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Determination of levels of Transferase enzymes, Alkaline phosphatase, Cholesterol and Bilirubin, associated with hepatic disturbances in patients presented to laboratories in Baquba-City

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Abstract

This cross–sectional study included 200 individuals, 15 males of one year, 25 females of one to 5 years old, 100 males of 10-73 years, and 60 females of 15-73 years, presented to official and private laboratories in Baqubah - City, during the 2023 year. Blood samples were collected upon which some biochemical constituents related to hepatic disturbances were determined, including transferase enzymes, serum bilirubin, serum alkaline phosphatase, cholesterol, serum total protein, albumin, urea nitrogen, and creatinine. The results showed that mean values of alanine aminotransferase were high in young males, and adult males, and females, the highest was in adult males. There is significant variance between young and adults and between males and females. The mean of aspartate aminotransferase was high in young females, and adult males and females. Means of alkaline phosphatase was high in the adult males and females. The mean of total bilirubin was high in all groups, direct bilirubin was higher than normal in adult males and females. Means of indirect bilirubin were within normal, cholesterol values were within normal. total protein low in young females, globin level high in adult males albumin level was high in young males. In conclusion, ALT was high in young males, while AST was high in young females. ALT, AST ALP, and direct bilirubin were high in adult males, and females. Total bilirubin levels were high in all groups. indirect bilirubin, cholesterol was within normal. total protein low in young females, globin level high in adult males albumin level was high in young males.

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1. INTRODUCTION

The liver is a large complex organ, that has a role in many functions, some of these are of metabolic, digestion, and get rid of the body from harmful elements [1,2]. Liver frequently suffering from a huge number of diseases which are often be difficult to confirm, as the symptoms easily confused with others health problems [3]. In facts many enzymes and the end products of the metabolic pathway occurring in the liver and very sensitive for these abnormalities which occurred, so may be regarded as biochemical markers of liver dysfunction. A series of special tests carried out on blood can frequently determine whether the liver functions normally or not. These tests can also differentiate the acute or chronic liver disturbances and between hepatitis and cholestasis [3]. Through such tests we can evaluate, the liver function (LFTs), from which, Transferase enzymes both Alanine and Aspartate (AST, ALT), Alkaline phosphatase (ALP), serum total bilirubin (TB), direct bilirubin, indirect bilirubin, lactate dehydrogenase, total protein, globulin, and albumin [1, 4].

These constituents are aminotransferase (ALT, AST), Alkaline phosphatase (ALP), and prothrombin. Alteration in the levels of these enzymes may be a signal to hepatic injury or interference with bile flow [5]. Changes in these elements, either accompanied with symptoms appeared in hepatic disease, or a local, non-expected finding in a patient suffering from a non-hepatic disease or for minor, vague complaints [5].

The excretion of anions was represented by the level of bilirubin, while transaminases reflected the degree of hepatocellular integrity, meanwhile, formation, and the flowing of bile measured by levels of bilirubin and ALP, and protein synthesis was indicated by the level of albumin [6]. Means and median values of ALP were higher in adult female and male groups, and within normal in young males and females. ALP is elevated with cholestasis [7].

In healthy individuals, biochemical signals pointed to hepatic injury often one of challenging faced even for experienced physicians, that lead to set off a battery of further, costly tests [8]. The aim of this study was estimation of elements and enzymes that reflect the hepatic state in patients suffering from one or more of hepatic disturbances.

2. MATERIALS AND METHODS

The study is cross-sectional and includes 200 patients, 15 males of one year (Group I); 25 females of one to 5 years (Group II); 100 males of 10- to 73 years (Group III); and 60 females of 15 to 73 years old (Group IV); presented to private and official laboratories in Baquba City, Diyala province, during 2023 year. They were either apparently normal or suffered from one or more of diseases related to hepatic disturbances. Blood was drawn to estimate some of the enzymes and elements related to liver disturbances, including alanine, and aspartate aminotransferase; bilirubin; alkaline phosphatase; cholesterol; protein; albumin; blood Urea nitrogen; creatinine, these were evaluated by colorimetric assay using automated analyzer (Bioreux, London) apparatus [9].

