IJITCE

ISSN 2347- 3657

International Journal of Information Technology & Computer Engineering

Email : ijitce.editor@gmail.com or editor@ijitce.com

International Journal of Information Technology & Computer Engineering

ISSN2347–3657

Volume13, Issue 1,2025

THE USE OF MACHINE LEARNING ALGORITHMS FOR THE PREDICTION OF BLOOD LACTATE LEVELS IN CHILDREN AFTER CARDIAC SURGERY

[1]KANEKANTI PRASHANTH, [2]KANAMATAREDDY HIMA BINDHU, [3]KATAKAM SRAVAN KUMAR, [4]BASATI ARAVIND KUMAR, [5]ALALL JASHWANTH REDDY, [6]Mr. GADE VENKATA VARA PRASAD, [7]Mrs. B RAMYA

[12345]Student Department of DS, Narsimha Reddy Engineering College, Maisammaguda (V), Kompally, Secunderabad, Telangana-500100.

[6]Assistant Professor, Department of CSE, Narsimha Reddy Engineering College, Maisammaguda (V), Kompally, Secunderabad, Telangana-500100.

[7]Assistant Professor, Department of Mechanical Engineering, Narsimha Reddy Engineering College, Maisammaguda (V), Kompally, Secunderabad, Telangana-500100.

Abstract–

In order to pinpoint the origin of the disease, the conventional LHC measures the fundamental biochemical parameters; a more comprehensive LHC incorporates The LDH parameter may provide more specific information on the origin, kind, and cause of pathology. During glycolysis, the enzyme lactate dehydrogenase catalyzes the process that forms lactic acid. As with the majority of catalysts, lactate dehydrogenase is rapidly and uniformly eliminated from the body upon formation. One of the main diagnostic tools available is the laboratory blood test. Their findings are used to assess potential disruptions in the operation of various bodily systems and organs. Determine hematological, cardiac, muscular, and ontological diseases using LDH in biochemical blood tests. The liver and kidney parenchyma have a high quantity of enzymes. Additionally, it may be found in the heart and skeletal muscles. An isoenzyme is specific to each area of localization. There is a trace quantity of lactate dehydrogenase in RBCs. Using Machine Learning Algorithms, this research discusses a clever way to predict blood lactate levels in children following cardiac surgery. The majority of the time, a rise in enzyme concentration is the unpleasant outcome of a biochemical blood test for LDH. This is due to the fact that a considerable amount of lactate dehydrogenate enters the circulation when an organ's cellular structure is harmfully compromised. When liver cancer and cirrhosis progress to their degenerative stages, enzyme levels drop or disappear entirely.

Keywords— Lactate, Enzyme, Acid, Blood tests, LactateDehydrogenate, Biochemical, Cardiac, Surgery, Machine learning.

INTRODUCTION

When cells that carry LDH are destroyed, the enzyme level in the blood rises [1]. During the biochemical progression, the isoenzyme type increased.decides where the harm will occur; in other words, the cells of the organ will be destroyed [2]. Depending on their position, enzyme forms are assigned a number between one and five. An indicator of harmful alteration in the tissues of the organs containing it is an increase in the activity of one or more types of lactate dehydrogenase [3]. The total LDH index is often shown on the form when normal biochemical analysis is performed [4]. If required, a comprehensive investigation is conducted to assess each enzyme isoform using techniques such as the Sevel-Tovarek test, urea inactivation methods, and heat inhibition [5]. A healthy person's blood has steady levels of LDH with established reference values. A particular illness cannot be diagnosed based on a changed lactate dehydrogenase concentration [6]. Various biochemical analysis markers are used to compare the acquired data [7]. If the findings are not acceptable, then it is necessary to investigate the system or organ in question further [8]. The production of lactic acid and glucose oxidation may be facilitated by the enzyme lactate dehydrogenate. The body stores LDH in several organs and tissues, including the kidneys, liver, heart, and muscles [9–10]. Adult blood level guidelines for a certain isoenzyme, which is responsible for each organelle. Age groups are used to categorize children's indicators [11].

