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Original article

Level of Liver Enzymes in Patients with Mono-Parasitic Infections

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Abstract

Background: Parasitic infections can cause different chemical changes in human body. This study was designed to determine the liver aminotransferase changes in Iranian people infected by parasite.
Materials and Methods: In this cross-sectional study, blood samples were collected from 183 parasite-infected patients. After serum isolation in laboratory, Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) rates of all samples were measured according to IFCC standard method, and after recording in the information form, the results were analyzed using descriptive statistics.
Results: The results of this study showed that patients were infected by 19 different types of parasites. Also, the results showed that the average value of ALT and AST in patients were equal to 32.30 ±23.40 and 38.60±34.80, respectively. The ANOVA test showed remarkable statistical differences between these values and various infections. There was positive and significant correlation between ALT and AST.
Conclusion: The abnormality in liver function in patients with eosinophilia can be caused by parasitic infections in endemic areas; therefore, it can be the cause of a differential diagnosis for physicians. Generally, non-significant changes in transaminase levels can also be attributed to the infection low intensity in patients tested.

Keywords: Parasitic infection, Liver enzymes, Alanine aminotransferase (ALT), Aspartate aminotransferase (AST)

1. Background

Parasites are responsible for the most common infectious diseases. According to the World Health Organization (WHO) reports, almost half of the world populations are infected by parasites. Regarding to their location, such infections can have several signs and symptoms such as temporal and transient abdominal pain, anorexia, nausea and vomiting, diarrhea, anemia, eosinophilia, weight loss, jaundice, neurological symptoms (teeth grinding), intestinal obstruction, and etc; therfore, sometimes diagnosis of parasitic infection and their side effects is difficult (1-2). Several studies have showed that generally, infection and parasites entrance into the body during the various stages of evolution and migration is associated with changes in serum protein fractions and cell metabolism (3-4). Experimental studies have showed that the aminotransferases level may change by parasitic infections. These enzymes transfer an aminegroup to alpha-ketoacid (3-4). There is a high concentration of Alanine-aminotransferase (ALT) in the liver. Aspartate aminotransferase (AST) is found with high concentration in the heart; it also exists in the liver and skeletal muscles (5-6). Normal levels of AST/ALT are between 0.70 to 1.40 (based on the used method); any increase in these amounts could be due to alcoholic hepatitis, cirrhosis, cholestasis, hepatocellular carcinoma, or chronic hepatitis and any reduction can be due to extrahepatic cholestasis or acute viral hepatitis. One possible reason for this change in enzymes is destructive effects of parasitic diseases on liver function because some parasites choose liver as a permanent or temporary implantation place; their visceral migration also causes damages to the cells (5-6).

The release of enzymes into the bloodstream occurs after an injury or cell death, and increase in their amount directly depends on the number of damaged cells and the time between injury and test (7-8). Thus, measuring their amounts can be effective in clinical diagnosis such as liver, biliary ducts, cardiovascular diseases; infections; inflammatory and allergic diseases; and in determining the eligibility of blood donors before transfusion (7-9).

2. Objectives

By considering the fact that there is no comprehensive study investigating the changes in these enzymes following parasitic infection in humans, this study was designed for studying liver aminotransferase changes in individuals infected by parasitic infections in Iran

3. Materials and Methods

This cross-sectional study included 183 patients (including 110 males and 73 females) from various Iranian cities. Patients' stool samples and blood serum were collected and examined using ELISA, IFA, stool exam, and expansion of peripheral blood techniques. At first, the questionnaire was completed for each patient (patients with more than one parasitic infection were excluded), and 5 mL blood was taken, and its serum was separated. Serum samples were kept at 20°C until use.

In this study, we asked about the medications whose name was in the questionnaire and used for 2 weeks ago to eliminate those increasing hepatic enzymes.

The levels of ALT and AST enzymes were assessed by International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) standard methods. Also, to be more precise, these enzymes were re-evaluated by COBAS auto analyzer which is capable of calibration tests in each round. Also, for checking the individuals' contamination by Hepatitis B and C,

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the markers of Hepatitis B (HBc-Ab, HBs-Ab, and HBs-Ag) and Hepatitis C (HCV-Ab) were determined by ELISA method.