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2.1 Statistical Analysis

Descriptive statistics for continuous variables were presented as Mean ± Standard error, as frequency and proportions (Percentage) for categories. T-test was used to compare the resultant between groups. < 0.05 was considered a significant level [10].

3. Results

Means of ALT values in groups I, III, and IV, were higher than normal (40.30 ± 5.43; 224.79 ± 31.97; and 189.98± 34.84) respectively. The highest was in G III, followed by G. IV. While in G II was within normal (33.03± 3.66). There were significant variations between young (G.I and II, P<0.05) and adult (G.III and IV, P<0.05), and between male and female groups. The percent was higher in male groups (G.I and III) In G.I; 7 /10 (70%) and G.III 55/66 (83.3%) cases showed higher, than in female G. IV 29/50 (58%) higher, 1/50 (2%) lower. and in G.II 1/13 (7.7%) lower and 5/13 (38.5%) higher than the normal limit. Median values were higher than normal in G. I, III, and IV (37.2; 146 and 87) respectively and were within normal in G.II (33.35) as shown in Table 1.

Means of AST in G. I was within normal (24.29 ±2.77); while in G. II, III, and IV were higher than normal (179.87±139.26; 214.96 ±27.76 and 198.90 ± 6.89) respectively there were significance differences in Gr. III and IV P<0.05) in comparison with other groups. The ranges in G. I only 1/10 (10%), G. II 4/23 (21.74%), G.III 28/47 (59.6%) and G.IV 19/38 (50%). The median in G.I, II, and IV were within normal (24.8; 29.55, and 35.5), but in G.III was higher (79) as shown in Table 1.

Means of ALP were within normal in groups I, and II (68.06 ± 11.11; and 99.43± 23.20). Those from groups III, and IV were higher, the highest was in G.III (406.15 ± 53.31 and 262.03± 28.12, P<0.05). The ranges in G.I. were lower in one case (11.11%), and higher in one case (11.11%); while in G.II two cases were lower (11.76%) and 4 cases (23.53%). In G. III one case lower (2.44%) and 29 (70.73%) higher, G.IV showed 27 higher (71.05%). The median values were within in G.I, II and higher in G.III and IV (62.72; 60.08; 256 and 156) as shown in Table 1.

Table 1 Levels of aminotransferase and alkaline phosphatase

Param.	Gr	M± SE	Range	Low.	High	Med.	Refer.
ALT u/l	I	40.30 ± 5.43 a	10.5-71.1	-	7/10 (70%)	37.2	10-35
	II	33.03 ± 3.66 a	7.67-52.76	1/13 (86.92%)	5/13 (38.46%)	33.35	
	III	224.89± 31.97 bc	10.0-1750	-	55/66 (83.33%)	146	
	IV	189.98 ± 34.84 b	9.1-987	1/50 (2.0%)	29/50 (58.0%)	87.0	
AST u/l	I	24.29 ± 2.77 a	15.28-40.58	-	1/10 (10%)	24.8	0-40
	II	28.10± 3.66 a	6.11-94	-	4/23 (17.39%)	24.8	
	III	214.96± 27.76 bc	13-965	-	28/47 (59.57%)	79	
	IV	198.90 ±6.89 b	14-921	-	19/38 (50%)	36.5	

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ALP u/l	I	68.06 ±11.11 a	33.74-139.47	1/9 (11.11%	1/9 (11.11%)	62.72	35-129
	II	66.02 ± 10.01 a	20.2-152.48	1/13 (7.69%)	1/13 (7.69%)	60.08	
	III	406.15 ± 53.31 bc	14-1900	1/41 (2.44%)	29/41 (70.73%)	235	
	IV	262.03 ±28.12 b	55-1350	-	27/38 (71.05%)	156	

M± SE; a, b, c, significance, between groups

Mean of total bilirubin were higher than normal in all groups (1.72± 0.46; 3.98 ± 2.01; 5.73 ±0.45 and 3.47± 0.233, P<0.05) respectively. Range in G. I, 2/10 (20%) high, in G. II, 6/15 (40%) high, and 5/15 (33.23%) low, G.III 47/61 (77.05%) high, and in G.IV 39/61 (63.93%) higher than normal. The medians were within normal in G.I and higher in those from other groups (0.9; 1.07; 6.7 and 2.0). Table-2-

