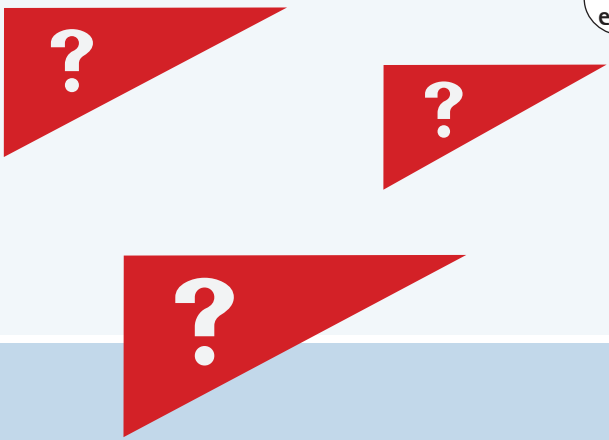
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Liver Function Tests and What They Mean

Deutsche Leberhilfe e. V.



Ingo van Thiel
Editor



Dr. Christoph Niederau
Medical Advisor

Dear Reader,

In this brochure, we would like to provide you with an overview of key liver function tests and what they mean. This guide also covers tests for hepatitis and key auto-antibodies.

Elevated liver test results are not something to be taken lightly and can have many different causes. Particularly if liver function test results are abnormal on more than one occasion, further investigation is essential. Many different factors can damage the liver. The sooner these causes are identified and addressed or treated, the better the chances of protecting the liver from damage.

If you have any questions about your own liver test results, please do not hesitate to speak to your doctor. Deutsche Leberhilfe e. V. will be happy to help you find a medical practice or clinic with experience in liver disease. On our website, www.leberhilfe.org, you will find a list of medical practices and centres specialising in liver disease in Germany. Alternatively, you can contact Deutsche Leberhilfe by telephone on +49 221 2829980 or by email at info@leberhilfe.org.

Deutsche Leberhilfe e. V.

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Last updated: September 2026

Elevated liver test results: What can they tell you?

Deutsche Leberhilfe e. V. receives a wide variety of enquiries about liver function test results. We are not doctors ourselves and cannot diagnose medical conditions. However, drawing on our many years of experience advising patients, we can provide some basic information that we hope will help you when discussing your test results with your doctor.



The liver and liver function tests

The liver is the body's factory and a vital organ. It performs a wide range of functions that are essential to life. The liver plays an important role in digestion, nutrient storage, blood clotting, the removal of toxins, the breakdown of old blood cells, metabolism and immune function.

Blood test results can provide some indication of how well these important processes are functioning: Liver function tests provide an indirect indication of how well – or poorly – the liver is performing these functions. Sometimes they can also indicate that harmful processes are taking place in the liver, meaning that liver cells or bile ducts are being

damaged. Initially, therefore, abnormal liver function test results simply indicate that something is not quite right with your liver.
Elevated liver test results may be an early sign of liver disease. Further medical investigation is therefore important. Chronic liver diseases often progress slowly but can damage the liver and cause scarring over many years, potentially leading to cirrhosis or liver cell cancer at an advanced stage. Early diagnosis can often prevent these complications, as many liver diseases can now be treated effectively.

Key principles and common misconceptions

It is often not possible to determine the cause of elevated liver test results from individual results alone. This depends on your individual circumstances – in other words, why you are reading this brochure. The following questions are particularly important when interpreting your test results – both for you and your doctor:

- Are you still undergoing medical investigations? Have you recently had elevated liver test results for the first time without knowing why?
- Have you already been diagnosed with a liver disease? This could be, for example, a hepatitis infection, fatty liver disease with inflammation, alcohol-related liver damage or an autoimmune or metabolic disorder.
- Have you previously been diagnosed with liver damage, such as cirrhosis?

The significance of an elevated liver test result therefore depends on your overall circumstances, including whether you have any other abnormal laboratory results or findings (e.g. from an ultrasound scan) and your medical history – in other words, whether you have a previous diagnosis of liver disease or another medical condition.

We frequently encounter certain misconceptions about laboratory test results when providing advice. These misconceptions can usually be cleared up quickly during the first consultation.

- A single liver test result is not enough to determine whether your liver is damaged or, if so, to what extent. You cannot, therefore, say, "*If my gamma-GT is at a certain level, I have cirrhosis*".
- Elevated liver test results may be a sign of harmful processes in the liver, but they are *not* the cause. Liver test results are not "toxins" and do not attack the liver.
- For the standard liver function tests – gamma-GT, GOT and GPT – there is no threshold comparable to a fever of 42°C, "above which it becomes fatal". Elevated liver test results are like an alarm system – a signal from the liver that something is wrong. However, the more elevated the results, the louder the warning signal and the more urgent the need for further investigation.
- In advanced liver disease, characteristic patterns of *multiple* abnormal laboratory results can sometimes suggest liver damage. However, you should leave the interpretation of these results to experienced doctors. And: to confirm suspected liver damage, the liver itself must be examined (e.g. using ultrasound or other imaging tests).
- If there is an arrow symbol before a number on your laboratory report, the number that follows is usually *not* your actual test result. "<" means "less than" and ">" means "greater than". This usually indicates a reference limit, meaning that a result is considered normal if it falls below the specified value.
- The same liver function test result can have very different meanings depending on the context. A significantly elevated bilirubin level in someone with cirrhosis raises concerns that liver function is declining. However,

a slightly elevated bilirubin level in someone with Gilbert's syndrome is of little clinical significance and may cause troublesome yet harmless episodes of jaundice.