The enzyme is released into the systemic circulation via the damaged sites when any of the

International Journal of Information Technology & Computer Engineering

ISSN2347–3657

Volume13, Issue 1,2025

aforementioned organs sustain catastrophic injury [12]. Getting Ready for the LDH Blood Test Do not consume any food for twelve hours before to the examination.
Additionally, it is advised by specialists not to smoke, consume alcohol, engage in strenuous physical activity, or eat a lot [13]. Oh, and don't ruin the atmosphere by The patient should sit quietly on the sidewalk outside the clinic to normalize his pulse rate and relax his heart before the examination [14–15]. In most cases, a patient will need to undergo a battery of tests, including an LDH blood test, before a particular illness can be diagnosed in their tissues and organs [16]. Several times after a set period, individuals pass the examination due to tissue necrosis or myocardial infarction [17]. Finding a problem in whatever organ is likely the case when the LDH blood test returns an increased result. Because it is aided by a limited number of circumstances, lowering the enzyme bar makes determining the reason straightforward [18]. In very rare instances, a low rate of registration is indicated. A drop in LDH levels is not seen by doctors as a sign of anything serious [19].
In most circumstances, increasing glucose oxidation or consuming vitamin C lowers the rate. Hereditary illnesses may cause a decrease in LDH in very unusual circumstances, however these instances do occur [20]. When diagnosing structural cardiac diseases, this indicator's investigation is quite valuable. Enzymes have a crucial role in the first twenty-four hours after a myocardial infarction [21], and this review summarizes important research on these enzymes. In the first ten hours following the onset of pain syndrome and necrosis in the heart muscle, the LDH band becomes more prominent. This is due to a number of factors, including an increase in the total index of lactate dehydrogenase, a change in the ratio of the first and second fractions, and an increase in the indicator of the first fraction (LDH-1) [22–23]. Additionally, there is a rise in the second fraction indirectly [24]. Total LDH is lower than LDH-1 in myocardial infarction due to necrotic alterations. Such mechanisms cause the initial percent to expand while the total amount stays minimal [25]. Alterations to the first-fraction indicators and the overall indicator may also reveal disorders like necrosis of the cardiac tissue [26]. Further hardware investigations ordered by the doctor to confirm a diagnosis once standard symptoms and lab testing have been run [27]. Increased levels of lactate dehydrogenase (LDH) in the blood are a typical complication of skeletal muscle damage, which occurs after a severe hit. The amount of this enzyme may also rise as a result of other injuries that impact organs including the brain, heart, or liver. The LDH level in the blood may rise for a variety of reasons if the endocrine glands (thyroid, adrenal glands, and pancreas) are damaged. Pancreatitis, hypothyroidism, hyperthyroidism, Hashimoto's thyroiditis, Addison's disease, malignancy, and Addison's disease may all be monitored using this enzyme.

RELATED WORKS

Mornings are reserved for laboratory procedures involving venous blood sample. The process begins with drawing blood from a vein.The process of decoding involves comparing the acquired references for indicators [1]. Within a day, you will be able to view the study's findings. In cases when a rapid assessment of the LDH level is critical (due to serious medical issues), blood samples are taken without any previous preparation. Concentration reference values of enzymes for children and adolescents, measured in units per liter. Due to less intense physical exercise, women often have lower blood levels of LDH compared to males [2]. The normal range for women is 135–214 U/L, while for males it is 135–225 U/L. Both pregnant women and elite athletes have somewhat higher reference values [3].

The foundation of extended diagnostics is the deviation of enzyme activity levels in response to an increase or decrease in signals. Myocardial infarction is most often indicated by an elevated LDH level, which is also a major clinical signal [4]. Within the first twenty-four hours after the start of myocardial infarction, the enzyme concentration is highest, and it stays there for one to two weeks [5]. Here, the amount of time and effort required to complete the task are proportional to the severity of the heart muscle necrosis. The overall LDH index goes up because the concentration of isoform No. 1, which is concentrated in the myocardium, goes up sharply [6]. Acute HBDH levels are always higher than chronic ones due to the fact that the high concentration of isoenzyme number 1 reduces the overall enzyme quantity [7]. Following a myocardial infarction, LDH levels rise. When markers are developed, pathogenic processes that cause cells and tissues to die are also present [8]. Elevated LDH levels may be caused by a number of things, including cardiac muscle necrosis. There is no pattern to when lactate dehydrogenate levels drop [9]. The incorrect administration of ascorbic acid, antibiotics, hormonal medicines, anticonvulsant and anticancer medications, and other similar pharmaceuticals is the first thing to be evaluated. Enzyme levels dropping might be because to hereditary defects, oxalic acid salts, or pH (acidity) violations [10].

