

ORIGINAL PAPER

doi: 10.5455/medarh.2020.74.384-386

MED ARCH. 2020 OCT; 74(5): 384-386

RECEIVED: JUL 01, 2020 | ACCEPTED: OCT 23, 2020

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Assessment of Lactate Dehydrogenase Levels Among Diabetic Patients Treated in the Outpatient Clinics at King Hussein Medical Center, Royal Medical Services, Jordan

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ABSTRACT

Introduction: Diabetes is a chronic disease and usually is associated with inflammatory conditions. Although assessment of inflammatory markers such lactate dehydrogenase (LDH) is not likely to be conducted in routine practice, it can help in monitoring disease progress.

Aim: The main objectives of the present study are to assess the levels of LDH among diabetic patients treated in the outpatient clinics at King Hussein Medical Center, and to investigate the relationships between the levels of LDH and other variables such as age, gender, BMI, and glucose levels. **Methods:** A retrospective study was conducted to collect data from files of diabetic patients. A total of 62 files were selected. Files of diabetic patients were included if complete information including LDH are included. An excel sheet was used to enter the raw data for all patients. The data were analyzed using SPSS version 20. Data were presented as means, standard deviations, frequencies and percentages. The relationships between variables were computed using T test, and Chi-square. The significance will be considered at $p \leq 0.05$. **Results:** The mean age was 75 ± 12 years. About 53% of participants were males. The mean of BMI was 31.47 ± 20.90 kg/m². The mean glucose level was 239 ± 85 mg/dl. The mean level of LDH was 328.34 ± 78 U/L. There was a significant association between the level of LDH and study variables. Gender had no significant impacts on the levels of LH and other study variables. **Conclusion:** Determination of the level of LDH helps in assessment of progression of diabetes and it is recommended to be performed clinically in routine practice.

Keywords: diabetes type 2, LDH, glucose, BMI, age.

1. INTRODUCTION

Diabetes is still an important health problem at global level, and type 2 diabetes ranks as the 9th cause of death (1). It has been estimated that among adults in the age range between 20-79 years, 415 million persons had diabetes type 2 in 2015 (2). Diabetes type 2 has an increasing prevalence which is thought to due to various factors among which are aged population, sedentary lifestyles, and bad eating habits (3-5).

The enzyme lactate dehydrogenase (LDH) has a role in most cells in the body (6, 7). Mainly, LDH acts through oxidation process on pyruvate to be converted into lactate. It is worth to mention that LDH is mainly localized in the cytoplasm of cell and becomes extracellular when cell dies (8, 9). It has been argued that LDH concentrations are varied based on energy requirements of different tissues (6).

LDH plays a role in catalyzing pyruvate into lactic acid through the process of glycolysis in which NADH₂ acts to donate electron (10, 11). There are various isoenzymes for LDH with different activities in saliva and blood. LDH1 and LDH2 mainly exist in blood while LDH4 and LDH5 mainly exist in saliva (11, 12). According to Avezov et al (12), the activity of LDH and its isoenzymes help in screening the progression of diseases including some tumors such as lymphoma and myocardial infarction.

In diabetes, insulin is released according to the glucose concentration and controls the metabolism of sugars via the process of glycolysis and following

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by oxidation of pyruvate in mitochondria (13, 14-19). This is in agreement with the consideration that more ATP is produced through mitochondria compared with glycolysis; and this is thought to induce insulin secretion (14).

2. AIM

The main objectives of the present study were to assess the levels of LDH among diabetic patients treated in the outpatient clinics at King Hussein Medical Center, Royal Medical Services, Jordan, and to investigate the relationships between the levels of LDH and other variables such as age, gender, BMI, and glucose levels.

3. PATIENTS AND METHODS

A retrospective study was conducted to collect data from files of diabetic patients. A total of 62 files were selected. Files of diabetic patients were included if complete information including LDH are included. An excel sheet was used to enter the raw data for all patients. The data were analyzed using SPSS version 20. Data were presented as means, standard deviations, frequencies and percentages. The relationships between variables were computed using T test, and Chi-square. The significance will be considered at $p \leq 0.05$.

4. RESULTS

General data of diabetic patients

All data are available and used in this study. The present study was funded by the authors.

Data in Table 1 summarized the general findings of diabetic patients. The mean age of study participants was 75 ± 12 years. The study included 62 diabetic patients of whom about 53% were males. The mean of BMI was 31.47 ± 20.90 kg/m². The mean glucose level indicated the diabetic state (239 ± 85 mg/dl). The mean level of LDH was 328.34 ± 78 U/L.