The means of direct bilirubin were higher than normal in G.III and IV (5.49± 0.81; and 5.27± 0.55). The ranges in G.III 3/323 (0.38%), low and 16/32 (50%) high, In G.IV 3/31 (9.68%) low and 18/31 (58.06%) high. Median high in G.III (4.2) and within in G.IV (0.39) table-2-

Means of indirect bilirubin were within normal in G.III and IV (0.82 ± 0.20 and 0.59 ± 0.04). The range is 2/13 (15.38%) in G.III and one /19 (5.26%) high. The medians were within normal (0.58 and 0.58) Table-2-

Table 2 levels of Bilirubin (Total, Conjugated, Unconjugated)

Param.	Gr	M± SE	Range	Low.	High	Med.	Refer.
T.B. mg / dl	I	1.75 ± 0.46 a	0.5-12.0		2/10 (20%)	0.9	0.3-1.0
	II	3.98 ± 2.01 b	0.13-18.0	5/15 (33.33%)	6/15 (40%)	1.07	
	III	5.73± 0.45 b	0.5-45		47/61 (77.05%)	6.0	
	IV	3.47 ± 0.33 b	0.4-73		39/50 (78%)	2.0	
D.B. mg/dl	III	5.49 ± 0.81 a	0.02-16.8	3/32 (9.38%)	16/32 (50%)	3.9	0.1-0.4
	IV	5.27 ±0.55 a	0.02-16.79	3/31 (9.68%)	18/31 (58.06%)	0.39	
I. B. mg / dl	III	0.82 ± 0.20 a	0.33-3.13		2/13 (15.38%)	0.58	0.1-1.0
	IV	0.59± 0.04 a	0.29-1.03		1/19 (5.26)	0.58	

M± SE; a, b, significance, between groups

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Ranges, Median of cholesterol, were within a normal; total cholesterol (1.36 ±0.13; 1.45 ± 0.21; 2.06 ± 0.08 and 1.30± 0.12). Median (1.17; 1.29; 1.98 and 1.27) as shown in Table 3. HDL cholesterol, was within normal, in those from G.III and IV (55.26 ± 1.38; 49.0 ±3.51). The ranges of 3 cases in G.III and 4 cases in G.IV were higher. The medians were lower than normal (55; and 49) as presented in Table 3. VLDL – cholesterol was higher in G.III (42.25± 6.52), and within (26.25± 4.31) in G.IV; 2 cases in G.III high. Medians were higher in G.III and within G.IV (51 and 33) as shown in bellow Table 3. Levels of LDL were between (133.73±8.46; and 73.4±15.23). Range one case in G.III high; 3 in G.IV low. Median were within in G.III and low in G.IV (138.9; 68.2) as shown in bellow table.

Table 3 Levels of different types of cholesterol

Param.	Gr	M± SE	Range	Low.	High	Med.	Refer.
T. chol. mg/dl	I	136± 13	85-187			117	<=190mg/dl
	II	145 ± 21	22-281		1/6	129	
	III	206± 8.26	191- 229	-	4/4	189	
	IV	130±11.82	107- 163	4/4		127	
HDL	III	55.26 ± 1.38	43-66		3/19	55	35-55mg/dl
	IV	49.0± 3.51	40-59		4/12	49	
LDL	III	133.73± 8.46	117.2-2145.1		1/3	138.9	70-140 mg/dl
	IV	73.4 ± 15.23	52.5-117.9	¾		68.2	
VLDL	III	42.25 ±6.52	27-55		2/4	51	<=40mg/dl
	IV	26.25± 4.31	15-33			33	

M± SE; a, b, c, significance, between groups

Serum protein was within normal, G. I, low in G.II (66.70± 0.30; 59.22± 0.67). Rangers 3 cases (421.86%) in G.I. low and 8 (61.54%) in G.II low; one case (7.69%) high. The median was within normal in G. I, and low in G.II (6.845; 5.734) as shown in Table 4. Globin levels were higher in G.III, than G. IV (163.63 ± 51.126; 141.08± 11.82). 4/19 (21.05%), in G.III, high; 2/12 in G. IV. Median were higher in G. III (130; 140) as shown in Table 4. Albumin levels were higher in G. I, and within in G. II (5.81± 0.10; 5.11± 0.53); G.III (5.04± 0.24; G.IV 4.66 ±0.29). Ranges 8 cases higher, and one case lower in G. I and 8 in G.II, higher. Median was higher in both groups (> 60; 5.31; 4.9; 4.3) as shown in Table 5.

