

---

**Original Article**

---

## **Elevated Serum Lactate Dehydrogenase Values in Children with Multiorgan Involvements and Severe Febrile Illness**

**Farah Sabouni<sup>1</sup>, Ahmad Siadati<sup>1</sup>, Soriyash Farpoor<sup>1</sup>, Farzaneh Sabouni<sup>2</sup>**

<sup>1</sup> Department of Pediatrics, Tehran University of Medical Science and Health Services and Milad Hospital,

<sup>2</sup> National Institute for Genetic Engineering and Biotechnology, TEHRAN-IRAN.

### **ABSTRACT**

**Background:** Lactate dehydrogenase (LDH) is present in almost all body tissues, so the LDH test is used to detect tissue alterations and as an aid in the diagnosis of heart attack, anemia, and liver disease. It is also used as a marker for differentiating multiple organ involvements and excessive destruction of tissues from mild illness.

**Materials and Methods:** LDH was measured by autoanalyser machine in serum samples of children who were eligible for this study at the time of admission. The t-test was used and differences between the means of the two groups' data were expressed as mean. The SPSS commercial statistical software package was used for data analysis. Ninety one cases (group 1) with fever and two or more than two organ involvements and 118 patients as group 0 with less than two organ involvement were studied.

**Results:** Group 0 showed a mean LDH value of 563.12 U/L and group 1 showed a mean LDH value of 700.08 U/L. A total number of 209 children (103 females and 106 males) were studied. The mean LDH value was 639.93 U/L in females and 606.06 U/L in males. One hundred sixty-six patients had an infectious disease. Their mean LDH was 615.90 U/L. Forty three patients had other uncomplicated non-infectious diseases. The mean LDH was 649.21 U/L in them. Differences of mean LDH between the two groups were statistically significant ( $p$ -value=0.001).

**Conclusion:** We can conclude that LDH measurement may be useful to identify patients who have severe diseases with excessive destruction of tissues.

**Keywords:** Lactate dehydrogenase, Multiorgan involvement, Febrile illness

---

**Corresponding author:** Sabouni Farah, M.D

**P.O.Box:** 14155-6343

**Email:** info@irisp.org

### **INTRODUCTION**

Lactate dehydrogenase, also called lactic dehydrogenase or LDH, is an enzyme found in the cells of various body tissues, including the heart,

liver, kidneys, skeletal muscles, brain, red blood cells and lungs. It is responsible for converting muscle lactic acid into pyruvic acid, an essential step in producing cellular energy.

Lactic dehydrogenase is present in almost all body tissues, so the LDH test is used to detect tissue alterations and as an aid in the diagnosis of heart attack, anemia and liver disease. Newer injury markers are becoming more useful than LDH for heart attack diagnosis (1).

Because the LDH enzyme is so widely distributed throughout the body, cellular damage causes an elevation in the total serum LDH. As a result the diagnostic efficacy of this enzyme by itself is not as valuable as determination of fractions that comprise LDH. These fractions are called isoenzymes and are better indicators of disease than the total LDH. A normal level of total LDH does not mean that individual isoenzyme levels should not be measured. Individual isoenzyme ranges can help in differential diagnosis.

When disease or injury affects tissues containing LDH, cells release LDH into the blood stream, where it is identified in higher than normal levels. For example, when a person has a heart attack, the LDH level begins to rise about 12 hours after the attack and usually returns to normal within 5-10 days. The level of LDH is also elevated in liver diseases, certain types of anemia and cases of excessive destruction of cells, as in fractures, trauma, muscle damage, and shock. Cancers can also elevate LDH level. Additionally, some patients chronically have elevated LDH levels with no identifiable cause and no apparent consequences.

It is indicated that serum total LDH and isoenzymes' patterns may be of diagnostic importance in neoplastic disorders encountered in clinical practice (2).

The aim of our study was to examine the usefulness of LDH concentration in serum as a discriminator between an uncomplicated disease and a severe progressive disseminated multiorgan involvement. The LDH results could be compared

with other inflammatory markers such as leukocyte count, CRP, ESR, and procalcitonin (PCT).

## **MATERIALS AND METHODS**

We studied children in four age groups of 0-1, 1-3, 3-5 and over 5 years of age who were admitted to the pediatric ward and PICU of Milad Hospital with the clinical signs of fever and two or more than two organ involvements. Ninety-one cases with these criteria were included in group 1. One hundred-eighteen children with or without fever and less than two organ involvement with the same age groups were eligible to enter group 0 to be studied. Subjects of the two groups were compared with each other.