Gamma-GT (γ-GT, GGT)

Gamma-glutamyl transferase

Men: below 60 U/L (below 1.0 µkat/L)
Women: below 40 U/L (below 0.67 µkat/L)

Gamma-GT is produced in the small bile ducts of the liver. It is highly sensitive and can rise in response to temporary strain on the liver, as well as in various diseases of the liver and bile ducts.

GGT levels may rise in various liver conditions: Fatty liver disease, viral hepatitis, bile duct diseases such as PBC and PSC, gallstones, autoimmune hepatitis, cirrhosis, liver tumours and metastases, medicines, environmental toxins or alcohol-related liver disease. Gamma-GT levels may also rise temporarily following temporary strain on the liver, such as alcohol consumption the previous evening.

However, elevated gamma-GT levels are not always caused by liver disease: Other medical conditions can also cause gamma-GT levels to rise. If gamma-GT is the only elevated liver test result, heart disease and diabetes mellitus should also be ruled out as a precaution. Diseases of the kidneys and the pancreas can also cause gamma-GT levels to rise.

Although an elevated gamma-GT level on its own does not reveal much, it should prompt you to seek medical advice to investigate the underlying cause. Particularly when the gamma-GT level is not the only elevated liver test result, it is often a key piece of the diagnostic puzzle.

Therefore, if your gamma-GT level is elevated, there is no cause for panic – but make sure you have it investigated further.

Liver function tests – transaminases

Aminotransferases

GOT/AST: Glutamate-oxaloacetate transaminase/ Aspartate aminotransferase
Men: below 50 U/L (below 0.85 µkat/L)
Women: below 35 U/L (below 0.60 µkat/L)

GPT/ALT: Glutamate-pyruvate transaminase/ Alanine aminotransferase
Men: below 50 U/L (below 0.85 µkat/L)
Women: below 35 U/L (below 0.60 µkat/L)

GOT and GPT are found mainly in the cell cytoplasm and, to a lesser extent, in the mitochondria of liver cells. These two enzymes play an important role in protein and amino acid metabolism. Small amounts of these transaminases are released naturally when old liver cells die and are broken down.

Neither of these transaminases is found exclusively in the liver. GPT is also found in the kidneys and skeletal muscles, amongst other places. GOT, meanwhile, is present in the heart muscle, skeletal muscles and brain.

Elevated GOT and GPT levels may indirectly indicate that an increased number of liver cells are dying as a result of inflammation or another condition. If liver function test results are elevated, various forms of liver inflammation should be investigated, such as acute or chronic viral hepatitis, fatty liver disease with inflammation and autoimmune hepatitis. These enzyme levels may also rise in cases of cirrhosis, liver tumours and metastases, as well as in diseases of the bile ducts. The higher these enzyme levels are above the normal range, the greater the concern about severe inflammation or other ongoing damage to the liver. Occasionally, GOT and GPT levels may also rise in response

to other conditions, such as a heart attack or a pulmonary embolism.

If both levels are elevated, your doctor will also consider how they compare with each other. If the GPT level is more elevated than the GOT level, this often suggests liver inflammation, for example due to hepatitis viruses, fatty liver with inflammation or autoimmune hepatitis. If the GOT level is significantly more elevated than the GPT level, this may indicate more severe liver damage and/or exposure to toxins, for example through increased alcohol consumption. However, a word of caution: if the GOT level



is higher than the GPT level, this is only an initial indication, not proof. There may also be other causes unrelated to alcohol, and in order to establish objectively whether liver damage is present, it is necessary to examine the liver itself, for example using ultrasound or other methods.

GOT levels can rise or fall by 10 to 15 percent within a single day, while GPT levels can fluctuate by even as much as 10 to 30 percent. Following strenuous physical exertion, GOT and GPT levels may also be temporarily elevated. Medical investigation is always important, particularly if liver test results are elevated on more than one occasion.

How urgently further investigation is needed depends partly on how elevated the liver test results are. Persistently elevated liver test results are generally not a good sign. In

the case of most liver diseases, however, the damage develops gradually over months and years. If GOT and GPT levels are, for example, five to ten times higher than normal, this is of course far too high and, in the long term, gives cause for concern about liver damage; however, in most cases, those affected still have time to wait a few weeks for an appointment at a specialist's surgery or a liver clinic. However, you must discuss with your doctor whether it is possible to wait: sometimes there are other factors that require more urgent action.

In cases of severe liver cell damage, GOT and GPT levels may be extremely elevated and may even reach several thousand U/L. These are often **emergencies** that require immediate admission to hospital.

