Hofmetr, N.G.; Acute Haemolytic Anaemia as a Complication of Typhoid Fever. *S Afr Med J* 1965 Jan 30.: 96-7.
19. Arjunan, M. and Al-Salamah, A.A.; Typhoid fever with severe abdominal pain: diagnosis and clinical findings using abdomen ultrasonogram, hematology-cell analysis and the Widal test, *J Infect Dev Ctries* 2010; 4(9): 593-596.
20. Jagadish, K.; Patwari, A.K.; Sarin, S.K.; Prakash, C.; Srivastava, D.K. and Anand, V.K.; Hepatic Manifestations in Typhoid fever, *Indi Pedia* 1994; 31(7): 807-811.
21. Mirsadraee, M.; Shirdel, A. and Roknee, F.; Typhoid myopathy or typhoid hepatitis : A matter of debate. *India J Med Microbiol* 2007; 25(4): 351-353.
22. Chakraborty, P.P.; Bhattacharjee, R. and Bandyopadhyay, D.; Complication typhoid fever, *JAPI* 2010; 58: 186-187.