Table- 4 - Levels of Total protein, albumin and globulin

Param.	Gr	M± SE	Range	Low.	High	Med.	Refer.
T.P. g/dl	I	6.67 ±0.30	5.67-7.95	3/7 (42.86%) B		6.85	6-8
	II	5.92 0.67	3.07- 8.78	8/13 (61.54%) bc	1/13 (76.92%) A	5.73	
	III	6.04± 0.21	4.5 – 8.2	8/19 (42.11%) A	1/19 (5.26%) A	6.3	
	IV	5.06 ±0.05	3.5 -6.8	9/12 (75%)		4.6	

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				A			
Albumin g/dl	I	5.81± 0.10	5.31->6.0		8/8 (100%) Bc	>6.0	3.5-5.0
	II	5.11± 0.53	2.97 - >6.0	1/13 (7.69%)	9/13 (69.23%) B	5.31	
	III	5.04± 0.24	3.6- 7.9		8/19 (42.11%)	4.9	
	IV	4.66± 0.29	3.5-6.9		5/12 (41.67%)	4.3	
Globin mg/dl	III	163.63 ±51.16	71-414		4/19 (21.05%)	130	<=200
	IV	141.08 ±11.82	89-210		2/12 (16.67%)	140	

Table 5 Levels of Creatinine and BUN

Param.	Gr	M± SE	Range	Low.	High	Med.	Refer.
Creatinine mg/dl	I	0.85± 0.06	0.57-1.05		4/9 (44.44%)	0.99	0.5-0.90
	II	0.71 ±0.06	0.38-1.11	1/13 (7.69%)	4/13 (30.77%)	0.63	
	III	0.73± 0.02	0.6-0.9	6/28 (21.43%)		0.7	
	IV	0.73± 0.05	0.6-0.9			0.7	
BUN mg/dl	I	9.63± 0.59	8.35-12.85			9.07	7-22
	II	7.08± 0.60	3.37-10.11	7/13 (53.85%)		6.84	
	III	29.21± 1.33	19-39		16/19 (84.21%)	29	
	IV	25.25 ± 1.79	16-32		9/12 (75%)	26	

M± SE; a, b, c, significance, between groups

4. Discussion

Approximately 8% of the general population, are suffering from abnormal LFTs. Which is transient in apparently healthy, not showing symptoms patients, about 30% of these elevations, resolving after three weeks [11, 12].

In this study, means and median, values of ALT, were higher than normal in most groups, the highest levels were in the adult male group. In females was within normal. Means of AST, were higher in most groups, particularly in adult males. Generally, ALT is the parameter that changes in acute and obstructive hepatic injury. While AST changed in chronic and infiltrative lesions of the liver [13]. ALT is found in high concentrations as it is specific and a cytosolic enzyme in the liver [14]. Individuals with liver dysfunction and reduced aminotransferase show insignificant fibrosis histologically [15].

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The results revealed that there were significant variations in values of aminotransferase and ALP, in young and adults, as the result of the study, showed the highest level in adult males, followed by adult females, then young males, and lastly young females. There were variations in the percentage of highest or lowest, as it was higher in adult and young males in comparison with those of adult female. This indicated a variation according to age, six. Levels of aminotransferase differ according to sex and age, and their levels may increase with strenuous exercise [16]. Aminotransferase ALT and AST are good indications for liver damage. Values of each aminotransferase are high in normal males in comparison with females [17]. Also associated with obesity with a natural range for comparison higher in those of high body mass index [18].