Recognising rare emergencies

In rare cases, a medical emergency may arise in which liver failure poses a risk to life. Possible causes include mushroom poisoning (e. g. death cap mushrooms), medication overdoses (e. g. paracetamol overdose), right-sided heart failure, Budd-Chiari syndrome and exceptionally severe cases of acute viral hepatitis or acute autoimmune hepatitis. These and other causes can lead to emergencies.

Medical help should be sought as soon as possible if any of the following warning signs are present:

- extremely elevated liver test results (e. g. more than 100 times the normal level)
- a marked deterioration in liver function tests such as cholinesterase, Quick/INR and albumin
- symptoms of liver failure, e. g. ascites (fluid build-up in the abdomen), vomiting blood or jaundice (yellowing of the skin and eyes) *accompanied by* reduced alertness

Alkaline phosphatase (AP, ALP)

Total
Men: 40–129 U/L
Women: 35–105 U/L

Alkaline phosphatase is an enzyme found primarily in the bile ducts, but also in liver cells. However, AP is also found outside the liver, including in bones and kidneys.
Elevated alkaline phosphatase levels are therefore particularly common in cases of disease or obstruction of the bile ducts. Such elevations may indicate disease of the liver or gallbladder, as well as inflammation or obstruction of the bile ducts associated with cholestatic liver diseases: These include, for example, primary biliary cholangitis (PBC) and primary sclerosing cholangitis (PSC).
AP levels may also rise as a result of kidney or bone disorders, as well as bone fractures. They may also be elevated during pregnancy, in cases of sarcoidosis or Epstein-Barr virus infection, or as a result of certain medicines (antiepileptic drugs, thiamazole, chlorpromazine, oestrogens or progestogens). If AP is the only elevated "liver function test", this may – but does not necessarily – indicate a liver problem. It is therefore helpful to check other liver test results as well, such as gamma-GT: If other liver test results are also abnormal, this provides much stronger evidence that the liver is involved. A specialist assessment is important in this case too.
In some cases, alkaline phosphatase levels may also be too low. In this respect, AP differs from the liver enzymes gamma-GT, GOT and GPT, for which values are never considered problematic simply because they are low. A low alkaline phosphatase level may occur, for example, with hypothyroidism, Wilson's disease (a copper storage

disorder), zinc or magnesium deficiency, severe vitamin C deficiency (scurvy), anaemia, following bypass surgery or while taking contraceptives.

Bilirubin

Adults – Total bilirubin in serum/plasma
Men: up to 1.4 mg/dL (up to 24 µmol/L)
Women: up to 0.9 mg/dL (up to 15 µmol/L)

Bilirubin is a yellowish-brown bile pigment. It is produced when old red blood cells (erythrocytes) break down. Bilirubin is transported to the liver in the bloodstream. It then passes into the intestine in the bile. Most of it is excreted in the stool and, to a lesser extent, in the urine.

Elevated bilirubin levels often cause jaundice (icterus): The whites of the eyes take on a yellowish tinge; if bilirubin levels rise significantly, the skin may also turn yellow.

The significance of an elevated bilirubin level depends on the overall clinical picture, including other laboratory results, diagnostic findings and your medical history.

If bilirubin is the only slightly elevated laboratory result and there are no other signs of liver disease, this is often simply due to a common and harmless metabolic disorder in which bilirubin is broken down more slowly (Gilbert's syndrome).

In cases of acute and chronic liver and biliary diseases, bilirubin provides indirect information about how well the liver and bile ducts are currently functioning. Elevated bilirubin levels are found, for example, in acute and chronic hepatitis infections, cholestasis, fatty liver disease, liver cirrhosis and liver tumours. If cirrhosis is already present and bilirubin levels rise, this may be a warning sign that liver function is deteriorating and/or that anaemia is

present. Medicines can also cause an increase in bilirubin levels. Elevated bilirubin levels may also indicate blood disorders in which red blood cells break down and release increased amounts of bilirubin, known as haemolytic anaemias. These include, for example, glucose-6-phosphate dehydrogenase deficiency, thalassaemia and spherocytosis.

Albumin

Adults: 34–48 g/L

Albumin is an important transport protein in the body. The body maintains a constant reserve of 300 g of albumin and produces around 12 g of this protein every day. Bilirubin, for example, binds to albumin so that it can be transported in the bloodstream to the liver, where it is broken down. Albumin is also essential for maintaining fluid balance and tissue pressure.

Albumin levels may be too low in people with advanced liver cirrhosis, for example. If too little albumin is present or produced, the body's fluid balance can also be disrupted. Fluid can leak into the tissues, leading to fluid build-up in the abdomen (ascites) and fluid retention (oedema).

