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Glutamate Dehydrogenase Enzyme Can Early Predict Liver Injury in Children with COVID-19

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Abstract

Background: Coronavirus disease 2019 (COVID-19) can lead to liver injury by various mechanisms. As liver disease is more noticeable in severe cases than in mild cases, liver injury can be an indicator of disease progression. Glutamate dehydrogenase (GLDH), an enzyme found in the matrix of mitochondria, enters the oxidative deamination of glutamate. The liver is rich in mitochondria, so it is highly enriched with GLDH. It is more specific to liver injury than alanine transaminase (ALT) and aspartate transaminase (AST) and increases earlier.

Aim of Study: This study aimed to evaluate liver affection in COVID-19 children and assess the effectiveness of GLDH as a biomarker of liver injury in COVID-19 patients.

Patients and Methods: A cross-sectional study was conducted at Children's Hospital, Ain Shams University, Egypt, on 73 infants and children diagnosed with COVID-19 by real-time polymerase chain reaction (RT-PCR) and 73 healthy subjects as the control group. The severity of COVID-19 was assessed clinically, biochemically, and radiologically. Serum GLDH levels were measured for both patients and controls.

Results: There was a highly significant difference between the patient and control groups as regards GLDH levels (p=0.00). There was a significant positive correlation between the levels of GLDH, ALT (p=0.018), and serum ferritin (p=0.001). However, there was a significant negative correlation between the levels of GLDH and serum creatinine (p=0.009), as well as the ejection fraction of the heart (p=0.002).

Conclusion: GLDHis an effective biomarker in the diagnosis of liver injury in COVID-19 patients.

Key Words: *Liver – Pediatrics, COVID-19 – Glutamate dehydrogenase (GLDH).*

Introduction

LIVER enzyme abnormalities are common in hospitalized patients with COVID-19, with an estimated range of 14-53% **[1-4]**. Although the precise pathophysiologic mechanism by which COVID-19 causes hepatic injury is not yet fully understood. Several mechanisms have been proposed, including immune-mediated injury, hypoxia-related injury, direct viral injury to the liver cells or bile duct, exacerbation of the pre-existing liver disease, and even treatment-related drug-induced liver injury (DILI), considering the variety of medications that are administered for the treatment of severe COVID-19 **[5]**.

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Abbreviations:

AKI	: Acute Kidney Injury.
ALB	: Serum albumin.
ALP	: Alkaline phosphatase.
ALT	: Alanine transaminase.
APTT	: Partial thromboplastin time.
AST	: Aspartate transaminase.
AUC	: Area under the curve.
CI	: Confidence Intervals.
CK-total	: Creatine kinase.
CO-RADS	: COVID-19 Reporting and Data System.
COVID-19	: Coronavirus disease 2019.
CRP	: C-reactive protein.
CT	: Computerized Tomography.
DBIL	: Direct bilirubin.
DILI	: Drug-induced liver injury.
ESR	: Erythrocyte sedimentation rate.
GLDH	: Glutamate dehydrogenase.
GTP	: Guanosine triphosphate.
HH	: Hypoxic hepatitis.
ICU	: Intensive care unit.
INR	: International normalized ratio.
LDH	: Lactate dehydrogenase.
LFTs	: Liver function tests.
NPV	: Negative predictive value.
PICU	: Pediatric intensive care.
PPV	: Positive predictive value.
PT	: Prothrombin time.
p-value	: Probability value.
RT-PCR	: Real-time polymerase chain reaction.
RV	: Right ventricular.
TBIL	: Total bilirubin.
ULN	: Upper limit of normal.

Additionally, multiple studies showed a significant increase in the severity of COVID-19 among pediatric patients receiving mechanical ventilation [6], which was explained by increasing pulmonary vascular resistance and thus reduced right ventricular (RV) activity [7]. The liver is the largest visceral organ in the human body and receives up to 25% of cardiac output. RV dysfunction is a good predictor of heart failure and can not only aggravate liver injury through liver congestion attributed to elevated central venous pressure but also through the development of ischemic hepatitis [8], so we should pay attention to the changes in cardiac function and the possibility of subsequent liver injury when mechanical ventilation is given to pediatric patients.