3.1. Statistical analysis

Finally, the results were recorded and analyzed using chi-square test, agreement coefficient of Chopra, ANOVA, LSD, and Pearson correlation tests. Differences were considered as significant when the *p*-value was lower than .05.

In this study, only one patient was found with *Dicrocoelium dendriticum*, to be more precise, data were not statistically significant.

4. Results

In this study, there were 183 patients (110 males and 73 females) with mean age of 30.30±17.40 years (minimum 2 and maximum 80 years) and just a single parasitic infection. In these patients, the most performed exam (92/183, 50%) was stool exam (Figure 1).

In this study, 169 patients (92%) did not have a history of drug use during the 2 weeks prior to the experiment. About 9 out of 14 patients with a history of drug use had used oral contraceptive drugs, and the other 5 people had used various drugs. Among them 180 patients (98%) had no history of jaundice or hepatitis, for whom hepatitis markers were negative. Remaining 3 patients (2%) were positive only in terms of HBs-Ag.

ANOVA test revealed that there are significant differences between the values of white blood cells and eosinophilia percentage in different infections. ALT level was 32.30 ± 23.40 (minimum 4, maximum 114) $IU.L^{-1}$, and the amount of AST was 38.60 ± 34.80 (minimum 9,maximum 287) $IU.L^{-1}$. ANOVA test revealed that the above values in various parasites were different. By using LSD test, different groups shown in Figure 3, Table 3 and 4 were determined (the above values were measured).

Distribution of parasitic infections based on the type of tests in people infected by a single parasite in Iran is shown in Table 1.

Also, *Giardia lamblia* and *Fasciola* were the most commonly found parasites in men (17 patients) and women (11 patients), respectively (Table 2).

The results of Pearson correlation test showed that there is positive and significant correlation between ALT and AST, but a relative was weak (r = 0.64) (Table 4).

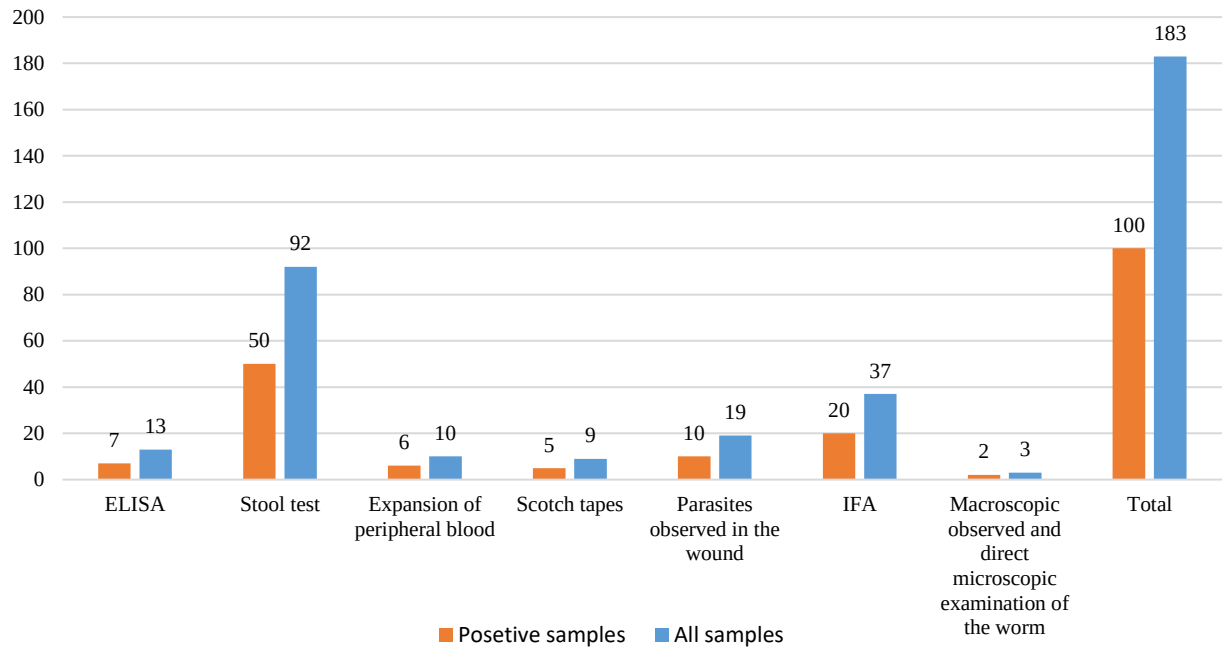

Figure 1. Frequency distribution of patients with a single parasitic infection according to the type of experiment carried out in IR Iran.