The result of acute or chronic hepatic injury is elevation of serum aminotransferase concentration. AST is present in isoenzymes of cytosolic and mitochondrial; liver, myocardium, skeletal muscles, brain, pancreas, lungs, kidneys, Erythrocytes and Leukocytes [14]. In this study means and median values of ALP were higher in adult female and male groups, and within normal in young males and females. ALP is elevated with cholestasis [7]. Principally the main two sites of ALP in the body, liver and bones. The diseases which are the common causes for its rise. Other sites from which ATP may originate include the placenta, kidneys, intestines, and leucocytes. Elevation may be physiological or pathological [14].

The late stage of pregnancy, and adolescent have a correlation with the elevation of ALP in serum, as they are main sources of it [16]. ALP elevated with cholestasis. If bilirubin and ALP elevated in disproportion to ALT and AST this is characterize a cholestatic state. Transferases are elevated with hepatocytic injury, as their elevation in out of proportion to ALP, and bilirubin denotes a hepatocellular disease [19]. Abnormal levels of ALP indicator of malignant liver tumor, lymphoma, or infiltration disease as sarcoidosis [14, 20]. In present study mean of total bilirubin were higher in all groups, while median was within only in young male and higher in other groups. Conjugated bilirubin was higher in adult male and females; while unconjugated bilirubin were within normal in adult females and males.

The less frequent cause for unconjugated hyperbilirubinemia included resorption of large size hematoma, or inactive erythropoiesis [14]. In healthy peoples, direct bilirubin in serum is not of importance as a result of rapid bile secretion [19]. It rises, in case of loss of half of the liver ability of excretion, so its increases are signs of liver disease. Hyperbilirubinemia in conjugation with significant rises in transferase, may indicate acute viral hepatitis or hepatic damage, due to toxic agents, or in ischemia, in addition to autoimmune hepatitis [20]. Cholestasis accompanied by hyperbilirubinemia rises in ALP, simple rises in transferase may occur in cholestasis as a result of drug reaction [21].

Serum bilirubin is normally in an indirect form, reflecting a balance between production and hepatobiliary excretion. Production of indirect bilirubin increases in hemolysis, ineffective erythropoiesis, resorption of a hematoma, and rarely in muscle damage. If conjugated with hyperbilirubinemia, this indicated hepatocellular injury and biliary obstruction [6].

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The results of study, showed that means of total protein, were within normal in all groups. While means of albumin values were higher in groups I and II, and within normal in groups III and IV. The actual function of the liver can be graded based on its ability to produce albumin as well as vitamin K dependent clotting factors [3, 19, 22].

Decreased serum albumin signifies decreased hepatic synthetic ability. However, albumin does not decrease with advanced liver fibrosis. So, albumin do not appear to be, a good measure, of hepatic fibrosis [12]. Cirrhosis due to many diseases is associated with diminished numbers of hepatocytes and thus decreased hepatic capacity to synthesize albumin. albumin is produced by liver cells, but it is not one of the specific liver tests, as albumin; levels in serum may lowered in patients with urination syndrome, malabsorption, loss of protein through intestines, or MA nutrient. Decreased serum albumin is induced by many diseases [9].

The results showed that mean values of globulin were the highest in G.II, and within normal in other groups. The mean and median values of total cholesterol, HDL, and LDL; were within normal in all groups. While values of VLDL were higher in adult males, and within normal in adult females. LDH is commonly included in biochemical liver panels but has poor diagnostic specificity for liver disease. Markedly increased LDH levels are observed in hepatocellular necrosis, shock liver, lymphoma, or hemolysis associated with liver disease [23].

5. Conclusions

There were individuals suffering from hepatic injury, on the dependence of elevation of values of constituents, mainly ALT, ALP, and bilirubin. ALT was high in young males, while AST was high in young females. ALT, AST ALP, and direct bilirubin were high in adult males, and females. Total bilirubin levels were high in all groups. indirect bilirubin, cholesterol was within normal. total protein low in young females, globin level high in adult males albumin levels were high in young males. It is necessary to carry out a general screening study to estimate the normal levels of blood constituents to be used as references in local Iraqi studiers, and by clinicians in hospitals.

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