The relationship between LDH and study variables

Variable	Description
Age (M±SD) years	57±12
Gender (N, %):	
Males	33 (53.2%)
Females	29 (56.8%)
BMI (M±SD) kg/m ²	31.47±20.90
Glucose (M±SD) mg/dl	239±85
LDH (M±SD) U/L	328.34±78

Table 1. General data of diabetic patients

Variables	Mean	SD	95% Confidence Interval level		Significance
			Lower	Upper	
LDH – Age	328.23	78.09	251.39	291.17	<0.001
	56.95	11.97	249.97	292.59	
LDH- Gender	328.23	78.09	308.13	347.40	<0.001
	0.46	0.50	306.65	348.88	
LDH- BMI	328.23	78.09	276.35	317.18	<0.001
	31.47	20.92	275.05	318.48	
LDH- Glucose	328.23	78.09	59.33	119.36	<0.001
	238.88	84.94	59.49	119.21	

Table 2. The relationship between LDH and study variables

Variables	group	N	Mean	Std. Deviation	Significance
Age	Males	33	56.9091	12.33988	0.977
	Females	29	57.0000	11.76557	
BMI	Males	33	33.5751	24.63083	0.403
	Females	29	29.0791	15.78573	
Glucose	Males	33	238.3636	76.71368	0.959
	Females	29	239.4828	94.83769	
Cholesterol	Males	33	217.0606	57.30234	0.917
	Females	29	218.4483	45.16999	
TG	Males	33	265.8485	220.96184	0.361
	Females	29	225.4138	89.73991	
HDL	Males	31	43.8323	13.18068	0.184
	Females	24	48.5667	12.59623	
LDL	Males	30	119.1000	43.83696	0.877
	Females	23	117.3043	38.76085	
LDH	Males	30	331.9667	62.75265	0.702
	Females	25	323.7600	94.47455	

Table 3. The impact of gender on study variables

As demonstrated in Table 2, there was a significant relationship between the level of LDH and each of variables including age ($p < 0.001$), gender ($p < 0.001$), BMI ($p < 0.001$), and glucose ($p < 0.001$).

The impact of gender on study variables

The impact of gender on study variables was studied using independent T test. As shown in Table 3, the results showed that study variables were not statistically affected by gender ($p > 0.05$ for all variables).

5. DISCUSSION

The present study aimed to assess the levels of LDH among diabetic patients, and to investigate the relationships between the levels of LDH and other variables such as age, gender, BMI, and glucose levels.

The results showed that the mean level of 328.34 ± 78 U/L. The reference range of LDH is between 140-280 U/L. This means that diabetes has adverse effects through increasing the levels of LDH. This is in agreement with other studies that reported higher levels of LDH in diabetic patients compared with control group (10). LDH is located in the cytoplasm of cells and is widely distributed in tissues. The increased activity level in serum is caused by their leakage from damaged tissues (20, 21). According to this context, diabetic patients have various adverse effects that should be taken into account through treating and controlling diabetes type 2.

The results of the present study indicated to significant differences in the means of LDH and study variables including age, gender, BMI, and glucose level ($p < 0.001$, for all variables) among diabetic patients. It is plausible to think of age as a factor reflecting the advancement of diabetic status. However, other studies that subdivided subjects according to age in groups, groups were matched for age, and gender (10).

The results of this study showed that the level of LDH is significantly associated with BMI. Increased BMI values implies the existence of obesity and the diabet-

ic status worsen. Increased level of LDH, as mentioned earlier, reflects the adverse effects of diabetes. The association between LDH and BMI among diabetic patients in our study is in line with other studies (15-17).

The data of this study showed the level of LDH was significantly associated with glucose level. This association is logic and explains the direct measure of diabetes (glucose) and the indirect effect of diabetes (LDH). This is in agreement with other studies (10, 15-17).

The results of this study did not show significant impact of gender on lactate dehydrogenase enzyme and other variables under study ($p>0.05$, for all variables). This is in consistent with other studies that showed the differences of levels of LDH between males and females was not statistically significant among patients with Chronic Lymphocytic Leukemia (CLL). In another study by Mohajertehran et al (18), patients with head and neck squamous cell carcinoma (HNSCC) did not show significant variations in the LDH in terms of positivity and intensity according to gender ($p>0.05$). On the other hand, males had significantly more salivary levels of LDH than females ($p<0.05$). In another study, Imai et al (19) found positive association between gender and levels of LDH among patients who had advanced non-small cell lung cancer.

6. CONCLUSION

Determination of the level of LDH helps in assessment of progression of diabetes and it is recommended to be performed clinically in routine practice.

- **Authors contribution:** All authors were involved in all phases of preparation this article. Final proof reading was made by the first author.
- **Conflict of interest:** No conflict of interest' for publication of manuscript.
- **Financial support and sponsorship:** Nil.