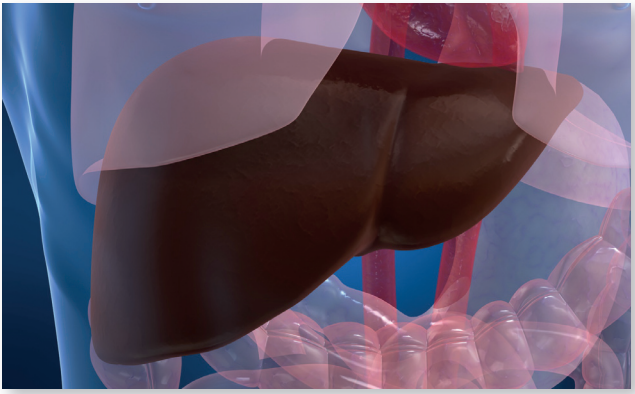
Albumin levels may also be low in cases of diarrhoea, starvation or kidney disease.

Glutamate dehydrogenase (GLDH)

Men: up to 7 U/L
Women: up to 5 U/L

Glutamate dehydrogenase is abbreviated to GLDH. This enzyme is involved in energy metabolism and is found in all the body's cells, but is particularly abundant within liver cells. There, GLDH is active in the mitochondria, the powerhouses of liver cells. Among other things, the enzyme plays an important role in the production of the amino acid glutamate and in the breakdown of harmful ammonia, which is produced during digestion.

Elevated GLDH levels are a warning sign of more severe liver damage. While GOT and GPT levels are often elevated even in the early stages of cell damage, GLDH levels only rise once liver cells have been completely destroyed. Elevated GLDH levels are found, for example, in chronic hepatitis, liver cirrhosis, liver cancer, mushroom poisoning, jaundice caused by obstruction of the bile ducts (obstructive jaundice) or in rejection reactions following a liver transplant. In practice, GLDH tends to be measured less frequently – when it is measured, the purpose is to supplement general liver function tests.



Lactate dehydrogenase (LDH)

Men and women: below 250 U/L

LDH is an enzyme found in all the body's cells. Particularly high concentrations are found in the liver, red blood cells, skeletal muscles and the heart muscle.

LDH plays an important role in lactic acid metabolism. Elevated LDH levels can occur in cases of liver and biliary tract disorders. Other possible causes include heart attacks, myocarditis, pulmonary embolisms, muscle disorders or blood disorders. LDH is also measured relatively rarely as part of a general liver assessment.

Cholinesterase (CHE)

Men and women over 40 years of age:
5,320–12,920 U/L
Women under 40 (not pregnant):
4,260–11,250 U/L
Women under 40 (pregnant or taking the pill):
3,650–9,120 U/L

Cholinesterase is an enzyme produced in liver cells. Cholinesterase provides an indication of how well the liver is still able to produce proteins.

Low CHE levels can be caused by a variety of factors, such as chronic liver inflammation (hepatitis), liver cirrhosis or liver tumours. However, a low cholinesterase level does not necessarily result from liver disease. Other possible causes of low CHE levels include poisoning with alkyl phosphates, kidney failure, hypothyroidism, certain medicines (oestrogens, diazepam and propranolol) or severe burns.

Elevated CHE levels are frequently seen in people with diabetes or coronary heart disease. Other causes include metabolic syndrome, protein loss (e. g. due to nephrotic syndrome or exudative gastroenteropathy), alcohol-related fatty liver disease or familial hypertriglyceridaemia (a lipid metabolism disorder).
In rare cases, inherited CHE variants can also cause CHE levels to be too high or too low.

Other important laboratory values: Quick value, total protein and ammonia

Some laboratory test results are not liver function tests in the strict sense, but provide additional important information on how well – or poorly – a diseased liver is still functioning.
The **Quick value** (a measure of blood clotting) and **total protein** levels are often reduced in cases of impaired liver function. **Ammonia** levels, on the other hand, may be elevated, as ammonia is a toxic by-product produced during digestion. We can only provide a brief overview of these laboratory test results in this brochure, as a more detailed description would go beyond its scope:

- **Total protein – protein metabolism**
  Adults 6.6–8.7 g/dL
- **Prothrombin time (PT) = Quick value 70–120 %**
  15–25 % during anticoagulant treatment,
  2.0–4.5 as INR
- **Ammonia: Adults below 82 µg/dL (reference ranges vary between laboratories)**
  Ammonia concentrations above 300 µg/dL usually lead to a comatose state.

Diagnosis of fatty liver disease

Metabolic dysfunction-associated steatotic liver disease (MASLD) affects up to a quarter of the population in Germany – often people who are overweight, physically inactive, have a poor or unbalanced diet, or have insulin resistance or type 2 diabetes. Fatty liver is also not uncommon in people of normal weight whose body fat is distributed unfavourably (e.g. with a "spare tyre" around the waist).



In some cases, a fatty liver may also become inflamed. This is known as **metabolic dysfunction-associated steatohepatitis (MASH)**. In people with MASH, the risk of liver damage and heart disease is significantly increased.

An **ultrasound scan (sonography)** is more informative than liver test results for the initial diagnosis of fatty liver. On an ultrasound scan, a fatty liver often appears bright and enlarged. Various liver test results, such as GGT, GOT, GPT or alkaline phosphatase, may be elevated in cases of fatty liver, but may also indicate numerous other liver diseases. General blood lipid levels, such as cholesterol and triglycerides (which are not discussed in detail in this brochure), may also be abnormal.

