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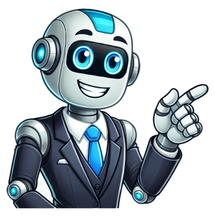

# Blood test ld high

High lactate dehydrogenase (LDH) is your body’s alarm bell: it signals tissue damage. LDH is an unspecific cue, as tissue damage can be due to many different conditions, including infections, liver, heart, kidney and muscle disease, anemia, and cancer. Read on to learn why doctors order this test, what the normal range for this marker is, and what high levels mean. What is Lactate Dehydrogenase (LDH)? Lactate dehydrogenase (also known as lactic acid dehydrogenase, LDH, or LD) is an enzyme found in almost all living things. It plays an important role in energy production in the body [1]. More specifically, LDH helps convert lactate to pyruvate or pyruvate to lactate. This, in turn, leads to more conversion between NAD+ and NADH, which store energy. NADH is used to create ATP, the energy currency of the cells [1]. LDH is found in most tissues of the body. Whenever your cells are damaged or destroyed, the LDH inside them can leak into the bloodstream [2]. This makes LDH a useful tool for identifying tissue damage due to injury or disease. However, LDH is not very specific as a disease marker: it can’t be used to determine the exact cause of tissue damage, and that’s why doctors use it in conjunction with other tests [2, 3]. Lactate Dehydrogenase Test Only a small amount of LDH can be normally found in the blood. However, LDL levels increase when there’s tissue damage somewhere in the body. Your doctor may order an LDH test, usually in conjunction with other tests, to [4]: Check for tissue damage Monitor disorders and disease that cause tissue damage, such as severe infections, hemolytic anemia (abnormal destruction of red blood cells), and liver disease Evaluate some types of cancer or to check if chemotherapy for certain cancers is working Procedure A blood sample is required for the test. In special cases like meningitis or Kawasaki disease, samples may need to be taken from the spinal fluid or urine [5, 6]. Results are reported in units per liter (U/L) or international units per liter (IU/L), where a unit is an arbitrary amount that scientists have made the standard. This value reflects the amount of LDH that has been released into the bloodstream from damaged tissues. Normal Range of LDH In general, normal levels for adults can range from 100 to 250 U/L [7, 8]. Ranges may slightly vary from lab to lab, due to the differences in equipment, techniques, and chemicals used. Children and infants typically have higher LDH levels. Normal ranges depend on the age of the child: newborns can have LDH values over 1,000 U/L, and this level gradually declines until adulthood [9]. Isoenzymes If your LDH result is high, your doctor may also order an LDH isoenzymes test. This test is similar to a normal LDH test but it provides more precise information on where the damage is [10]. There are actually five distinct types, called isoenzymes, of lactate dehydrogenase. Each isoenzyme has a slightly different structure, but they all work in a similar way [11]. The different isoenzymes are also concentrated in different areas of the body, although there is some overlap. Isoenzymes and their areas of high concentration include [12]: An increase in one type of isoenzyme may indicate an injury in the corresponding area; if you have increased LDH-3, your doctor will probably take a closer look at your lungs. If your LDH-5 is high, that may indicate liver damage. Increases in several isoenzymes may signify severe illness or infection affecting the whole body [4]. Ratios comparing one isoenzyme to another are sometimes more helpful than a single isoenzyme. For example, studies suggest that an LDH-1:LDH-2 ratio may provide better diagnostic information about heart injury than LDH-1 alone [13]. CPK Test Creatine phosphokinase (CPK), also known as creatine kinase (CK), is very similar to LDH. Both are enzymes found throughout the body that play a role in energy production [14]. A CPK test also serves a similar function: elevated levels of CPK may indicate tissue damage to the muscles, heart, and brain [14]. In the past, CPK and LDH tests were sometimes used together to evaluate muscle damage or help diagnose a heart attack, but they have been replaced with newer tests nowadays, such as troponin [15, 16]. Take a look at our CPK article for more information on this enzyme. High Lactate Dehydrogenase