REFERENCES

- 1- Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. *Nature reviews, endocrinology*, 2018; 14: 89-98.
- 2- International Diabetes Federation. IDF Diabetes Atlas - 7th Edition. *DiabetesAtlas* <http://www.diabetesatlas.org/>. 2015..
- 3- Zimmet PZ Diabetes and its drivers: the largest epidemic in human history? *Clin. Diabetes Endocrinol.* 2017; 3: 1.
- 4- Young B, Gadsby, R. Current prevalence of type 1 and type 2 diabetes in adults and children in the UK. *Diabet Med.*, 2015; 32: 1119-1120.
- 5- Bruno, G. et al. Incidence of type 1 and type 2 diabetes in adults aged 30-49 years: the populationbased registry in the province of Turin, Italy. *Diabetes Care.* 2005; 28: 2613-2619.
- 6- Joshi SP., et al. Comparison between salivary and serum lactatedehydrogenase levels in patients with oral leukoplakia, and oral squamous cell carcinoma - A pilot study. *International-Journal of Oral and Maxillofacial Pathology*, 2012; 3(4): 7-12.
- 7- Acharya S, Kale J, Hallikeri K, Desai A. Prognostic Significance of Preoperative Salivary and Serum LactateDehydrogenase in Oral Squamous Cell Carcinoma Patients. *Acta Scientific Cancer Biology.* 2018; 2(8): 2-10.
- 8- Sivaramkrishnan M. et al. Evaluation of lactate dehydrogenaseenzyme activity in saliva and serum of oral submucous-fibrosis patients. *Journal of Oral Pathology Medicine.* 2015; 44(6): 449-452.
- 9- Alkhatib AJ, AlrakafNASM. Lactate Dehydrogenase: Physiological Roles and Clinical Implications. *Am J Biomed Sci and Res.*, 2019; 3(5). doi: 10.34297/AJBSR.2019.03.000705.
- 10- Malicka B, Skoskiewicz-Malinowska K, Kaczmarek U. Salivary lactate dehydrogenase and aminotransferases in diabetic patients. *Medicine.* 2016; 95(47): 1-6.
- 11- Nagler RM, Lischinsky S, Diamond E, et al. New insight into salivary lactate dehydrogenase of human subjects. *J Lab Clin Med.* 2001; 137: 363-369.
- 12- Avezov K, Reznick AZ, Aizenbud D. LDH enzyme activity in human saliva: the effect of exposure to cigarette smoke and its different components. *Arch Oral Biol.*, 2014; 59: 142-148.
- 13- Edward K. Ainscow, Chao Zhao, and Guy A. Rutter. Acute Overexpression of Lactate Dehydrogenase - A Perturbs β -Cell Mitochondrial Metabolism and Insulin Secretion. *Diabetes*, 2000; 49: 1149-1155.
- 14- Prentki M, Tornheim K, Corkey BE. Signal transduction mechanisms in nutrient- induced insulin secretion. *Diabetologia*, 1977; 40: S32-S41.
- 15- Liu HH, Wang J, Chen XM, Li JP, Ye W, Zheng J. Reduced local diffusion homogeneity as a biomarker for temporal lobe epilepsy. *Medicine*, 2016; 95: e4032. doi: 10.1097/MD.00000000000004032
- 16- Liu G., Tan S., Dang C., Peng K., Xie C., Xing S., et al. Motor recovery prediction with clinical assessment and local diffusion homogeneity after acute subcortical infarction. *Stroke*, 2017; 48: 2121-2128. doi: 10.1161/STROKEAHA.117.017060.
- 17- Liang Y, Zhang H., Tan X, Liu J, Qin C, Zeng H, Shen D.. Local Diffusion Homogeneity Provides Supplementary Information in T2DM-Related WM Microstructural Abnormality Detection. *Frontiers in neuroscience*, 2019; 13: 63. doi:10.3389/fnins.2019.00063.
- 18- Mohajertehran F, Ayatollahi H, Jafarian AH, Khazaeni K, Soukhtanloo M, Shakeri MT, Mohtasham N. Overexpression of Lactate Dehydrogenase in the Saliva and Tissues of Patients with Head and Neck Squamous Cell Carcinoma. *Reports of biochemistry & molecular biology.* 2019; 7(2): 142-149.
- 19- Imai H, Kaira K, Mori K. et al. Prognostic significance of diabetes mellitus in locally advanced non-small cell lung cancer. *BMC Cancer.* 2015; 15: 989. <https://doi.org/10.1186/s12885-015-2012-4>
- 20- Al-Rubae EA, Kadum HA, Al-Braich MS. Salivary aspartate amino transferase and alanine amino transferase of non-insulin-dependents (Type 2) diabetic patients. *J Fac Med Baghdad.* 2010; 2: 212-214.
- 21- Verma M, Metgud R, Madhusudan AS, et al. A comparative study of glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT) levels in the saliva of diabetic and normal patients. *Biotech Histochem.* 2014; 89, 529-534.
- 22- Autore F, Strati P, Innocenti I, Corrente F, Trentin L, Cor-telezzi et A. al. Elevated Lactate Dehydrogenase Has Prognostic Relevance in Treatment-Naive Patients Affected by Chronic Lymphocytic Leukemia with Trisomy 12. *Cancers*, 2019; 11: 896. doi:10.3390/cancers11070896.