The difference between simple fatty liver and fatty liver with inflammation can usually only be determined by a liver biopsy. Elevated liver test results may be an indirect indication of

liver inflammation, but they are not reliable in this respect. Lifestyle changes, including a healthy diet, exercise and abstaining from alcohol, can help reverse fatty liver or fatty liver with inflammation and are therefore the most important measures for treating these conditions. The first medicines for the treatment of MASH have recently become available. Fatty liver disease can sometimes also occur in people who do not appear to have any of the risk factors mentioned above. In such cases, a specialist medical assessment is advisable to investigate other possible causes, such as genetic metabolic disorders.

Diagnosis of alcohol-related liver disease

Excessive alcohol consumption can also cause alcohol-related liver disease (ALD), including fatty liver and fatty liver with inflammation. In its end stage, the disease may progress to liver cirrhosis.

Diagnostic investigations such as an ultrasound scan and, if necessary, a liver biopsy cannot reliably determine whether fatty liver is caused by alcohol or has other causes.

It is important to ask those affected about their alcohol consumption. Additional indications include an alcohol test if recent alcohol consumption is suspected, and typical signs associated with alcohol consumption that may be observed during a medical examination (e.g. the smell of alcohol on the breath, an unsteady gait and slurred speech). While certain combinations of liver and other laboratory test results cannot conclusively establish alcohol misuse, they may raise suspicion:

- Elevated **gamma-GT**
- **AST** more elevated than **ALT**
- Elevated **CDT** and **MCV** levels

CDT: Carbohydrate-deficient transferrin

Normal, i.e. no indication of chronic excessive alcohol consumption:
below 2.47 % of total transferrin

MCV: Mean corpuscular volume

Adults: 83–97 fL

Elevated CDT levels are often found in cases of chronic excessive alcohol consumption. Other causes of elevated CDT levels may include pregnancy and rare liver diseases such as PBC or autoimmune hepatitis.

MCV is a measure of the average volume of red blood cells. It can be elevated in cases of alcohol misuse, but also in cases of vitamin B12 and folic acid deficiency.

There is no laboratory test that can conclusively prove that a person does *not* consume alcohol. If proof of abstinence is important (e.g. for a medical-psychological assessment for a driving licence or inclusion on a transplant waiting list), a hair sample may show that no alcohol has been consumed in recent weeks.

If in doubt, other causes of liver disease should be ruled out in cases of elevated liver test results. This also applies even when excessive alcohol consumption is a known factor, as another liver disease may also be present (e.g. chronic viral hepatitis), or there may be additional risk factors for fatty liver, such as obesity and diabetes.

For alcohol-related liver damage, only consistent abstinence from alcohol will help: in the early stages of alcohol-related fatty liver or fatty liver with inflammation, the damage can still be completely reversed. Even in the advanced stages of alcohol-related cirrhosis, giving up alcohol can significantly prolong life expectancy.

Diagnosis of viral hepatitis

There are currently five known hepatitis viruses: A, B, C, D and E. These vary considerably and are transmitted and treated differently in each case. However, it is possible to become infected with several of these viruses at the same time or one after the other.

Diagnosis of hepatitis A

HAV-IgG negative **HAV-IgM** negative	**The person is healthy and has not been vaccinated.** *No risk of transmission.* *Exception: The infection is so recent that it cannot yet be detected.*
HAV-IgG negative **HAV-IgM** negative **HAV RNA** detected in stool	**Very recent infection** *at the end of the incubation period. Risk of transmission.*
HAV-IgG positive **HAV-IgM** positive	**New or recent infection.** *Risk of transmission. Continue with follow-up testing. As the infection clears, usually after three to six months, HAV-IgM normally disappears.*
HAV-IgG positive **HAV-IgM** negative	**Resolved infection** or **successful vaccination.** *No risk of transmission.* *The person is protected against a new infection with hepatitis A.*

The hepatitis A virus is transmitted through contact with hands, surfaces or objects contaminated with faeces, as well as through contaminated water, food and drinks. Hepatitis A resolves on its own and never becomes chronic,

but it can be severe, particularly in people with liver disease and older adults. Vaccination can prevent infection. Two laboratory test results are usually sufficient to diagnose hepatitis A:

- the **HAV-IgM** antibody, which becomes detectable shortly after infection, and
- the **HAV-IgG** antibody, which becomes detectable later in the course of the infection and remains present after recovery.

Antibodies are the body's immune response to the virus. It is not usually necessary to perform other laboratory tests. If a very recent infection is suspected, **HAV RNA** can also be tested for in a stool sample, as it becomes detectable even earlier than the antibodies.

Diagnosis of hepatitis B

Three markers are important for the initial diagnosis of hepatitis B virus (HBV) infection. These can already indicate whether a person is uninfected, currently infected, has recovered from an infection or has been vaccinated.