A study by [9] found that adult COVID-19 patients who had abnormal liver function tests (LFTs) had a 2.5-fold higher rate of transfer to the intensive care unit (ICU). Additionally, they had a 2.3-fold increase in the need for mechanical ventilatory support and a 1.7-fold increase in acute kidney injury (AKI). The mortality rate for these patients was 21%, which is 1.9 times higher than that of COVID-19 patients without abnormal LFTs. This suggests that liver injury in COVID-19 patients is linked to systemic inflammation and organ dysfunction and is an independent predictor of transfer to the ICU or death [9].

ALT is an enzyme found primarily in the liver; it is commonly used as a marker for liver injury. Like ALT, elevated levels of AST in the blood can be a sign of liver injury, but AST is less liver-specific than ALT, as AST is an enzyme found in the liver as well as in other tissues such as the heart and muscles. GLDH is an enzyme found within the mitochondria of liver cells. It is considered a more specific marker for liver damage compared to ALT and AST. GLDH levels may rise in conditions where there is severe liver damage or hepatocellular injury. GLDH may be used when there is a need for a more specific marker of hepatocellular damage [10].

Patients and Methods

This cross-sectional study was conducted at Children's Hospital, Ain Shams University, Cairo, Egypt, from July 2020 to March 2021 on infants and children aged between 2 months and 16 years with a positive RT-PCR for COVID-19. The study included 73 hospitalized pediatric cases in the isolation department with COVID-19 infection and 73 healthy subjects RT-PCR for COVID-19 negative as the control group. The data was collected from each patient, including demographic data, clinical signs and symptoms at presentation, history of chronic disease, duration of symptoms, vaccination history, source of infection (contact with an infected patient with COVID-19), therapies used for COVID-19 treatment, mode of ventilation if needed, ventilatorsettings, and duration of admission. A clinical examination was done for vital data and weight (plotted on weight for age Z-scores) [11].

Blood samples were collected from patients to be analyzed for liver function tests: [alanine aminotransferase (ALT), aspartate aminotransferase (AST), total bilirubin (TBIL), direct bilirubin (DBIL), serum albumin (ALB), and alkaline phosphatase (ALP), partial thromboplastin time (APTT), international normalized ratio (INR), and prothrombin time (PT)], complete blood count, kidney function tests (serum urea and serum creatinine), cardiac assessment (serum creatine kinase (CK-total), troponin I), serum electrolyte, venous blood gases, serum ferritin, D-dimer, C-reactive protein (CRP), lactate dehydrogenase (LDH), and erythrocyte sedimentation rate (ESR) tests. To confirm the diagnosis of COVID-19: COVID Ig G, Ig M, and RT-PCR were done.

The 73 COVID-19 patients were divided into two categories based on their liver function test results: Normal and abnormal. Any patient with at least one abnormal liver function test was considered to have a liver injury if ALT/AST levels exceeded three times the normal upper limit and/or ALP levels exceeded twice the upper limit [12]. Liver injury was then categorized by degree of ALT elevation as mild (<2 times ULN), moderate (2–5 times ULN), and severe (>5 times ULN) ALT was selected to represent liver injury rather than AST because of the more predominant extrahepatic sources of AST, rendering it less liver-specific. Measures of synthetic dysfunction, including international normalized ratio (INR) and bilirubin, were not included in this definition given the multifactorial reasons for abnormal values in this clinical setting [13].

The patients were evaluated through a plain chest X-ray and a computerized tomography (CT) scan of the chest to assess the severity of COVID-19 using the COVID-19 Reporting and Data System (CO-RADS) classification [14]. Additionally, echocardiography was performed on all COVID-19 patients to evaluate their cardiac function. Based on their clinical severity, COVID-19 patients were categorized as mild, moderate, severe, and critically ill [15].

Measurement of glutamate dehydrogenase enzyme (GLDH): A volume of 5ml of venous blood on a plain tube was withdrawn from all cases and controls included in the study. Samples were centrifuged at 3600 rpm for 20 minutes and stored at –20°C. The serum was separated and placed in the freezer until analysis by kinetic absorption assay for both patients and controls samples.