In this cross sectional study, the convenience sampling was used and serum LDH concentration was measured after adding LDH solution to serum (Pars Azmoon Company) and read by auto-analyzer RA 1000 machine.

Reference range for total LDH varies in different laboratories and the normal range in this study was 220-500 U/L. Normal values are usually higher in childhood. This test requires a 4-ml blood sample (clot). It is not necessary for the patient to fast before the test unless upon the physician's request. This study was conducted in a one-year period from summer 2003 to June 2004. LDH concentration was measured by auto analyzer machine in serum samples of children who were eligible to enter the study at the time of admission and the t-test was used to analyze the differences between the means of the two groups.

Data was expressed as mean and the SPSS commercial statistical software package was used for statistical analysis.

## **RESULTS**

Ninety-one cases as group 1 and 118 patients as group 0 were included in the study (table 1).

**Table 1.** Frequency distribution of two groups under the study. Group 1: fever with two or more than two organ involvements and group 0: less than two involvement

Group No	Frequency	Percent	Valid Percent	Cumulative Percent
0	118	56.5	56.5	56.5
1	91	43.5	43.5	100.0
Total	209	100.0	100.0	

Group 0 showed a mean LDH value of 563.12u/l while group 1 showed a mean LDH value of 700.08 u/l (table 2).

**Table 2.** Mean serum LDH concentrations in the two groups.

Group No	N	Mean LDH U/L	Std. Deviation	Std. Error
0	118	563.12	282.25	25.98
1	91	700.08	314.83	33.00

A total number of 209 children (103 females and 106 males) were studied (Table 3).

**Table 3.** The frequency distribution of understudy patients according to gender.

Sex	Frequency	Percent	Valid percent	Cumulative
Female	103	49.3	49.3	48.3
Male	106	50.7	50.7	100.0
Total	209	100.0	100.0	

The mean LDH value was 639.93 U/L in females and 606.06 in males (table 4).

**Table 4.** The mean serum LDH concentrations in males and females under the study.

Sex	N	Mean	Std. Deviation	Std.Error
Female	103	639.93	343.37	33.83
Male	106	606.06	260.38	25.29

The age distribution and LDH values of patients are shown in Table 5.

**Table 5.** The age distribution of patients in both groups.

Age (year)	frequency	Percent	Valid Percent	Cumulative Percent
0-1	64	30.6	30.8	30.8
1-3	57	27.3	27.4	58.2
3-5	34	16.3	16.3	74.5
<5	53	25.4	25.5	100.0

One hundred sixty six patients had an infectious disease and the mean LDH was 615.90 U/L in them and 43 patients had other uncomplicated, non-infectious diseases; their mean LDH was 649-21 U/L (table 6, 7).

Differences in the LDH level between the two groups are demonstrated in table 8. The mean differences in the LDH level with 95% confidence interval between the two groups, between the two sexes and infectious and non- infectious diseases are shown in table 9.

**Table 6.** The frequency distribution of infectious and non infectious diseases (Unknown, Unclassified, Rheumatologic, ...)

Group	Frequency	Percent	Valid Percent	Cumulative Percent
Infectious	166	79.4	79.4	79.4
Non infectious	43	20.6	20.6	100.0
Total	209	100.0	100.0	

**Table 7.** The mean serum LDH level in the two groups of infectious and non infectious diseases.

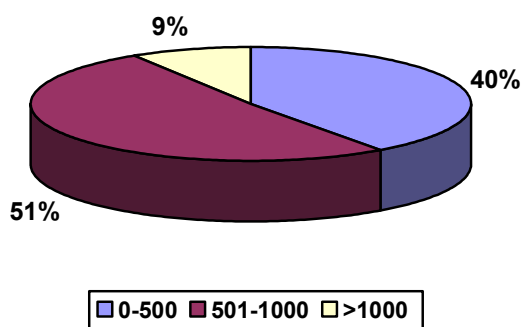
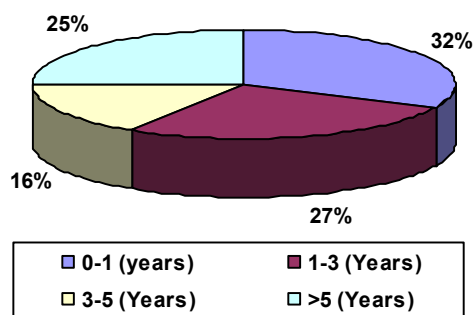
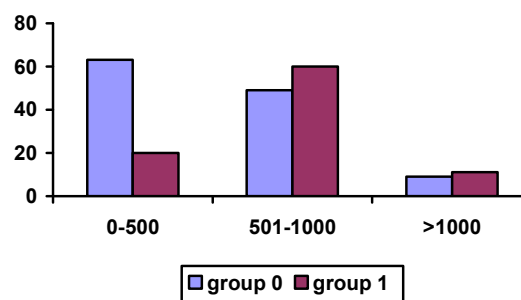
Group	Number	Mean LDH	Std. Deviation	Std. Error
Infectious	166	615.90	281.38	21.84
Non infectious	43	649.21	381.20	58.13