- **Hepatitis B surface antigen (HBsAg):** Part of the surface of the virus. Confirms hepatitis B infection and disappears once the infection has cleared. People aged 35 and over who are covered by health insurance in Germany can have this test carried out once free of charge as part of the "health check-up" ("Gesundheitsuntersuchung") .
- **Anti-HBs (HBs antibody)**: An antibody produced by the immune system against HBsAg. It is found in healthy vaccinated people or after spontaneous recovery and indicates immunity to hepatitis B.
- **Anti-HBc (HBc antibody):** An antibody against the viral core. It is found only in people who have been

infected and remains detectable, regardless of whether the infection clears up or not. In healthy vaccinated individuals, this value is always negative.

If acute or chronic hepatitis B is diagnosed, other test results may also be important. These include:

- **Hepatitis B e antigen (HBeAg):** Part of the virus. It is often detectable in acute (= new) infections and is also often detectable during the first few years of chronic infection. The virus often replicates very rapidly when HBeAg is present. In cases of long-standing chronic infection, this antigen is often no longer detectable. In the event of spontaneous recovery, this disappears along with the HBs antigen.
- **Anti-HBe:** An antibody produced by the immune system against the HBe antigen.
- **HBV DNA:** Genetic material of the hepatitis B virus. This marker is monitored repeatedly, particularly in cases of chronic hepatitis B infection, to assess the course of the infection and the response to antiviral treatment.

Hepatitis B can be transmitted through almost all bodily fluids, particularly blood. Infection can also occur through vaginal secretions, semen and, in some cases, saliva and tears. Hepatitis B can clear up on its own, but it can also become chronic. Chronic infections can lead to cirrhosis or liver cancer after several years. Modern medicines can control viral replication in chronic hepatitis B infections, thereby reducing the risk of transmission to others and the risk of liver damage. Unfortunately, modern medicines are usually unable to cure a hepatitis B infection. Research is being carried out into better medicines (information correct as of 2026).

There is a vaccine against hepatitis B. This also provides indirect protection against the hepatitis D virus, which can only infect people who also have hepatitis B.

Initial diagnosis of hepatitis B

Possible combinations and what they usually mean

Infected patient (acute or chronic)

☒ HBsAg positive = The virus is present.
☐ Anti-HBs negative* = No immune protection
☒ Anti-HBc positive = There has been exposure to HBV.

Recovered patient

☐ HBsAg negative = The virus is no longer present.
☒ Anti-HBs positive* = Immune protection
☒ Anti-HBc positive = There has been exposure to HBV.

Patient who recovered a long time ago

☐ HBsAg negative = The virus is no longer present.
☐ Anti-HBs negative = Immune protection is no longer detectable (but is probably still present, although not visible in the test results).
☒ Anti-HBc positive = There has been exposure to HBV.

Healthy, vaccinated patient

☐ HBsAg negative = The virus is not present.
☒ Anti-HBs positive = Immune protection
☐ Anti-HBc negative = There has never been any exposure to the actual hepatitis B virus.

Healthy but not vaccinated**

☐ HBsAg negative = The virus is not present.
☐ Anti-HBs negative = No immune protection
☐ Anti-HBc negative = There has never been any exposure to the actual hepatitis B virus.

* *"Anti-HBs negative" means less than (<) 10 IU/L; a positive result is indicated by levels greater than (>) 10 IU/L.*

** *Note: Shortly after an infection or vaccination, these results may still be negative as well.*

Diagnosis of hepatitis C (HCV)

Anti-HCV negative	*No evidence of exposure to hepatitis C (or a recent infection)*
Anti-HCV positive **HCV RNA positive**	*Acute or chronic hepatitis C infection*
Anti-HCV positive **HCV RNA negative**	*Resolved hepatitis C infection*
Anti-HCV negative **HCV RNA positive**	*Recent infection*

For the initial diagnosis of hepatitis C, testing is usually initially limited to antibodies: anti-HCV. This marker usually becomes positive six to nine weeks after infection. People aged 35 and over who are insured in Germany are entitled to one free anti-HCV test as part of the "health check-up" (formerly "Check-up 35"). Antibodies are an immune response to the hepatitis C virus. These antibodies are present in acute and chronic infections and often persist for a long time even after recovery. If the antibody test is negative, further testing for hepatitis C is usually not carried out – unless there has been a potential exposure to the virus only recently. In cases of weakly positive HCV antibody results, a so-called HCV immunoblot is sometimes carried out as well; this will not be discussed in detail here. If the HCV antibody test is positive, this does not yet indicate whether the infection is still present or has already cleared. Even a positive immunoblot cannot distinguish between the two. A second, more complex PCR test is then carried out to clarify the hepatitis C diagnosis. This tests for

HCV RNA, the genetic material of the virus. If HCV RNA is detected, a hepatitis C infection is present.

Hepatitis C is transmitted through blood that enters the bloodstream or mucous membranes of an uninfected person. A new infection only clears up on its own in a minority of cases – instead, it usually becomes chronic. If left untreated, hepatitis C can lead to cirrhosis and liver cancer after several years. There is no vaccine against hepatitis C, but the infection can almost always be cured with modern medication. When the infection is cured, HCV RNA disappears permanently, while only HCV antibodies remain detectable as an immune response. However, people who have recovered are not immune and can become infected again if they come into contact with the virus once more.