Levels Many things can increase lactate dehydrogenase. An elevated result is not necessarily a cause for concern. For example, strenuous exercise can temporarily increase LDH [17, 18]. Issues with the specimen (hemolysis) can falsely increase the result. They can happen if the sample was not handled or stored properly or when the sample was difficult to collect. In addition, LDH can be inaccurate if there’s a high number of platelets in the blood [19]. Your doctor will interpret your results, taking into account your medical history, symptoms, and other test results, and will repeat the test if necessary. Causes shown below are commonly associated with elevated LDH levels. Work with your doctor or another health care professional to get an accurate diagnosis. Causes 1) Exercise Muscle damage due to exercise causes a temporary increase in LDH [17, 18, 20]. A small study of 12 men found that aerobic exercise and strength training both cause spikes in LDH, although strength training appears to trigger a greater increase [17]. 2) Infections A number of different infections (including bacterial, viral, and fungal infections) can increase LDH. These include: Infectious mononucleosis (Epstein-Barr virus) [21, 22] Bacterial meningitis [23, 24] HIV [25] Pneumocystis pneumonia [26, 27, 28, 29] Histoplasmosis [30] 3) Heart Attack and Heart Failure Conditions that cause damage or reduce oxygen flow to the heart can elevate LDH. In the past, LDH was used as a lab marker to determine if someone had experienced a heart attack. Information about isoenzymes can be particularly helpful [31]. LDH-2 levels in the body are normally greater than LDH-1. After a heart attack, LDH-1 starts to outnumber LDH-2, a process called “LDH flip.” This change in isoenzyme ratios can help diagnose a heart attack [13, 32]. However, LDH fell out of favor when better lab markers specific to the heart, like troponin, were discovered [31]. LDH also increases in heart failure, which can happen due to various conditions. An example is idiopathic pulmonary arterial hypertension (IPAH) [33]. 4) Liver Disease LDH increases in liver disease and damage, including viral and toxic hepatitis [34]. In acute liver failure, people suddenly and rapidly lose liver function. This form of liver failure massively increases LDH, according to a study of seven patients [35]. 5) Anemia People with anemia don’t have enough healthy red blood cells, which reduces oxygen supply to all their tissues [36]. LDH may help differentiate between various kinds of anemia and monitor disease progression [36]. For example, LDH levels (primarily isoenzymes 1 and 2) rise in hemolytic anemia, a type of anemia caused by an abnormal breakdown of red blood cells [36]. Hemolytic anemia caused by birth defects only slightly raises LDH, while conditions caused by artificial heart valves can increase LDH levels by five times or more [36]. Megaloblastic anemia, wherein certain blood cells become enlarged, can cause LDH levels to skyrocket to 3000 IU/L or more. It is also associated with higher ratios of LDH-1 to LDH-2, which helps distinguish it from other forms of anemia [37]. 6) Brain Inflammation and Injury Meningitis occurs when the protective tissues that surround the brain and spinal cord become inflamed. It is typically caused by an infection, but other factors can lead to meningitis, such as cancer and certain medications [38, 39]. People with meningitis often have high LDH [40]. Testing isoenzymes of LDH may also be useful in identifying the cause of each case of meningitis. A study of 157 children analyzed LDH isoenzymes in various forms of meningitis. They found that bacterial meningitis had uniquely low LDH-2 levels in spite of an increase in total LDH [24]. On the other hand, meningitis not caused by bacteria had relatively high LDH-3 levels. All types of meningitis have high levels of LDH-1, LDH-4, and LDH-5 [24]. Other brain disorders and injuries also increase LDH. In a study of 110 people who experienced a head injury, higher LDH levels were associated with more severe brain damage and a worse prognosis [41]. Finally, stroke increases LDH levels [42]. 7) Kidney Disease Lactate dehydrogenase can increase in kidney damage and disease [43]. 