Table 1. Frequency distribution of parasitic infections based on the type of tests in people with a single parasitic infection in IR Iran.

Type of Tests	Number (%)
ELISA	13 (7)
Stool exam	92 (50)
Expansion of peripheral blood	10 (6)
Scotch test	9 (5)
Parasites observed in the wound	19 (10)
IFA	37 (20)
Macroscopic observed and direct microscopic examination of the worms	3 (2)
Total	183 (100)

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Table 2. Frequency distribution of parasitic infections based on the type of parasites in people with a single parasitic infection in IR Iran.

Type of Parasites	Male	Female	Total Number	Frequency (%)
Ascarislumbricoides	2	0	2	1
Strongyloidesstercoralis	8	3	11	6
Entamoeba coli	3	2	5	3
Entamoeba histolytica	3	3	6	3
Enterobious vermicolaris	4	5	9	5
Endolimax Nana	2	1	3	2
Blastocystis hominis	10	10	20	11
Trichostrongylus sp.	2	2	4	2
Tenia saginata	3	1	4	2
Toxoplasma gondii	10	5	15	8
Dicrocoelium dendriticum #	0	1	1	1
Giardia lamblia	17	9	26	14
Fasciola sp.	7	11	18	10
Kala-azar	4	0	4	2
Hookworms	2	1	3	2
Hydatid cyst	7	6	13	7
Cutaneous Leishmaniasis	13	6	19	11
Malaria	6	4	10	5
Hymenolepis nana	7	3	10	5
Parasitic infections	110	73	183	100