The patient's medication is discontinued in the event that the values decline. Both clinical and

International Journal of Information Technology & Computer Engineering
ISSN2347–3657
Volume13, Issue 1,2025

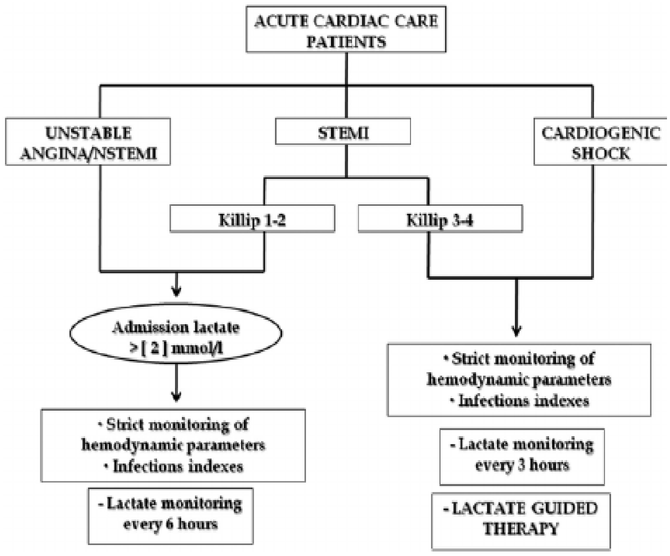
nonpathological factors may alter LDH levels in the blood [11]. Visual inspection, palpation, listening to cardiac and pulmonary sounds, taking a temperature, and checking a patient's pulse are all standard first steps in any medical evaluation [28]. Ultrasound, X-ray, general urine analysis, clinical blood tests, and a thorough physical examination are all highly suggested. Biochemical blood tests (PACs) are more precise laboratory investigations that will be used after these procedures have shown the presence of a pathology but have not been able to determine its type [29]. As a consequence of the prior selection, the kind of LHC is decided. An extended LHC is used when there is just one pathologic localization, while a generic LHC is used when there are many. The reasoning behind the appointment is that while the general LHC can help pinpoint the source of the pathology by measuring the basic biochemical parameters, an extended LHC that incorporates the LDH parameter can provide more specific information about the source, type, and cause of the pathology [30].

As a first step in the modern medical examination process that is based on the principle of "from simple to complex," any doctor can use visual examination, palpation, listening to the patient's heart and lungs, taking their temperature, and checking their pulse to assess the patient's health. A thorough evaluation including a clinical blood test, general urine analysis, X-ray, ultrasound, and a clinical assessment is also advised. More precise laboratory study, in the form of a biochemical blood test (PAC), will be conducted if these approaches detect pathology but are unable to determine its type. Which kind of LHC is used is dependent on the outcomes of the prior selection. A general LHC is used when there are many pathologic localizations; an extended LHC is used when there is only one.

PROPOSED MODEL

Lactate dehydrogenate is an intracellular glycolytic enzyme that speeds up the process of pyretic acid synthesis from lactic acid. It encourages the reversal process, which may transform Llactate, by oxidation.

in all human bodily tissues (to pyruvate). The five isoenzymes of lactate dehydrogenase (LDH) are most abundant in the parenchyma of the heart, liver, and kidneys, as well as in skeletal muscles and red blood cells. The isoenzymes' electrical activity is completely in line with that of globulins - α 1, β 1, γ 1, ι 2. The cells store the elevated levels of LDH. Following myocardial injury, there is a significant rise in the concentration of the first fraction, also known as LDH-1 or the HHHH tetramer, which is primarily produced in the heart muscle. When platelets die in large numbers, as they do in pathological circumstances like pulmonary embolism (PE), the second, third, and fourth fractions of lactate dehydrogenase (LDH-2, LDH-3, and LDH-4) start to actively enter the plasma. Liver parenchyma cells are the source of the fifth isoenzyme, which is known as LDH-5 or the MMMM tetramer. During the acute phase of viral hepatitis, it is released in significant amounts in the blood plasma. Figure 1 from reference [31] shows the suggested methodology for predicting blood lactate levels.



Model for Predicting Blood Lactate Levels (Fig. 1)

The amounts of LDH secreted and accumulated by various organs vary. The percentages of The distribution of lactate dehydrogenate isoenzymes in blood plasma is not uniform. Red blood cells have an activity level of lactate dehydrogenates that is 100 times greater than the plasma enzyme level. In many physiological circumstances, as well as in pathological ones, elevated levels are seen. Excessive physical activity, pregnancy, or the first few months of a child's existence all cause LDH activity to rise. Another way to diagnose it is with a blood test for LDH. While this study is useful for confirming or ruling out certain diagnoses, it is not necessary for making a full diagnosis. All five isoenzyme fractions contribute to the human body's LDH concentration. Their cellular structure and the organs in which they are found determine their