The assay was done using a commercially available kit supplied by Randox Laboratories Ltd. (55 Diamond Road, Crumlin, Country Antrim, BT294QY, United Kingdom) using the Deutsche

Gesellschaft für Klinusche Chemie (DGKC). The assay was made by the ADVIA 1800 Chemistry System from Siemens (Germany).

GLDH activity was measured by a coupled enzyme assay in which glutamate consumed by GLDH generated a colorimetric (450nm) product proportional to the GLDH activity present. One unit of GLDH was the amount of enzyme that generated 1.0µmol of NADH per minute at PH 7.6 at 37°C.

Results

This current study was conducted on a total of 146 infants and children, with 73 cases of COVID-19 as the study group and 73 age- and sex-matched healthy subjects as the control group. There was no significant difference between patients and controls regarding age and sex (p=0.100 and 0.868, respectively) (Table 1).

According to the findings, 68.5% of the patients had liver function abnormalities. Out of these patients, 12 cases (16.4%) had high levels of Alanine aminotransferase (ALT), 26 cases (35.6%) had high levels of Aspartate transferase (AST) and 4 cases (11.4%) had high levels of Alkaline phosphatase (ALP). Additionally, 12 cases (16.4%) had high levels of total bilirubin (T-BIL), and 43 patients (58.9%) had low levels of serum albumin. Coagulation profiles were high in 26 cases (35.6%).

There was a highly significant difference between the patient and control groups as regards glutamate dehydrogenase levels (p-value=0.00) (Table 2). In addition, statistically significant higher glutamate dehydrogenase levels were found in COVID-19 patients with elevated transaminases and impaired liver functions (Table 3).

There was a significant positive correlation between the levels of GLDH, ALT, and S. ferritin. On the other hand, there was a significant negative correlation between the levels of glutamate dehydrogenase and serum creatinine, as well as the ejection fraction of the heart. However, no significant correlation was found between GLDH and other parameters of liver functions such as AST, ALP, total and direct bilirubin, PT, PTT, and INR; and other parameters of the severity of COVID-19 such as TLC, platelet count, D-dimer, ESR, and LDH; and other parameters of cardiac affection such as troponin I and CK (Table 4, Fig. 1). GLDH levels significantly increased in more severe clinical cases, those admitted to the PICU who required mechanical ventilation, and those who died (Table 5).

For distinguishing children with COVID-19, the test's sensitivity was 90.41% and its specificity was 81.94%, with a cutoff of >1.1pg/mL; its positive predictive value (PPV) was 83.5%; and its negative predictive value (NPV) was 89.4%. The test's area under the curve (AUC) was 0.941, which indicates high accuracy. Regarding validity (AUC, sensitivity, and specificity) for serum glutamate dehydrogenase level to detect abnormal liver function in children with COVID-19, its sensitivity was 62%, its specificity was 82.61%, its PPV was 88.6%, its NPV was 50.0%, its cutoff was >3.8pg/mL, and its AUC was 0.684, with a significant difference between normal liver function and abnormal liver function in the studied cases with COVID-19 (p=0.01) (Table 6).

Multivariate analysis showed that glutamate dehydrogenase level >3.8 (U/L) is the most common variable affected by liver function test abnormalities (Table 7).

Table (1): Statistical comparison between the control group and patients group regarding demographic data (age, sex).

	Control group No. = 73	Patients group No. = 73	Test value	p-value	Sig.
Age (years):					
Median (IQR)	4 (1-8)	6 (2-10)	–1.646$	0.100	NS
Range	0.17-15	0.17-16			
Sex (No, %):					
Female	34 (46.6%)	33 (45.2%)	0.028*	0.868	NS
Male	39 (53.4%)	40 (54.8%)			

Abb: (IQR): Interquartile range, p-value >0.05: Non-significant (NS); *:Chi-square test; $: Mann Whitney test.

Table (2): Comparison between the control group and patients group regarding Glutamate dehydrogenase level.

Glutamate dehydrogenase level	Control group No. = 73	COVID-19 group No. = 73	Test value$	p-value	Sig.
Median (IQR)	0.4 (0.2-0.9)	3.7 (2.1-6)	–9.166	0.000	HS
Range	0-5.7	0.5-9.2			

Abb: (IQR): Interquartile range; p-value >0.05: Non significant (NS); p-value <0.05: Significant (S); p-value< 0.01: Highly significant (HS)$: Mann Whitney test.