Diagnosis of hepatitis D (HDV)

HDV occurs only in people with hepatitis B.

HBsAg positive	*There is a hepatitis B infection.*
Anti-HDV positive	*A positive anti-HDV antibody result should always prompt a PCR test for HDV RNA.*
HDV RNA positive	*The genetic material of the virus can be detected in a PCR test. This confirms an active HDV infection.*

The hepatitis D virus (HDV) never occurs on its own, as it is dependent on the envelope (HBsAg) of the hepatitis B virus. Healthy people who have been vaccinated against hepatitis B are therefore also indirectly protected against hepatitis D. HDV is transmitted in a similar way to hepatitis

B. An infection can occur with both viruses at the same time (co-infection) and may resolve spontaneously, but it can also become chronic. Occasionally, a person may initially have only chronic hepatitis B and may later become infected with hepatitis D as well (superinfection).
Chronic hepatitis B and D infections are very damaging to the liver, but can now be effectively treated with medication. It is therefore important, in cases of chronic hepatitis B infection, to also investigate the possibility of a hepatitis D virus infection. Treatment greatly reduces the hepatitis D viral load (HDV RNA) and normalises elevated liver test results, indicating a reduction in liver inflammation. At the time of this brochure (2026), it is not yet clear to what extent hepatitis D treatment merely suppresses the virus or whether prolonged treatment might also lead to a cure.

Diagnosis of hepatitis E (HEV)

Anti-HEV IgM positive **Anti-HEV IgG** negative, becoming positive later	*Indication of a recent hepatitis E infection*
Anti-HEV IgM negative **Anti-HEV IgG** positive	*Hepatitis E infection that has been present for some time or has resolved*
HEV RNA detectable in blood or stool	*Confirms a current hepatitis E infection; a complex PCR test, but useful in cases of doubt or where complications or a chronic course are suspected*

The hepatitis E virus is very widespread in Germany. As with hepatitis A, infection occurs through contact with hands,

surfaces or objects contaminated with faeces, as well as through contaminated food, water and drinks. In Germany, raw meat from domestic pigs, wild boar and other game (e. g. raw minced pork or steak tartare) is also a common route of transmission. Blood products are now tested for hepatitis E as well as hepatitis B and C. Most hepatitis E infections clear up on their own without causing any lasting effects.



In people with severely weakened immune systems (e. g. following an organ transplant), the infection may become chronic and lead to cirrhosis within a few years. Severe acute illness, including liver failure, has been reported in people with liver disease and in pregnant women. In rare cases, the infection leads to neurological complications such as pain or paralysis, which may resolve completely or partially as the infection clears up. In such cases, hepatitis E can be treated with medication, which can cure chronic or severe acute infections.

There is no vaccine against hepatitis E in Europe or the USA. In China, there is a vaccine against a different subtype of hepatitis E (genotype 1), and it is unclear whether this would also protect against genotype 3, which is prevalent in Germany.

Autoantibodies in PBC, PSC and AIH

In autoimmune diseases, the body's own immune system malfunctions. The body's own proteins are mistakenly attacked as hostile "antigens", and body cells are destroyed. The three most well-known autoimmune liver diseases are **autoimmune hepatitis (AIH)**, **primary biliary cholangitis (PBC)** and **primary sclerosing cholangitis (PSC).** In autoimmune hepatitis, the liver cells – the hepatocytes – are the target. In PBC and PSC, the bile ducts are attacked first. These conditions are lifelong. For PBC and autoimmune hepatitis, there are drug treatments that can reduce or even halt liver damage. For now, PSC is merely monitored and complications are treated. The first drug treatment is expected in the near future (information correct as of September 2026).

Depending on the condition, the immune system may produce so-called autoantibodies, which target the body's own cellular structures. **Important: Autoantibodies alone are not sufficient for a definitive diagnosis.** However, they form an important part of the diagnostic process, which includes further laboratory tests, examinations of the affected organs, ruling out other causes and speaking with the person affected.

PBC: Diagnosis is usually based on abnormal AMA-M2 results and elevated alkaline phosphatase levels; with this combination of findings, PBC is generally considered confirmed. Immunoglobulin M (IgM) is also often elevated. In cases of doubt, further autoantibody tests and/or a liver biopsy may provide clarification. **PSC** is complex to diagnose and requires specialist assessment. Magnetic resonance cholangiopancreatography (MRCP) often provides more reliable results than blood tests. If bowel disease is also present, this strengthens the suspicion of PSC. Immunoglobulin G and autoantibodies

Reference ranges for autoantibodies

AMA – antimitochondrial antibodies
IF (qualitative): negative/titre below 1:40

ANA – antinuclear antibodies
titre up to 1:80 (IFT)

SMA – antibodies against smooth muscle
titre up to 1:80 (IFT)

SLA – antibodies against soluble liver antigen
below 20 U/mL

p-ANCA – perinuclear anti-neutrophil cytoplasmic antibodies
titre below 1:10 (IFT)

LKM – liver-kidney microsomal antigen
negative (IFT)

LP – liver-pancreas antigen
negative (immunoblot)

LC-1 – liver cytosol antigen 1
negative (immunoblot)

such as ANCA, and in some cases ANA and ASMA, may be abnormal. Gamma-GT, alkaline phosphatase and bilirubin may become abnormal as the condition progresses.

