

LIVER FUNCTION TESTS

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INDICATIONS OF LIVER FUNCTION :

Detection of hepatic dysfunction.

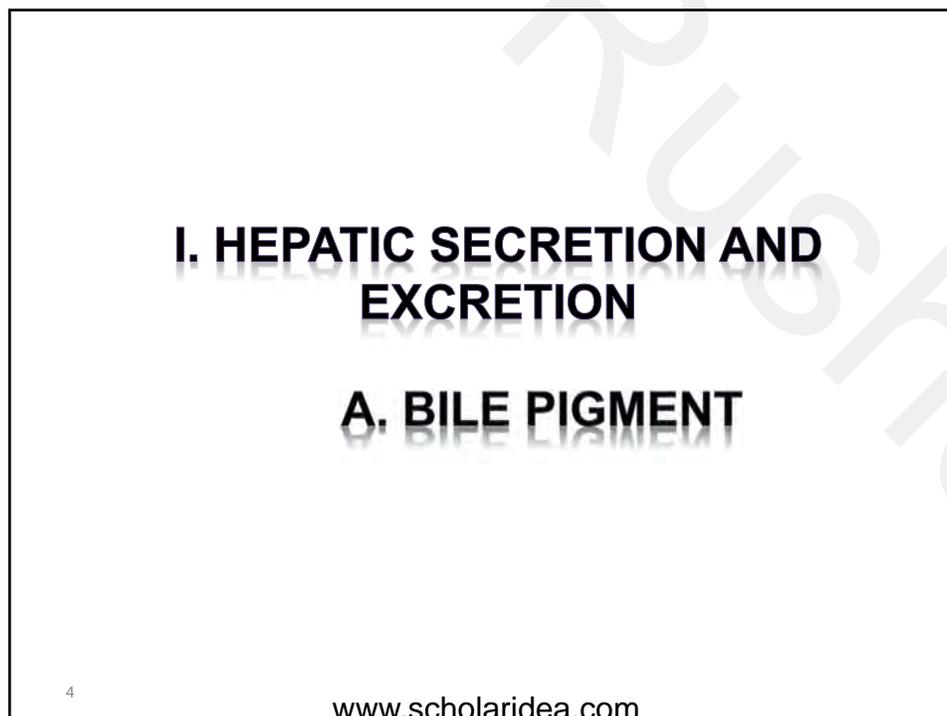
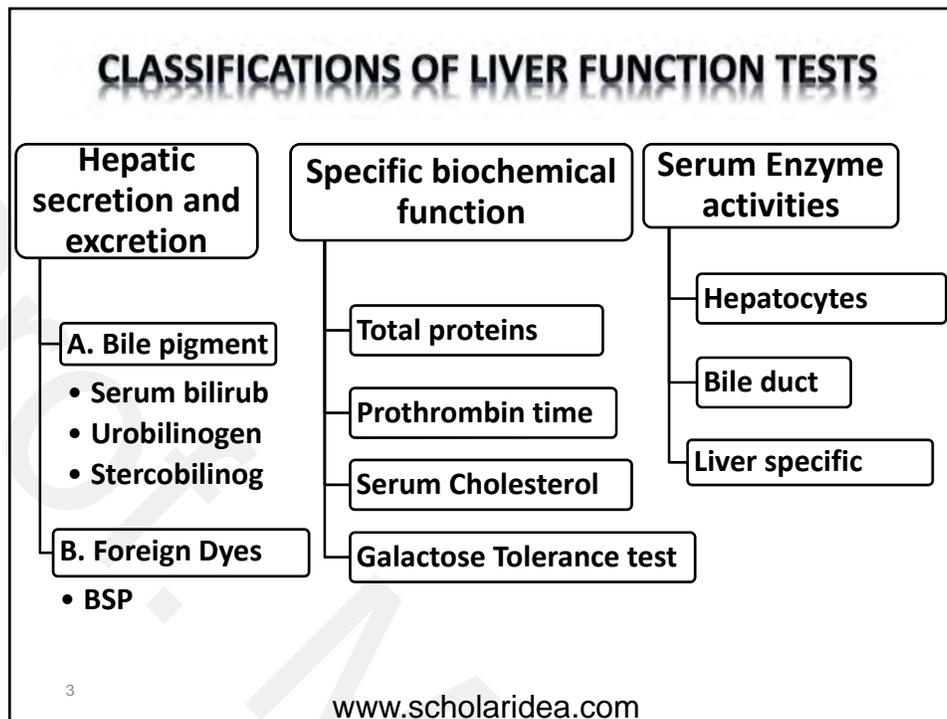
Differentiation for types of Jaundice.