Table (3): Comparison between two groups' normal and abnormal liver function cases regarding Glutamate dehydrogenase level.

Glutamate dehydrogenase level	Abnormal liver function: Normal liver function No. = 23	Abnormal liver function: Abnormal liver function No. = 50	Test value	p-value
Median (IQR)	2.9 (1.8-3.7)	5.25 (2.1-6.7)	–2.513	0.012
Range	0.9-6.7	0.5-9.2		

Abb: (IQR): Interquartile range; p-value >0.05: Non significant (NS); p-value <0.05: Significant ‡: Mann Whitney test.

Table (4): Correlation between glutamate dehydrogenase levels with different parameters of the studied cases with COVID-19.

	Glutamate dehydrogenase level	
	Spearman's Correlation (*r*)	*p*-value
Age (years)	-0.029	0.806
Duration admission (week)	0.041	0.731
Weight	-0.032	0.788
Z- Score	-0.014	0.909
Height	-0.038	0.752
Z-Score	-0.173	0.144
BMI	0.074	0.588
Z-Score	0.042	0.759
CBC:		
TLC	0.050	0.674
Neutrophils	0.060	0.614
Lymphocytes	-0.050	0.674
Monocytes	0.114	0.336
Eosinophils	0.084	0.482
Basophils	0.151	0.201
Hemoglobin	0.119	0.314
RBCs	0.108	0.365
HTC	0.085	0.476
MCV	0.074	0.532
MCH	0.091	0.441
MCHC	0.068	0.570
RDW	0.129	0.277
PLT	-0.029	0.808
ALT	0.277*	0.018
AST	0.211	0.073
ALP	-0.245	0.155
T.BIL	0.095	0.426
D. BIL	0.111	0.349
S. Albumin	-0.169	0.152
PT	0.181	0.124
PTT	0.210	0.075
INR	0.181	0.125
D-dimer	0.124	0.298
S. Ferritin	0.387**	0.001
CRP	0.105	0.375
LDH	-0.089	0.454
S. Urea	-0.122	0.302
S. Creatinine	-0.304**	0.009
Troponin I	0.188	0.110
CK-total	-0.068	0.627
ESR	0.078	0.514
Ejection Fraction of the heart (%)	-0.387**	0.002

Abb: p-value >0.05 insignificant, * *p*-value ≤0.05 significant, *p*** value ≤0.001 highly significant, BMI: Body Mass Index, TLC: Total Leucocytic Count RBCs: Red Blood cells PLT: Platelets HTC: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, RDW: Red blood cell distribution width, HCT: Hematocrit, ALT: Alanine aminotransferase, AST: Aspartate transferase, ALP: Alkaline phosphatase, T.BIL: Total Bilirubin, D. BIL: Direct Bilirubin, S. Albumin: Serum Albumin, PT: Prothrombin Time. PTT: Partial Thromboplastin Time INR: International normalized ratio, CRP: C-reactive protein, LDH: lactate dehydrogenase, CK: Creatine kinase, ESR: Erythrocyte sedimentation rate.

Table (5): Correlation of glutamate dehydrogenase level with different degrees of clinical severity assessment, mechanical ventilation, ICU admission, and mortality of studied cases with COVID-19.

	Glutamate dehydrogenase level		Test value	*p*-value	Sig.
	Median (IQR)	Range			
Clinical severity assessment of COVID-19:					
Mild	2.5 (1.6-5.7)	0.6 – 9.2	10.985	0.012	S
Moderate	3.2 (1.2-5.3)	0.5 – 8.5			
Severe	4.85 (2.9-6)	1.1 – 7			
Critical	5.8 (4.4-7.2)	1.17 – 8.4			
Mechanical ventilation:					
No	3.1 (1.8-5.2)	0.5 – 8.5	-3.292$	0.001	HS
Yes	5.8 (3.4-7)	0.6 – 9.2			
PICU Admission:					
No	2.9 (1.6-5.2)	0.5 – 9.2	-2.608$	0.009	HS
Yes	4.8 (3.2-6.7)	0.6 – 8.4			
Mortality:					
Alive	3.2 (1.8-5.5)	0.5 – 9.2	-3.355$	0.001	HS
Died	6.25 (4.65-7.15)	1.17 – 8.4			

p-value >0.05: Non-significant (NS).
p-value <0.05: Significant (S).
p-value <0.01: Highly significant (HS).
$: Mann Whitney test.
$$: Kruskal Wallis test.
PICU: Pediatric intensive care unit.