8) Muscle Disease Muscular dystrophy is a group of diseases that cause muscle weakness and breakdown. Out of five types of muscular dystrophy, three greatly increase LDH. The largest rise has been observed in Duchenne muscular dystrophy, which increased LDH levels to four times the normal value [44]. Another condition, called rhabdomyolysis, causes rapid muscle breakdown. In this condition, dying muscle cells release their contents into the blood, including significant amounts of LDH [45]. Rhabdomyolisis can occur due to various causes, including [46, 47]: Crush injury Prolonged immobilization Electrical injury or burns Snake or spider venom As a side effect of some medication and illicit drugs Heat stroke Seizures Viral or bacterial infections 9) Pancreatitis Elevated LDH can indicate tissue damage in pancreatitis (pancreatic inflammation) [48]. 10) Aortic Disorders Acute aortic syndrome (AAS) refers to a group of disorders that all have one thing in common: damage to the inner layer of the aorta – the largest artery that goes from the heart [49]. This syndrome also increases LDH levels, according to a study of 999 emergency room patients whose LDH levels were about 424 U/L [50]. 11) Cancer Many different types of cancer can cause elevations in LDH levels, including: Gastric cancer [51] Prostate cancer [52] Lung cancer [53] Testicular cancer [54] Non-Hodgkin’s lymphoma [55] Oral cancer [56] Renal cell carcinoma [57] Melanoma [58] In most of these cancers, LDH levels can help predict how well a patient will do. A large study of 76 studies including over 22,800 cancer patients found that high LDH levels were strongly associated with lower survival rates in over 10 kinds of cancer [51]. But that’s not all: LDH has quite a unique relationship with cancer. Cancer cells prefer to use a process called glycolysis as an energy source, which takes place without oxygen. This process uses glucose as energy, turning it into pyruvate and lactate. LDH is required for this reaction to occur [59]. This means that LDH may promote the growth and spread of cancer cells, especially at high concentrations [59, 60]. On the bright side, this also means that LDH is a potential target for cancer treatment. Ongoing research is looking at anticancer drugs that can block LDH [60, 59, 1]. 12) Tobacco, Alcohol, and Drugs of Abuse Cigarette smokers have significantly higher LDH levels compared to non-smokers, according to a study of 60 people [61]. It’s not just cigarettes, either. A different study found that people who use chewing tobacco have LDH levels over 400 U/L, on average. This result suggests that tobacco itself, rather than smoke, is the culprit behind this LDH rise [62]. Alcohol can also increase LDH levels [63]. Alcohol, and drugs of abuse, such as heroin, amphetamines, cocaine, and other sedatives or stimulants can cause rhabdomyolysis (muscle tissue breakdown), which increases LDH [64]. Health Effects Many illnesses are associated with high LDH levels. But LDH itself typically does not cause problems; rather, its presence exposes an underlying disease [2]. However, cancer is one case in which LDH does have a direct negative impact on health. Cancer cells use LDH for their energy production, allowing them to grow and spread uncontrolled [59, 60]. Some studies suggest that increased levels of LDH may promote inflammation, leading to even more tissue damage [65, 66]. This has led researchers to consider LDH inhibitors as a possible treatment for a variety of conditions, including cancer, liver failure, and epilepsy [59, 65, 67, 68]. Decreasing LDH While an elevated LDH is not necessarily a cause for concern, it can signal serious underlying diseases and disorders. That’s why the most important thing is to work with your doctor to find out what’s causing your high LDH and to treat any underlying conditions. If you are engaging in intense forms of exercise/training, make sure you are giving your body enough time to recover between sessions [18]. Low Lactate Dehydrogenase Levels Lower LDH is generally not considered a problem. Normally, people do not have low LDH levels unless they have a genetic mutation that causes LDH deficiency, a very rare genetic disorder in which the body cannot properly make the LDH enzyme [69, 70]. Depending on the mutation, LDH deficiency can be without signs or symptoms or it can result in fatigue, muscle pain, skin lesions, and dark urine (caused by high protein levels in the urine due to muscle breakdown) [69, 71]. High vitamin C (ascorbic acid) intake may also cause falsely low LDH results [72]. If your LDH is abnormally low, work with your doctor to get an accurate diagnosis.