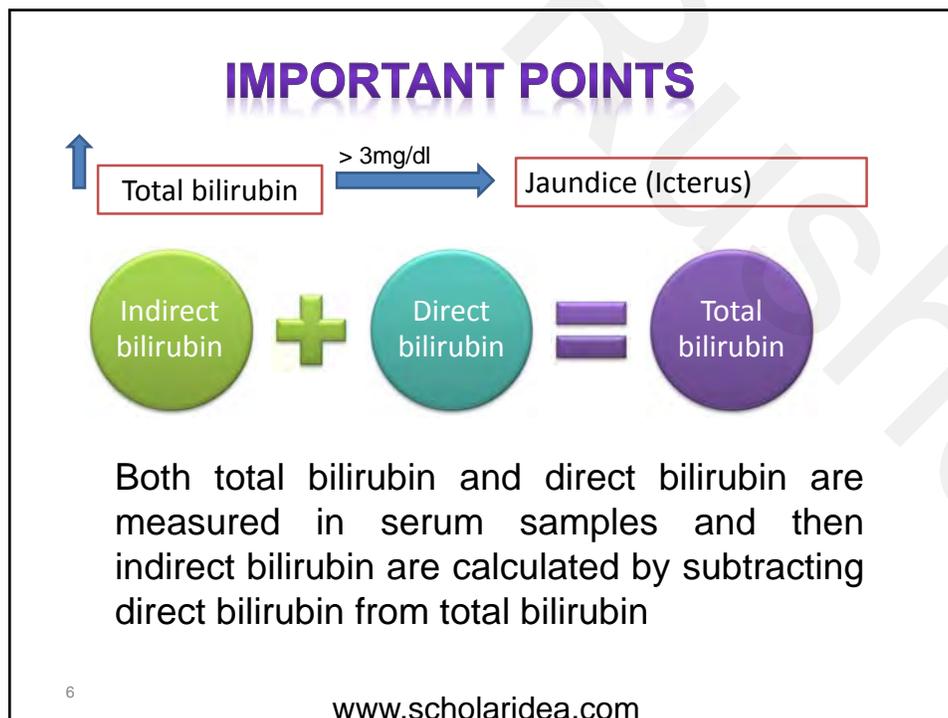
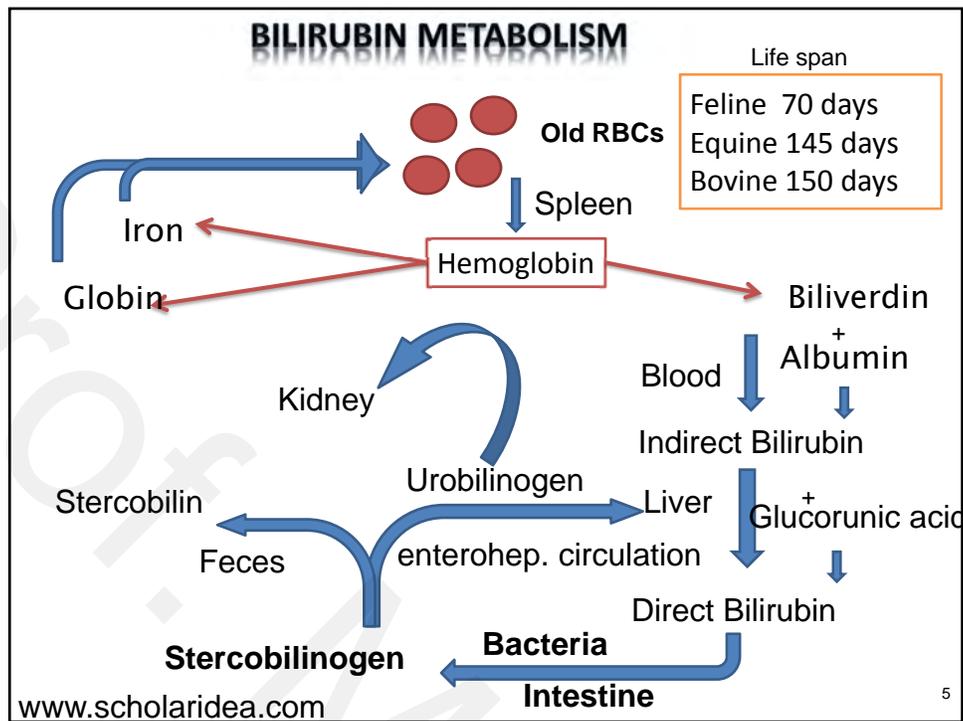
Evaluation for the prognosis of hepatic disease.