Table (6): The cut off value of glutamate dehydrogenase to diagnose COVID-19 in children and to detect liver affection in COVID-19 children.

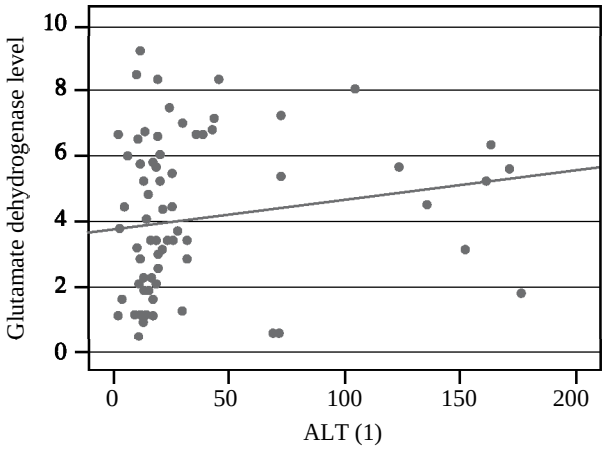
Parameter	AUC	Cut of Point	Sensitivity	Specificity	PPV	NPV
GLDH in COVID-19	0.941	>1.1	90.41	81.94	83.5	89.4
GLDH in liver disease	0.684	>3.8	62.00	82.61	99.6	50

GLDH: Glutamate dehydrogenase.
AUC (Area under the Curve).
p-value (Probability value).
CI (Confidence Intervals).
NPV (Negative Predictive Value).
PPV (Positive Predictive Value).
Statistically significant at $p \leq 0.05$.*

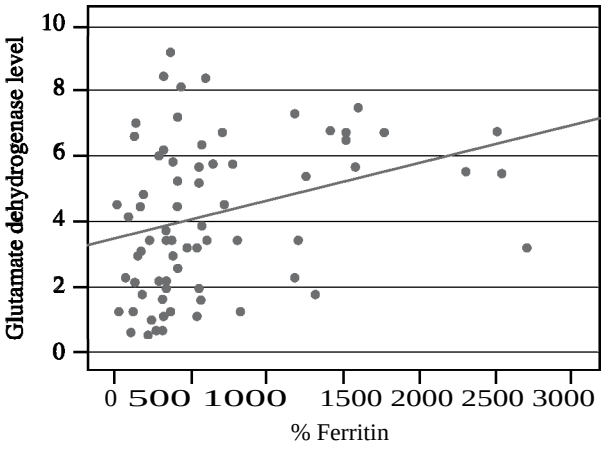
Table (7): Univariate and multivariate logistic regression analysis to assess factors associated with abnormal liver function among the studied COVID-19 children.

	Univariate				Multivariate			
	p-value	Odds ratio (OR)	95% C.I. for OR		*p*-value	Odds ratio (OR)	95% C.I. for OR	
			Lower	Upper			Lower	Upper
Influenza vaccine	0.006	0.095	0.018	0.506	0.163	0.073	0.002	2.889
Pulse oximetry class	0.084	0.465	0.195	1.110	–	–	–	–
UOP< 2ml/kg/hr	0.071	6.947	0.845	57.103	–	–	–	–
ALT at baseline >17	0.000	8.400	2.631	26.818	0.128	5.713	0.607	53.760
AST at baseline >25	0.000	16.841	4.734	59.906	0.106	7.135	0.660	77.078
S. Albumin <=3	0.005	5.576	1.657	18.759	0.373	3.541	0.220	57.019
CK-total >43	0.010	4.773	1.444	15.770	0.058	12.481	0.921	169.085
No Antiviral	0.022	3.429	1.196	9.828	0.313	3.681	0.292	46.355
Glutamate dehydrogenase level >3.8	0.001	7.750	2.288	26.253	0.023	31.380	1.594	617.880