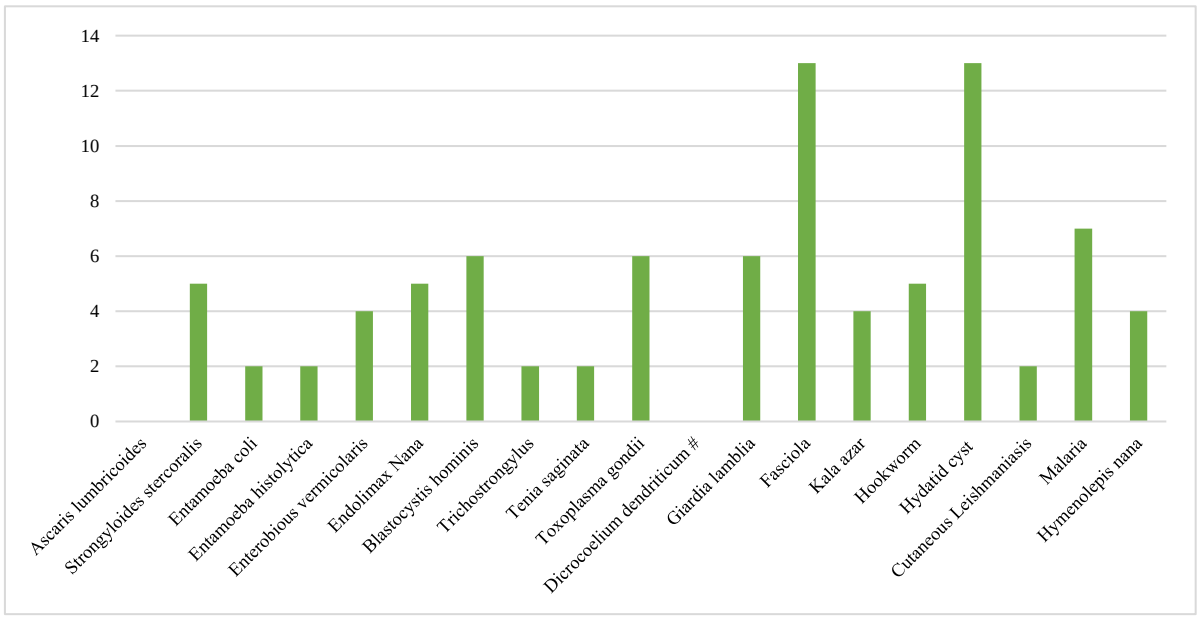

Figure 2. Results of significantly different values of ALT based on LSD test in people with a single parasitic infection in IR Iran. The level of significance *P* <.05.

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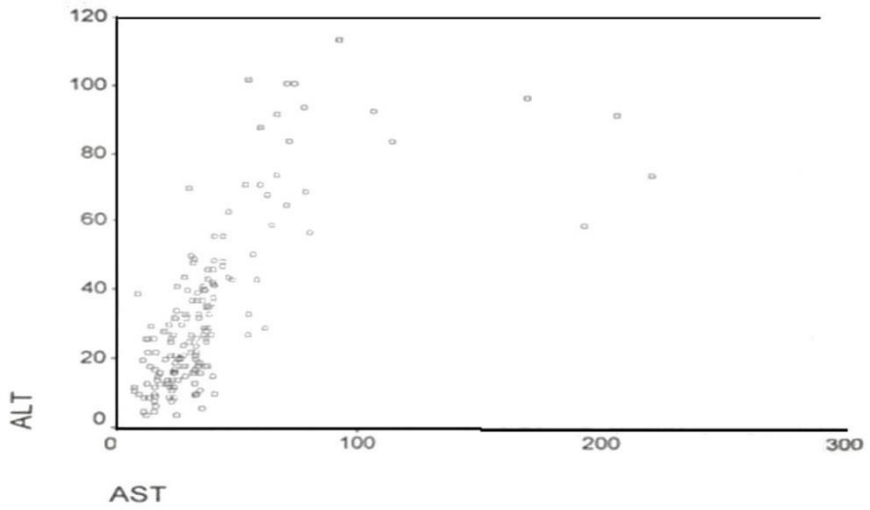

Figure 3. Pearson correlation test, correlation between ALT and AST in people infected by a single parasitic infection in IR Iran.

Table 3. Results of significantly different values of AST based on LSD test in people infected by a single parasitic infection in IR Iran.

No	Parasitic	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Ascarislumbricoides													*						
2	Strongyloidesstercoralis													*						
3	Entamoeba coli													*						
4	Entamoeba histolytica													*						
5	Enterobious vermicolaris													*			*			
6	Endolimax Nana													*						
7	Blastocystis hominis													*						
8	Trichostrongylus sp.													*						
9	Tenia saginata													*						
10	Toxoplasma gondii													*			*			
11	Dicrocoelium dendriticum													*						
12	Giardia lamblia													*			*			
13	Fasciola sp.	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*
14	Kala-azar													*						
15	Hookworms													*						
16	Hydatid cyst		*			*					*			*						*
17	Cutaneous Leishmaniasis													*						
18	Malaria													*						
19	Hymenolepis nana													*			*			

The level of significance: P <.05

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Table 4. Pearson correlation between ALT and AST.

		ALT	AST
ALT	Pearson Correlation	1.000	639 **
	Sig. (2-tailed)		000
	N	182	182
AST	Pearson Correlation	639 **	1.000
	Sig. (2-tailed)	000	
	N	182	182

** Correlation is significant at the .01 level.

5. Discussion

Some of the parasitic diseases are not in the context of classic diseases due to specific biological and physiological conditions. Symptoms of parasitic diseases are usually varied with wide range based on the infection location, duration, patient age, and other factors (1-2).

In this research, an answer was sought for the question of" whether aminotransferases levels change in parasitic infections, and what are the characteristics of hosts?"