Evaluation of therapy.

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Jaundice

Jaundice or icterus is defined as the yellowish pigmentation of skin and mucous membranes especially conjunctiva and sclera, as a consequence of increased blood bilirubin level.

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Jaundice

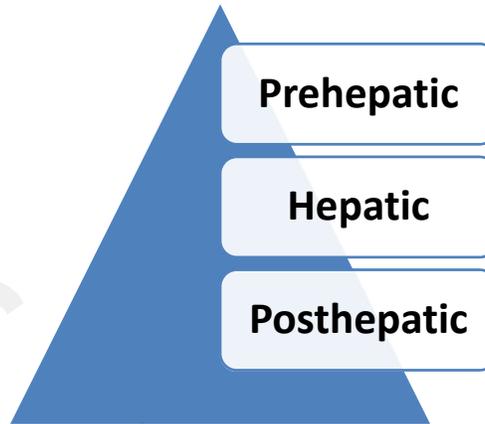
There are two forms of bilirubin in the blood circulation, which are direct or conjugated and indirect or unconjugated bilirubin. The increase of any one of them result in increased the total bilirubin level, which cause the yellowish color of skin.

Normally total bilirubin level in adult animals is below 1 mg/dl.

Jaundice occurs when the total bilirubin level become above 3 mg/dl.

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Types of Jaundice



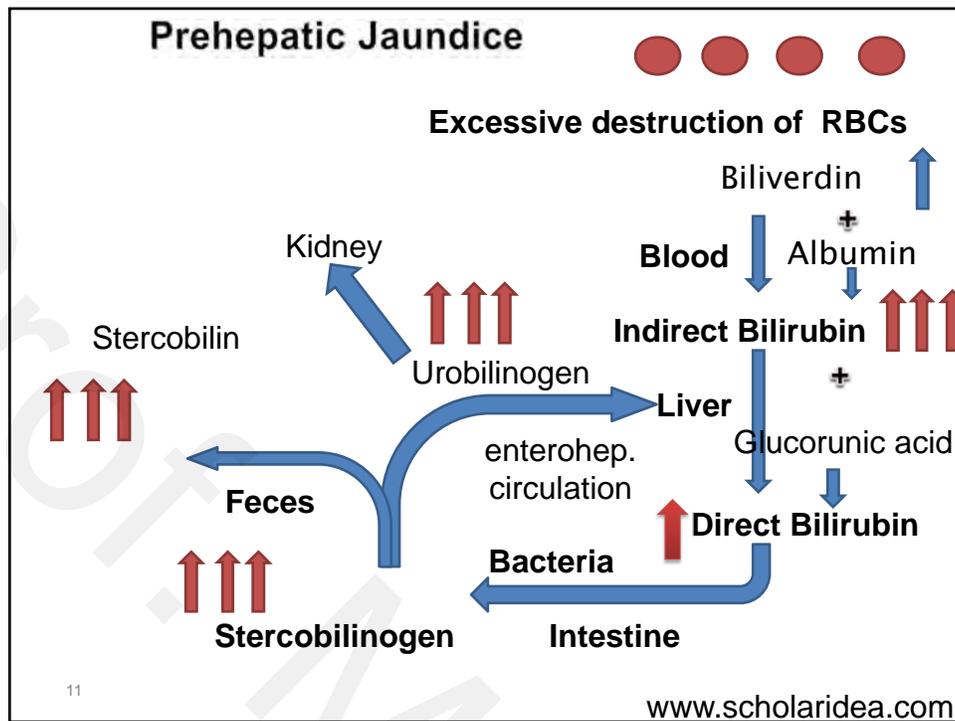
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Prehepatic Jaundice HEMOLYTIC JAUNDICE