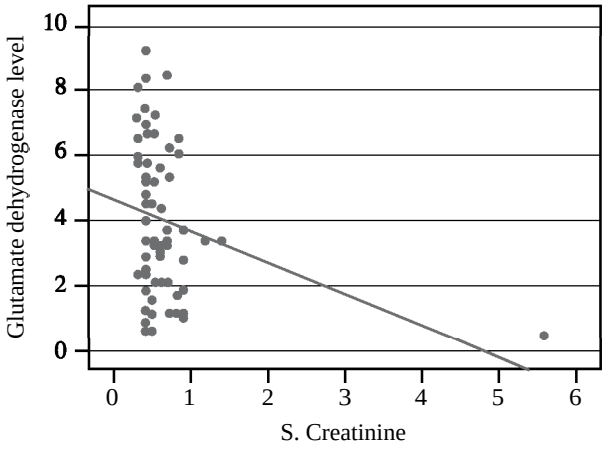
Fig. (1): Scatterplot.



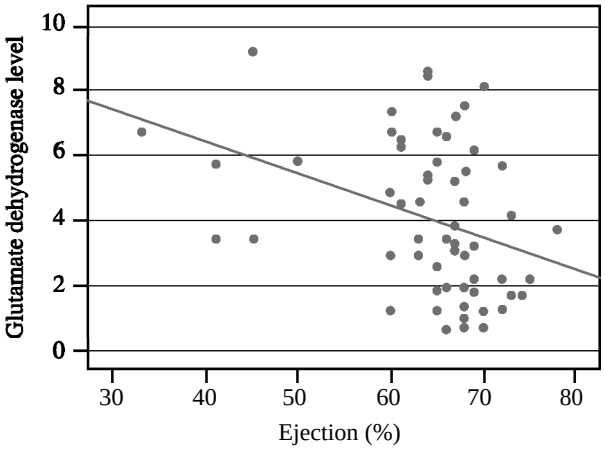
- Positive correlation of glutamate dehydrogenase level with ALT with *r*=0.277* and *p*-value=0.018.



- Positive correlation of glutamate dehydrogenase level with serum ferritin with *r*=0.387** and *p*-value=0.001.



- Negative correlation of glutamate dehydrogenase level with serum creatinine with *r*=–0.304** and *p*-value=0.009.



- Negative correlation of glutamate dehydrogenase level with ejection (%) with *r*=0.387** and *p*-value=0.002.

Discussion

COVID-19 primarily affects the respiratory system. In severe cases, it can also cause complications in other organs, including the liver. ALT and AST are commonly used to assess liver function and can indicate a range of liver conditions, including mild to moderate hepatocellular injury. GLDH levels are assumed to rise in more severe cases of hepatocellular damage, and their elevation may suggest more extensive liver cell injury *[16,17]*. We studied 73 PCR-positive COVID-19 children, out of whom 50 had abnormal liver function tests. 14 cases (28%) had a severe liver injury, 32 cases (64%) had a moderate liver injury, and 4 cases (8%) had a mild liver injury. Of the 56 COVID-19 patients (76.7%) who were admitted to the PICU, the liver function was abnormal in 42 patients (75%). Furthermore, 38 patients (79.1%) out of the 48 COVID-19 patients who needed mechanical ventilation had abnormal liver function. Unfortunately, 11 patients who had abnormal liver function died. According to a study, severe COVID-19 was nine times more likely to develop in patients with liver injuries *[12]*. Patients with COVID-19 who had a moderate or severe liver injury have a higher risk of disease progression, admission to the intensive care unit (ICU), and death compared to those without elevated liver functions *[13,18,19]*. In a retrospective cohort study, COVID-19 patients with severe liver injury (ALT >5 ULN) compared to those with moderate liver injury (ALT >2 ULN) and no/mild liver injury (<2 ULN) had worse clinical outcomes, including higher rates of ICU admission (69% vs. 42% vs. 16%), intubation (65% vs. 38% vs. 13%), and mortality (42% vs. 23% vs. 21%) *[13]*.