Autoimmune hepatitis is complex to diagnose and requires specialist assessment. This includes blood tests for autoantibodies, elevated liver test results and elevated immunoglobulin G levels, and ruling out other causes (e. g. viral hepatitis, fatty liver with inflammation, liver damage caused by medication, metabolic or hereditary disorders). A liver biopsy is necessary for the diagnosis of AIH and can identify typical cellular changes in the liver tissue. Elevated ANA and SMA levels are consistent with type I autoimmune hepatitis; LKM-1 and LC-1 antibodies are found in type II autoimmune hepatitis.

Causes of liver disease

Liver test results may be abnormal for a variety of reasons. Not every elevated liver test result is necessarily evidence of liver disease, but it should always prompt further investigation. The most common causes of chronic liver disease in Germany are:

- **metabolic dysfunction-associated steatotic liver disease (MASLD),** which is usually detected by an ultrasound scan
- **alcohol-related liver diseases;**
- **hepatitis B or hepatitis C virus infections.**

However, there are numerous other causes that should also be ruled out if there is any doubt.

Toxic liver damage can be caused not only by alcohol but also by medicines, herbal remedies, anabolic steroids, recreational drugs, environmental toxins or – as an acute emergency – mushroom poisoning.

Autoimmune liver diseases – AIH, PBC and PSC – have already been described in this brochure.

Liver infections can also be caused by Epstein-Barr virus or parasites such as dog tapeworms, fox tapeworms or the parasites that cause schistosomiasis. Inflammatory reactions in the body, for example in cases of severe influenza or COVID-19, can also affect the liver.

Right-sided **heart failure, Budd-Chiari syndrome**, **burn injuries** or **heatstroke** can also put the liver at risk.

Inherited disorders can lead to severe liver damage, for example because important enzymes are missing or because certain substances accumulate in excess in the liver and other tissues. These include, for example, iron storage disease (haemochromatosis), copper storage disease (Wilson's disease), alpha-1 antitrypsin deficiency, lysosomal acid lipase deficiency (LAL-D) or progressive familial intrahepatic cholestasis (PFIC).

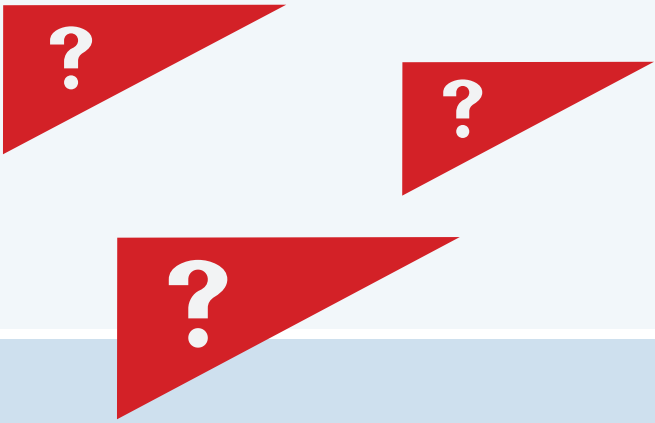
Afterword

We hope that this brochure has provided you with an overview of important liver test results and what they might mean. This is intended to help you better understand what the individual results might mean as you and your doctor work together to identify the cause. If liver test results are repeatedly elevated and no clear cause can be identified, it is advisable to seek specialist assessment at a hepatology practice or liver clinic. It is also advisable to seek specialist medical advice and care if you have already been diagnosed with a liver condition.

If you have found the information in this brochure helpful, we would be delighted if you could support us with a donation or consider becoming a member. Members receive the magazine "Lebenszeichen" four times a year, with the latest news in hepatology. Members also have the opportunity to make regular use of our telephone and email advice services. We also offer a no-obligation initial consultation to non-members. You can contact us on +49 221 2829980 or by email at info@leberhilfe.org. You can find information about membership on our website: www.leberhilfe.org/mitglied-werden

Your team at Deutsche Leberhilfe e.V.

Deutsche Leberhilfe e.V.
Donation account: Sparkasse Melle
Account no.: 124 800, sort code: 265 522 86
IBAN: DE95265522860000124800
BIC: NOLADE21MEL



If you have any further questions about liver diseases or are looking for a specialist practice or clinic in your area, please do not hesitate to contact us.

Deutsche Leberhilfe e. V.
Krieler Str. 100 – 50935 Cologne
Tel. +49 221 2829980 – Fax +49 221 2829981
www.leberhilfe.org – info@leberhilfe.org

We would like to thank the BKK Dachverband for funding this brochure.