**Table 8.** Serum LDH level distribution in the two groups.

Group No	LDH U/L			Total
	1	2	3	
0	63	48	7	118
1	20	59	12	91
Total	83	107	19	209

**Table 9.** Independent samples test, mean differences between the two groups p- value= 0.001

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	Sig (2-tailed)	Mean Difference	Std. Error	95% Confidence interval of the Difference	
LDH Equal variances assumed	1.262	0.263	-3.307	207	0.001	-136.96	41.41	Lower	Upper
LDH equal variances not assumed			-3.261	182.276	0.001	-136.96	42.00	-219.83	-54.08

**Figure 1.** Three LDH value groups and percentage of patients in each group**Figure 2.** The frequency distribution of patients according to their age range.**Figure 3.** Histogram of Serum LDH level in the two groups of 0 and 1.

## DISCUSSION

The aim of this study was to evaluate the usefulness of lactate dehydrogenase in distinguishing mild uncomplicated non disseminated disease from severe inflammatory responses destructing tissues. Certain diagnosis can be assisted by determination of the total LDH. One example is infectious mononucleosis in which the LDH level is usually elevated in a higher degree than a liver enzyme

called AST (1,2). Elevated levels of serum alanine aminotransferase, lactate dehydrogenase and erythrocyte sedimentation are the common findings in severe acute respiratory syndrome (SARS) (3).

LDH is also high in Kawasaki disease with hemophagocytosis syndrome (4). In our study differences were statistically significant between the cases in group 1 who had fever and two or more than 2 organ involvements and those who did not have more than one organ involvement (group 0) (P-value= 0.001). LDH values were divided into three groups of less than 500 U/L, 500 to 1000 U/L and over 1500 U/L. There was a significant correlation (p value=0.001) between the two groups regarding LDH level at presentation within 95% confidence interval. There was an inverse relationship between CD4 cell count and LDH level in histoplasmosis patients.

Serum LDH levels of 600 IU/L or greater are suggestive of histoplasmosis rather than PCP (pneumocystis). Serum LDH may serve as a laboratory marker in the diagnosis of histoplasmosis (5).

Elevated serum LDH levels have been associated with PCR, bacterial pneumonia, toxoplasmosis and tuberculosis. Serum LDH levels also have a prognostic significance in patients with PCP. A recent case control study showed that levels greater than 600 IU/L are significantly associated with a diagnosis of disseminated histoplasmosis in patients with AIDS who present with fever and pulmonary infiltrates.

There was no significant correlation in elevated serum LDH levels between males and females (p=0.422). Also no significant relationship was found in LDH value between infectious and non infectious diseases (P=0.544).

## CONCLUSION

We can conclude that LDH measurement may be useful in identifying patients who have a disease with excessive destruction of tissues.

## REFERENCES

1. [http:// www. Health atoz.com/health atoz/ Atoz/ ency/lactate dehydrogenase- test.](http://www.Healthatoz.com/healthatoz/Atoz/ency/lactatedehydrogenase-test)
2. Nigam B, Joshi SP. Lactate dehydrogenase and its isoenzymes in serum from patients with neoplastic disorders. *Indian J of Medical and Pediatric Oncology* 1996, 17 (4): 178-84 Extracted from Ind Med.
3. Jiamg T1/ Zhou xz/ shao M. Analysis of severe acute respiratory syndrome in Beijing. PMID Zhongha Nei.
4. Palazzi DL, McClain KL, Kaplan SL. Hemophagocytic syndrome after Kawasaki disease. *Pediatr Infect Dis J* 2003; 22 (7): 663- 6.
5. Butt AA, Michaels S, Greer D, Clark R, Kissinger P, Martin DH. Serum LDH level as a clue to the diagnosis of histoplasmosis. *AIDS Read.*2002; 12 (7): 317- 21.