GLDH is the only biomarker that can be used to detect liver injury in humans, as GLDH is not a biomarker for cell death but a biomarker for mitochondrial dysfunction *[20]*. Our study revealed that GLDH was significantly higher in COVID-19 patients than in controls and in those with abnormal liver enzymes than with normal liver enzymes. There is no human research on the impact of GLDH on COVID-19-related liver damage.

Study on the possible hepatotoxic effects of treating COVID-19 infection in adult male albino rats with ivermectin and paracetamol. GLDH levels increased after 14 days, while aminotransferase levels increased only after 28 days *[21]*. A different study conducted on rats discovered that ALT was not useful in identifying acetaminophen-induced hepatic toxicity. In contrast, GLDH increased ten times faster than ALT, remained in the serum three times longer, and increased in plasma following hepatocellular injury even before ALT was detected, making GLDH more sensitive and specific to pre-necrotic injury than ALT *[22]*. Furthermore, GLDH levels were not impacted by steroid intake or skeletal muscle injury, in contrast to ALT *[16,23]*. Suggesting that GLDH may be an early predictor of liver injury in COVID-19 patients.

Our study of GLDH showed no significant positive correlation with any parameters other than ALT and serum ferritin. Severe cases of COVID-19 were often characterized by an exaggerated immune response, leading to a cytokine storm. Ferritin levels can rise significantly in response to this inflammatory state. The release of ferritin is not limited to immune cells; it can also be released from damaged tissues, including the lungs and the liver *[24]*. In our study, the levels of GLDH correlated positively with the levels of serum ferritin, as both were influenced by liver damage. Serum ferritin is correlated with ALT in patients with acute hepatocellular injury, as both are found in the cytosol of hepatocytes [25]. However, GLDH is a more specific marker for hepatocellular damage, whereas ferritin is more commonly associated with inflammation and is not specific to liver damage.

GLDH is not involved in cardiac metabolism, although it is present in the cardiac mitochondria [26]. GLDH is present in cardiac muscle, but the majority of its serum level originates from the hepatocyte, whether in healthy or diseased animals [27]. However, in our study, GLDH negatively correlated with the heart ejection fraction, which could not be explained by previous research and needs further studies to confirm.

GLDH is an enzyme that facilitates the reversible conversion of glutamate into α-ketoglutarate and ammonia, while glutamate can also be converted by glutamine syntheses into glutamine, which has been proven to improve low ejection fraction in patients undergoing coronary artery bypass grafting surgery *[28]*. In addition, there is a correlation between myocardial glutamate and diminished left ventricular functions, which is important for the contractile functions of the heart in patients with ischemic heart disease *[29]*. Therefore, we could suggest that GLDH decreases the level of glutamate, which in turn lowers the level of glutamine formation that worsens the ejection fraction.

In addition, in our study, GLDH correlated negatively with serum creatinine. GLDH is an enzyme found in the kidney that helps to regulate acidosis by producing ammonia from glutamate. There are two isoforms of GLDH, GLDH1 and GLDH2, which play different roles in maintaining ammonia homeostasis. While GLDH1 is sensitive to guanosine triphosphate (GTP) inhibition, GLDH2's function is not affected by GTP control. Moreover, it is mainly expressed in the epithelial cells lining the convoluted tubules of the renal cortex. As GLDH2 is more efficient under acidotic conditions without GTP energy, its presence in the kidney may enhance maintaining acid-base balance *[30]* consequently, we could conclude that serum creatinine and GLDH correlate negatively. However, further

investigation is needed into the role of GLDH in myocardial function and its relation to serum creatinine, which has not been studied before.

Conclusion:

GLDH, or glutamate dehydrogenase, is correlated with the severity of COVID-19 However; further studies on a larger number of cases with varying degrees of severity are needed to confirm the role of GLDH in liver injury. Additionally, further research is necessary to fully understand the role of hypoxic hepatitis (HH) in pediatric liver injury. Furthermore, more research is needed to understand how GLDH affects myocardial function and its relationship with serum creatinine.