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Prehepatic jaundice

Indirect bilirubin is the dominant bilirubin in the blood

Urobilinogen increased in urine

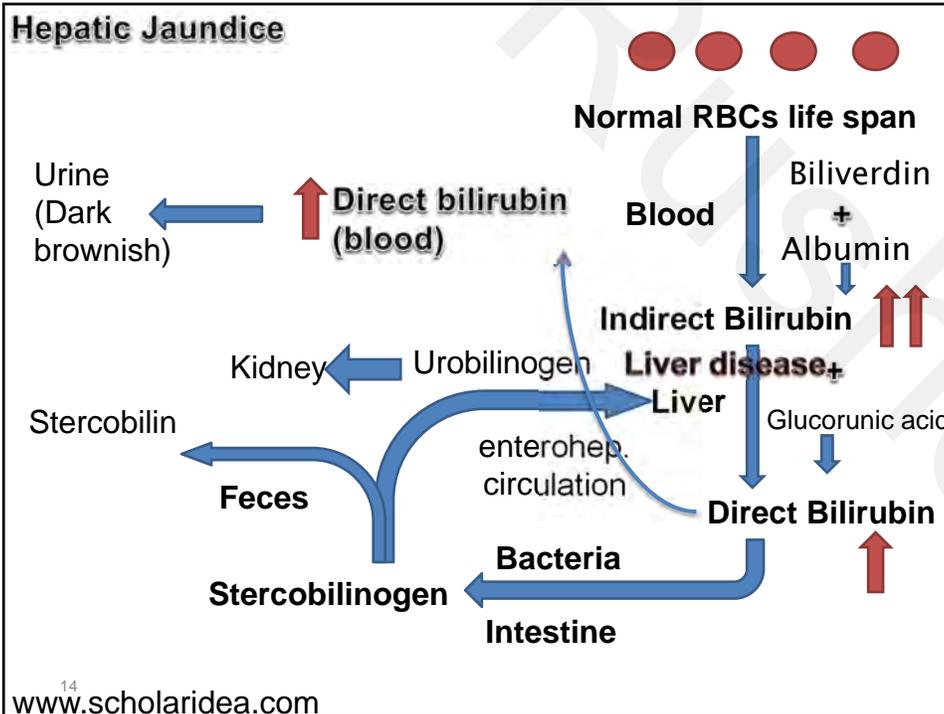
The color of feces is dark orange due to excess stercobilin

As a rule indirect bilirubin is not secreted in urine because it is bound to albumin .

Hepatic Jaundice

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HEPATIC JAUNDICE

Both direct and indirect bilirubin increased in blood

Increase in total bilirubin mainly due to increase in both direct and indirect bilirubin

Direct bilirubin excreted in urine and results in change the color of urine to Dark brownish.