International Journal of Information Technology & Computer Engineering
ISSN2347–3657
Volume13, Issue 1,2025

classification. Doctors may now more easily diagnose diseased illnesses with the use of this categorization, which helps them swiftly identify which organ tissues degenerate. Fig. 2 shows the predicted lactate levels.
One example is LTG-1. The HHHH tetramer is another name for the first fraction. Also, the heart and brain are where you'll find the most of it. As heart muscle tissue deteriorates, the first fraction indication starts to rise sharply.
LTG-2 is one thing. The enzyme has been found in biological materials and liver tissues at high quantities.
This is LTG-3. Thyroid, lung, kidney, and pancreatic tissues, as well as all smooth muscle tissues, have high concentrations of these isoforms.
This is LTG-4. The majority of its organelle locations are in the liver, placenta, third isoenzyme, and male reproductive system.
• Liver tissues, skeletal muscles, the placenta, and the male reproductive system all contain LTG-5, which is found as an enzyme. When viral hepatitis is severe, the enzyme levels rise dramatically.

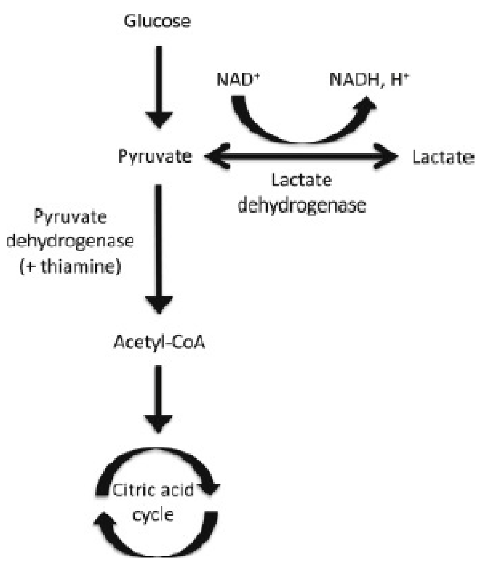


Fig 2: Lactate level prediction

Normative indications for blood LDH are rough at best; it's not a good idea to commit them to memory since the blood may be tested at either 30 or 37 degrees Celsius, and the

level may be determined using a number of different units, including that/l, mmol/(h l), U/l, or U/l. But let's say we need to compare our own outcomes to deviations of the norm immediately. In such instance, you could find it useful to inquire about the laboratory's behavioral procedures, measurement units, and the firm that conducted the study. You shouldn't take more than 35 mg of lactate dehydrogenase isoenzymes (LDH-4 and LDH-5) daily in your urine. Systemic vascular disease, functional heart failure, and pulmonary function. Pulmonary circulation involvement and development of circulatory failure in lung tissue.
The following is the typical range for total LDH in blood samples taken from people of various ages: Adults: 235-250 U/l; newborns: up to 2000 U/l; children: under 2 years old: 425 U/l; children: 2–12 years old: 295–300 U/l; children: 250 U/l; and adults: 235–300 U/l.
In order to use one or more LDH isoenzymes as biochemical markers, they conduct specialized laboratory tests.
The methods are heat inhibition, urea inactivation, and several-Tovarek. Through these assays, it is possible to determine the degree of isozyme activity.
Circulatory problems, symptoms, and elevated LDH-4 and LDH-5 fraction activity result from diminished cardiac function. Glycolytic enzyme studies are useful for diagnosing heart muscle failure since they are the primary enzyme tests that identify myocardial infarction on day one (due to LDH-2). Blood LDH levels peak a day or two after a painful episode and, in the majority of instances, stay at high activity levels for up to 10 days. The area of cardiac injury is directly proportional to activity. During the early stages of the illness, HBDH levels spike as LDH-1's total lactate dehydrogenase activity drops; thus, the LDH/HBDH ratio drops precipitously and seldom rises over 1.30. But the LDH-1/LDH-2 ratio is trending upwards, with occasional attempts to surpass the 1.00 mark. The LDH indication is essential for disease detection and health monitoring, as previously noted. Because it is so easy to track how a patient is recovering, lactate dehydrogenase is a useful clinical indicator of overall health. Lactate dehydrogenate is present in the following organs: the heart, skeletal muscles, liver, kidneys, brain, blood cells, and endocrine glands. Therefore, if the patient's overall level of LDH rises, it might indicate that their condition is becoming worse.

RESULTS AND DISCUSSION

There has been a comparison between the current Blood lactate concentration prediction (BLCP) and the proposed Prediction of Blood Lactate Levels (PBLL) model.

values (PBLV), MLPB, a technique for machine learning to predict blood lactate levels (MLPA). The five isozyme forms of lactate dehydrogenase found in blood serum are LDH-1, LDH-2, LDG-3, LDG-4, and LDH-5. These are functionally distinct molecular variants of lactate dehydrogenase. M (from "muscle" in English) and H (from "heart" in English) are the two kinds of subunits that biochemists identify as making up LDH, which is a tetramer. One or another kind of LDH may thus be found.