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اصابة الكبد فى الاطفال المصابين بفيروس كورونا المستجد وقيمة انزيم نازع هيدروجين الجلوتامات كمؤشر لاصابة الكبد

المقدمة: فيروس كورونا ٢ المتلازمة التنفسية الحادة الوخيمة عبارة عن سلسلة كبيرة إيجابية (٢٧-٣٢ كيلو بايت) من فيروس الحمض النووي الريبى الذى ينتمى إلى فصيلة Orthocoronavirinae الفرعية، ويُعتقد أن مستقبل الإنزيم المحول للأنجيوتنسين ٢ هو المستقبل الرئيسي لبروتين السنبلة الفيروسية وهو مهم للعدوى.

الهدف من البحث: لتقييم تأثر الكبد لدى الأطفال الذين تم تشخيصهم بمرض فيروس كورونا لعام ٢٠١٩، لتقييم فعالية نازعة هيدروجين الغلوتامات كمؤشر حيوى لإصابة الكبد فى مرض فيروس كورونا لعام ٢٠١٩، للارتباط بين ألانين أمينوترانسفيراز و(نازعة هيدروجين الغلوتامات) فى إصابة الكبد بمرض فيروس كورونا لعام ٢٠١٩. .

المرضى وطرق البحث: هذه دراسة مقطعية تم إجراؤها على إجمالى ١٤٦ شخصًا، بما في ذلك ٧٣ حالة فى مجموعة كوفيد-١٩ و٧٣ شخصًا صحيًا في المجموعة الضابطة. وكانوا متطابقين في العمر والجنس، وتراوحت أعمارهم بين شهرين وستة عشر عامًا. وفى الفترة من يوليو ٢٠٢٠ إلى مارس ٢٠٢١، أجريت الدراسة فى مستشفى الأطفال بجامعة عين شمس.

النتائج: كشف التحليل متعدد المتغيرات أن مستوى نازع هيدروجيناز الغلوتامات الذى يزيد عن ٣,٨ وحدة / لتر هو المتغير الأكثر أهمية الذى يؤثر على وظائف الكبد لدى المرضى المصابين بمرض فيروس كورونا لعام ٢٠١٩. وكان هناك ارتباط كبير بين هيدروجيناز الغلوتامات وناقلة أمين الألانين فى مرض فيروس كورونا لعام ٢٠١٩. أظهر التحليل أحادى المتغير أن خط الأساس ألانين أمينوترانسفيراز> ١٧ وحدة دولية / لتر يؤثر على وظائف الكبد. فى مرض فيروس كورونا لعام ٢٠١٩، يُظهر التحليل أحادي المتغير أن مستويات ناقلة أمين الأسبارتات الأساسية > ٢٥ وحدة دولية / لتر، ومستويات ألبومين المصل ≤ ٣ جم / ديسيلتر، والتطعيم ضد الأنفلونزا، وعدم استخدام الأدوية المضادة للفيروسات، كلها مرتبطة بضعف وظائف الكبد. كان هناك ارتباط معنوى لمستوى هيدروجيناز الغلوتامات مع الفيريتين فى الدم.

الخلاصة: كانت مستويات نازع هيدروجيناز الغلوتامات فى الدم أعلى بشكل ملحوظ فى مرض فيروس كورونا لعام ٢٠١٩ لدى المرضى الذين يعانون من مرض شديد أو خطير، وقبول وحدة العناية المركزة، ومتطلبات التهوية الميكانيكية، وعدم البقاء على قيد الحياة. كانت مستويات نازع هيدروجيناز الغلوتامات فى الدم أعلى بشكل ملحوظ فى مرض فيروس كورونا لعام ٢٠١٩ لدى المرضى الذين تلقوا الأكسجين الإضافى والعلاج بالجلوبيولين المناعى الوريدى. كان هناك ارتباط سلبى بين مستوى هيدروجيناز الغلوتامات والكرياتينين فى الدم لدى مرضى فيروس كورونا لعام ٢٠١٩، وكذلك مع الكسر القذفى للقلب. علاوة على ذلك، هناك اختلاف كبير فى مستوى هيدروجيناز الغلوتامات بين المرضى الذين لديهم نتائج تخطيط صدى القلب طبيعية وأولئك الذين ليس لديهم. كان هناك ارتباط كبير بين مستوى هيدروجيناز الغلوتامات والمرضى الذين يعانون من الحمى ونقص الأكسجة ووقت إعادة ملء الشعيرات الدموية الطبيعى (≤ ٣ ثوانى).