Although several studies have been done on changes in blood parameters such as hemoglobin, hematocrit, and eosinophilia in patients with parasitic infections, there is no any report about blood biochemical information in patients with a single parasitic infection. Also, in the field of parasites pathology, their effects on human blood factors have not been investigated; comprehensive research done in the world is mostly related to the animals (10-15). Therefore, this study was designed in order to assess the liver aminotransferase changes in individuals infected by a single parasitic disease. Various studies have shown that symptoms caused by parasites migrating to different viscera and organs' tissue are very different so that they can justify the high levels of aminotransferase in these parasites. The obtained results in this study are consistent with the results of another study done by Chatterji and Chowdhury in India (1970), indicating defects in involved member cells (7-9).

In this study, most patients were in an acute phase of fasciolosis which is the period of young worms' migration and penetration into the liver parenchyma, or shortly, the period after the establishment of worms in hungarian bile. In this period, patients have not yet been entered into the obstructive or chronic stage; thus, they have normal ALT levels. In these patients, ALT and AST increase through an acute (invasive) phase of the disease; also, AST increases more during worm's migration and tissue destruction (16-17). In the present study, some patients with positive ELISA test had normal or near normal transaminase levels; according to the available resources, these values can be justified with patients' entrance into the chronic phase of the disease, which due to the presence of parasites in hungarian bile, destruction of liver parenchyma tissue is low (1-2).

In this study, increased levels of ALT and AST were found in most patients with hydatid cysts. These results are justified due to damage in such tissues as liver, lung, spleen, kidneys, and then other organs during the infection with *Echinococcus granulosu*. Cyst growth and its pressure on the involved members and cell harassment leads to cell damage and enzyme release.

Hydatid cysts grow slowly in human body, delaying the manifestation of clinical symptoms for several years. Generally, the symptoms are varied based on the location of the cysts. Therefore, in this study, normal results in infected patients can be justified by small hydatid cysts and low pressure on an involved member whose cells have not yet been destructed.

Also, some degrees of functional disorders in liver have been reported in malaria infection. Almost in malaria disease, serum transaminases increase with average rate, which is consistent with the results of this study, showing mild to moderate degrees of elevations in serum levels (3-4, 18-19). The main pathological finding in Kala-azar disease is amplification in phagocytic cells in the reticuloendothelial system. These cells are amplified, and considerable amounts of Leishmania can be stored in them; in this disease, spleen, liver, and bone marrow show more changes. In a study carried out on patients admitted to the hospitals in Tehran, it was reported that 7.9% of the patients with kala-azar had jaundice signs (1). In this study, high levels of ALT and AST in the last stages of the diseases can be attributed to the mentioned reasons. Also, in early stages of the disease occurrence, normal results and the absence of liver severe involvement with pathogens can be justifiable.

Generally, in kala-azar and other chronic infections, AST enzyme shows a greater increase in comparison with ALT because ALT enzyme is only located in cytoplasm, and AST is more located in mitochondria and then in cytoplasm; therefore, it is expected that AST rate goes up in chronic cases in which the center of cells are more damaged. On the contrary, in acute disease, ALT increases more than AST because in these cases, the cytoplasm is initially damaged; all above-mentioned cases conform to this investigation (20-21).

Regarding other studied parasitic diseases in which transaminases values are normal, this changeless is due to the evolution of the parasites causing non-significant tissue damage and not involving the viscera. In addition, non-significant changes in ALT and AST levels may be attributed to the low intensity of infection in examined individuals.

6. Conclusion

In general, based on the biochemical and serological laboratory tests and investigating the statistical results of the research, it can be said that the presence of jaundice and abnormality in liver function in endemic areas can be caused by parasitic diseases; therefore, it can be considered as one of the possible and differential diagnosis for physicians. However, no remarkable changes in transaminase levels can be attributed to the low intensity of infection in patients and the evolution of parasites causing non-significant tissue damage.

Conflict of Interest

The authors declare no conflict of interest.

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Authors' Contributions

Mohsen Rahimi and AliyarMirzapour designed the study, collected samples, performed the research, analyzed data, wrote laboratory assays, and evaluated clinical records. They also

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collaborated to the manuscript writing. Farnaz Kheirandish and Zahra Arab-Mazar collaborated to the manuscript writing and revision.

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