A. Optimizing Resource Utilization

These are symptoms that patients may experience as a result of many medical conditions that cause damage to tissues and cells, such as cirrhosis, cancer, pancreatic necrosis, pulmonary thromboembolism, renal apparatus illnesses, and myocardial infarction. No particular illness was determined from the study's findings. A thorough patient evaluation is based on the signs' reliance. Table 1 shows the results of comparing High Efficiency Management.

Table 1: Comparison of High efficiency Management (in %)

INPUTS	BLCP	PBLV	MLPB	MLPA
100	66.41	68.40	37.49	50.08
200	66.30	68.42	37.32	49.81
300	66.28	69.30	38.05	50.11
400	69.38	72.13	41.39	53.62
500	70.58	73.45	42.12	54.94
600	71.19	74.28	43.01	55.48
700	71.60	74.68	43.09	55.78

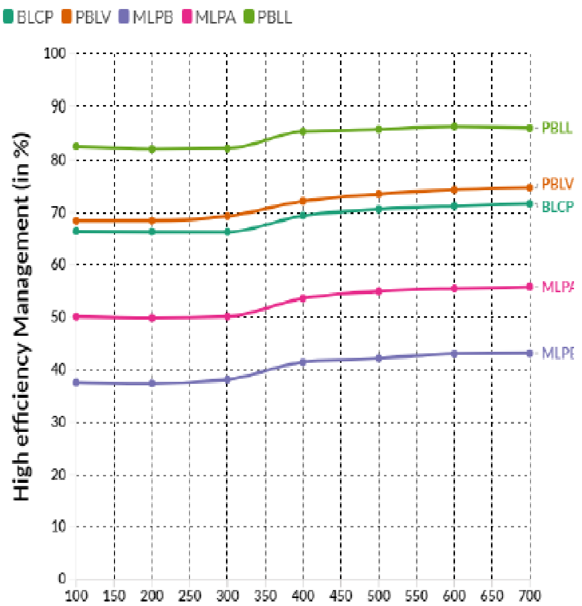


Fig 3: Comparison of High efficiency Management

An essential isoenzyme present in blood is lactate dehydrogenate. It happens when glucose is oxidized and the body produces lactic acid. Assuming regular LDH levels, no element because it decomposes and is eliminated by itself. On the other hand, in clinical practice, changes in LDH levels indicate the presence or absence of certain disorders. Figure 3 displays the results of the assessment based on High Efficiency Management. The suggested PBLL achieved 85.41 percent of High Efficiency Management at the cutoff point. The current BLCP accomplished 69.38%, PBLV 72.13%, MLPB 41.39%, and MLPA 53.62% in the same range. When tested against preexisting models, the suggested model outperformed them in terms of high efficiency management. It is not unexpected that lactate dehydrogenate is used as a marker to monitor numerous blood illnesses, including liver ailments, given that it is a component of many blood cells in these conditions. Liver cells, or hepatocytes, which produce biochemical compounds like LDH, die off when a person has hepatitis or another liver illness.

B. Managing Enzymes

When there is congestion in the liver, coronary insufficiency, or an increase in lactate dehydrogenate, it is identified. All the signs point to cardiac arrhythmia, however the patient's enzyme level will rise after electrical impulse treatment. Lactate dehydrogenate is an enzyme found in the liver, kidneys, and bones that may assist identify a number of diseases and disorders. Table 2 shows the results of the comparison of Enzyme Management.

Table 2: Enzyme Management Comparison (in percentage)

INPUTS	BLCP	PBLV	MLPB	MLPA	PBLL
100	57.90	72.03	40.00	54.28	82.40
200	59.39	74.00	42.42	56.48	82.39
300	60.19	75.13	42.83	57.28	83.59
400	62.52	76.32	44.43	57.95	84.07
500	63.53	76.71	46.75	59.38	85.50
600	64.17	78.23	48.00	60.47	86.66
700	64.83	78.47	50.73	60.95	87.43

International Journal of Information Technology & Computer Engineering

ISSN2347–3657

Volume13, Issue 1,2025

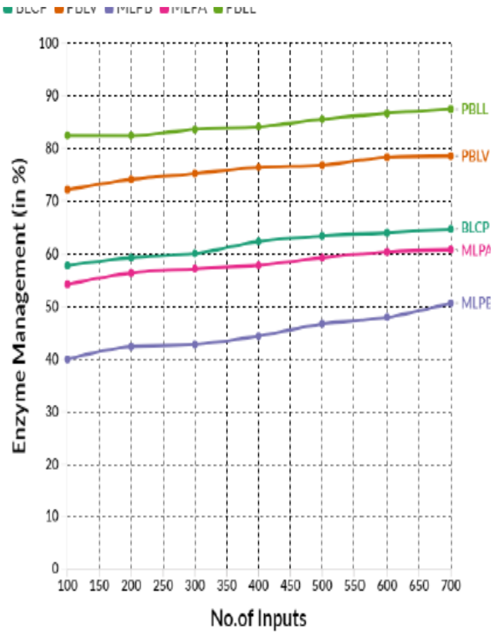


Fig 4: Comparison of Enzyme Management

As an example, researchers have found LDH1 and LDH2 in cardiac muscle, while the slower LDH5 was only found in the liver. Never forget that in infants,

Although a rise in LDH is a characteristic of this condition, it will eventually revert to normal levels. In rare cases, this enzyme may not be present in the blood or may have a hereditary abnormality. Figure 4 shows the results of the examination based on Enzyme Management. The suggested PBLL achieved 84.07% Enzyme Management in a cutoff threshold. While MLPB got 44.43% and MLPA got 57.95% in the same range, the current BLCP got 62.52% and PBLV got 76.32%. When compared to the current models, the suggested model outperformed them in the area of Enzyme Management.

A wide variety of biochemical substances are released when human cells die. With the aid of blood, almost all newly created compounds are either harmful or useless to the body, therefore they are transported out of their range by the liver and kidneys. One example of an organic compound is lactate dehydrogenase. You may find it in certain tissues throughout your body. Hence, an abnormally high level of a certain component of human blood might suggest an excessive amount of cell death.

C. Managing LDH

Say a doctor has reason to believe the patient has suffered tissue damage. On the other hand, this LDH study is done in tandem with other research. A myocardial infarction, pneumonia, or angina pectoris might be a possible reason of the patient's sensitive chest discomfort. For this research to be conducted with different types of malignant tumors, it is essential to determine the patient's kidney and liver health status during the growth examination, which includes testing for abnormalities in red blood cells. By doing so, we can pinpoint the specific source of the pathology. For two days, blood samples are kept at a temperature of 18–20 degrees Celsius for lactate dehydrogenate analysis. Cold temperatures cause the enzymes to vanish, therefore the end product shouldn't be frozen. Table 3 displays the results of the comparison of LDH Management.

Table 3: Comparison of LDH Management (in %)

INPUTS	BLCP	PBLV	MLPB	MLPA	PBLL
100	67.79	67.93	39.84	53.27	82.40
200	69.42	69.67	41.42	54.69	83.69
300	69.90	72.01	43.62	55.95	84.70
400	71.19	72.82	45.25	57.94	85.59
500	73.30	75.11	46.39	60.41	85.96
600	74.79	77.04	48.59	61.85	87.00
700	76.60	78.77	49.74	63.57	87.77

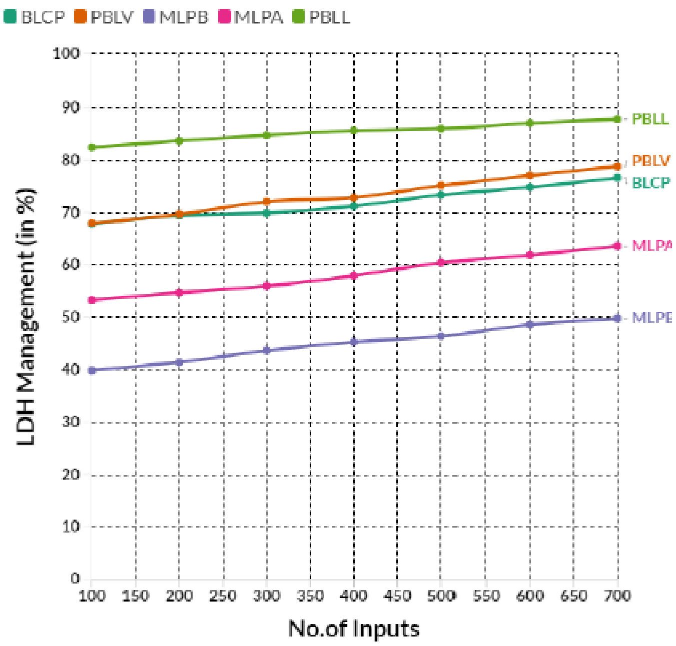


Fig 5: Comparison of LDH Management

Figure 5 displays the results of the assessment based on LDH management. The suggested PBLL was able to attain 85.59% of LDH Management in a cutoff threshold. Along the same lines, from

BLCP 71.19%, PBLV 72.82%, MLPB 45.25 %,

and MLPA 57.04% were all attained by the current group. The outcomes of LDH Management were improved by the suggested model when compared to the current models.
D. Care of Blood Lactate
There is a gender difference in the typical levels of LDH in healthy individuals. Levels and markers also vary by gender in both children and adults. Blood lactate levels are consistently elevated in infants. Because the findings must be interpreted in light of the child's age group and his physical signs, it is the responsibility of a competent physician to comprehend the study. Table 4 shows the results of comparing blood lactate management.

Table 4: Comparison of Blood lactate Management (in %)

INPUTS	BLCP	PBLV	MLPB	MLPA	PBLL
100	66.53	75.67	47.40	61.71	81.66
200	66.86	77.17	47.99	63.58	82.70
300	68.20	78.28	48.97	64.41	82.83
400	69.34	78.66	50.18	65.32	83.79
500	70.39	79.67	51.32	66.24	83.36
600	71.10	80.60	52.43	67.57	84.60
700	72.40	81.60	53.13	68.44	84.71

managed blood lactate to an extent of 83.79 percent. In the same range, MLPB attained 50.18%, PBLV 78.66%, the present BLCP 69.34%, and MLPA 79.66%. 65.320 percent. When compared to other models, the suggested one improved blood lactate management.

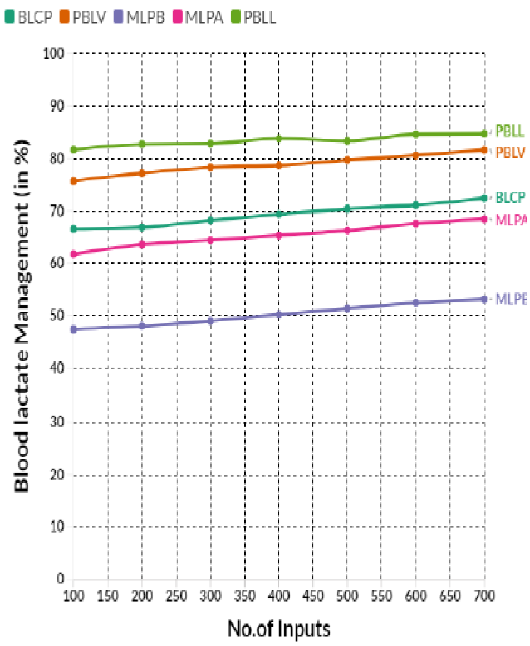


Fig 6: Comparison of Blood lactate Management

Additionally, indicators are computed using activity levels. As expected, the LDH level rises when the youngster plays an active role in athletic activities. Along with it, the indication in the The gender of the female is less prominent than that of the male. Units of measurement and norm indicators may have different definitions in different laboratories. To get the temperature up and include an enzyme or other catalytic material. In living things, enzymes are often very specific molecules that speed up a certain process. To illustrate the point, "ATP-ase" enzymes only catalyze the ATP molecule's splitting, but "kinase" enzymes facilitate the ATP molecule's phosphate group exchange. As part of glycolysis operations, lactate dehydrogenase facilitates the conversion of lactate to pyruvate. The process results in the formation of the crucial coenzyme NADH, which stands for reduced nicotinamide adenine dinucleotide.

CONCLUSION

Many variables impact the prediction since the development of LDH indices is influenced by dying tissue. To what extent are necrotic alterations present, the pinpointing the dying tissue, the level of damage, the existence of comorbid conditions, and the efficacy of therapy. Finding fatalities early on, rather than in critical organs, improves prognosis, allows for more effective treatment, and increases the likelihood that patients will follow all preventative measures prescribed. The outlook takes a turn for the worse when important organ tissue, such as that of the heart, liver, or brain, perishes. In this context, the rate of death and the efficacy of the recommended therapy are crucial factors. A number of disorders, both particular and general, may be better understood by looking at LDH in biochemical blood tests. Laboratory pathology determination and, in certain cases, patient recovery dynamics monitoring both need LDH (lactate dehydrogenase).

REFERENCES

[1]. Mamandipoor, B., Majd, M., Moz, M., & Osmani, V. (2020). Bloodlactate concentrat ion predict ion in critical care. In DigitalPersonalized Health and Medicine (pp. 73-77). IOS Press.

[2]. Mamandipoor, B., Yeung, W., Agha-Mir-Salim, L., Stone, D. J.,Osmani, V., & Celi, L. A. (2022). Predict ion of blood lactate values incrit ically ill pat ients: a retrospect ive mult i-center cohort study. Journalof clinical monitoring and computing, 36(4), 1087-1097.

[3]. Sughimoto, K., Levman, J., Baig, F., Berger, D., Oshima, Y.,Kurosawa, H., ... & Miyaji, K. (2022). Machine learning predictsblood lactate levels in

children after cardiac surgery in paediat ric ICU.Cardiology in the Young, 1-8.

[4]. Mahmoud, E., Al Dhoayan, M., Bosaeed, M., Al Johani, S., & Arabi,Y. M. (2021). Developing machine-learning predict ion algorithm forbacteremia in admitted pat ients. Infect ion and Drug Resistance, 14,757.

[5]. Heldt, F. S., Vizcaychipi, M. P., Peacock, S., Cinelli, M., McLachlan,L., Andreott i, F., ... & Khan, R. T. (2021). Early risk assessment forCOVID-19 pat ients from emergency department data using machinelearning. Scient ific reports, 11(1), 1-13.

[6]. Aktar, S., Ahamad, M. M., Rashed-Al-Mahfuz, M., Azad, A. K. M.,Uddin, S., Kamal, A. H. M., ... & Moni, M. A. (2021). Machinelearning approach to predict ing COVID-19 disease severity based onclinical blood test data: stat ist ical analysis and model development.JMIR medical informatics, 9(4), e25884.

[7]. Olaetxea, I., Valero, A., Lopez, E., Lafuente, H., Izeta, A., Jaunarena,I., & Seifert , A. (2020). Machine learning-assisted Ramanspectroscopy for pH and lactate sensing in body fluids. Analyt icalChemist ry, 92(20), 13888-13895.

[8]. Seo, D. W., Yi, H., Park, B., Kim, Y. J., Jung, D. H., Woo, I., ... &Kim, W. Y. (2020). Predict ion of Adverse Events in Stable Non-Variceal Gastrointest inal Bleeding Using Machine Learning. Journalof clinical medicine, 9(8), 2603.

[9]. Giannini, H. M., Ginest ra, J. C., Chivers, C., Draugelis, M., Hanish,A., Schweickert , W. D., ... & Umscheid, C. A. (2019). A machinelearning algorithm to predict severe sepsis and sept ic shock:Development, implementat ion and impact on clinical pract ice. Crit icalcare medicine, 47(11), 1485.

[10]. Kim, K. A., Choi, J. Y., Yoo, T. K., Kim, S. K., Chung, K., & Kim,D. W. (2013). Mortality predict ion of rats in acute hemorrhagic shockusing machine learning techniques. Medical & biological engineering

[11]. & comput ing, 51(9), 1059-1067.

[12]. Convert ino, V. A., Johnson, M. C., Alarhayem, A., Nicholson, S. E.,Chung, K. K., DeRosa, M., & Eastridge, B. J. (2021). Compensatoryreserve detects subclinical shock with more expedit ious predict ion forneed of life - saving intervent ions compared to systolic bloodpressure and blood lactate. Transfusion, 61, S167-S173.

[13]. Rawson, T. M., Hernandez, B., Moore, L. S. P., Blandy, O., Herrero,P., Gilchrist , M., ... & Holmes, A. H. (2019). Supervised machinelearning for the predict ion of infect ion on admission to hospital: aprospect ive observat ional cohort study. Journal of Ant imicrobialChemotherapy, 74(4), 1108-1115.

[14]. Iwase, S., Nakada, T. A., Shimada, T., Oami, T., Shimazui, T.,Takahashi, N., ... & Kawakami, E. (2022). Predict ion algorithm forICU mortality and length of stay using machine learning. Scient ificReports, 12(1), 1-9.

[15]. Wu, W., & Zhou, Z. (2021). A comprehensive way to access hospitaldeath predict ion model for Acute mesenteric ischemia: a combinat ionof t radit ional stat istics and machine learning. Internat ional Journal ofGeneral Medicine, 14, 591.

[16]. Huyut, M. T., & Üst ündağ, H. (2022). P redict ion of diagnosis andprognosis of COVID-19 disease by blood gas parameters usingdecision t rees machine learning model: A ret rospect ive observat ional

[17]. study. Medical Gas Research, 12(2), 60.

[18]. Burdick, H., Lam, C., Mataraso, S., Siefkas, A., Braden, G.,Dellinger, R. P., ... & Das, R. (2020). Predict ion of respiratorydecompensat ion in Covid-19 pat ients using machine learning: TheREADY t rial. Computers in biology and medicine, 124, 103949.

[19]. Pattharanit ima, P., Thongprayoon, C., Kaewput, W., Qureshi, F.,Qureshi, F., Petnak, T., ... & Cheungpasitporn, W. (2021). Machine