Normal urobilinogen level

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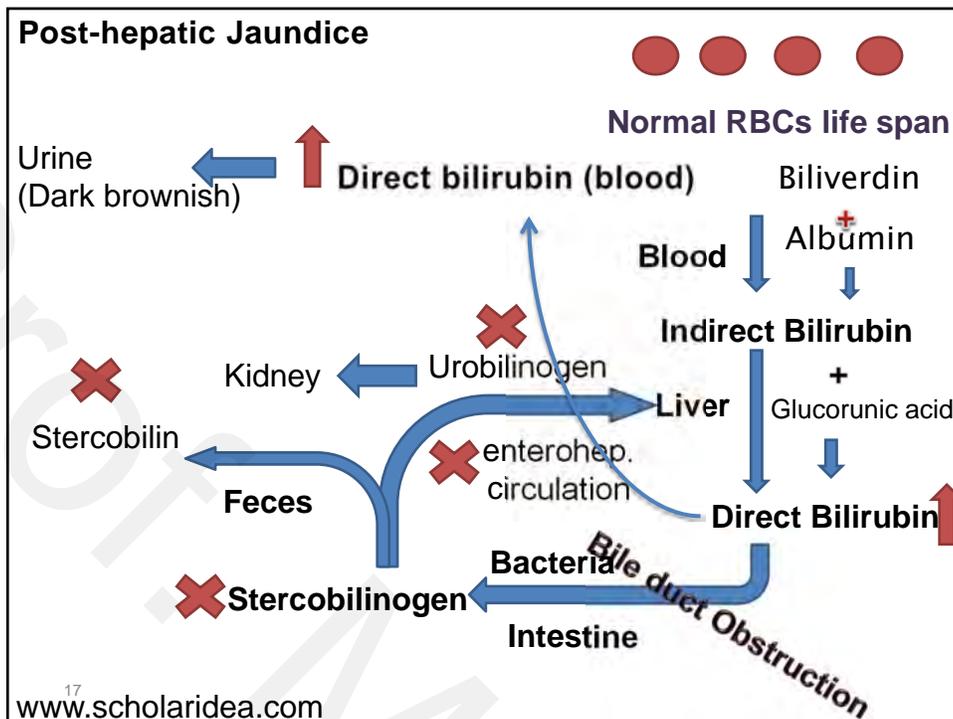
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Post-hepatic Jaundice

OBSTRUCTIVE JAUNDICE

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POST-HEPATIC JAUNDICE

Direct bilirubin is the main bilirubin in the circulation

Direct bilirubin excreted in urine and give the urine Dark brownish in color.

Urobilinogen is absent in urine

CONCLUSION

Direct bilirubin is excreted in urine in hepatic and obstructive jaundice.

Urobilinogen is absent from urine in obstructive jaundice

Both direct and indirect bilirubin increased in hepatic jaundice

Indirect bilirubin is the dominant in blood in cases of prehepatic jaundice

Direct bilirubin is the dominant in blood in cases of obstructive jaundice.

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B. Foreign Dyes

Dyes used are Sulphobromophthalein (Bromsulphothalin-BSP), rose Bengal or indocyanine green.

Dye is injected i/v and a sample of blood is withdrawn at 30 min. post injection.

The amount of dye retention in the blood serves as a measure of the degree of hepatic disease and blood.

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II-TESTS BASED ON SPECIFIC BIOCHEMICAL FUNCTION

- A- Plasma protein level.**
- B- Prothrombin time.**
- C- Galactose tolerance test.**
- D- Blood cholesterol level**

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II-TESTS BASED ON SPECIFIC BIOCHEMICAL FUNCTION

A- Plasma protein level

- Total proteins level measured in plasma is higher than that measured in serum.
- Usually measured serum proteins include total proteins, albumin and globulins. The latter can be separated by electrophoresis into α -globulin, β -globulin and γ -globulins.

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II-TESTS BASED ON SPECIFIC BIOCHEMICAL FUNCTION

A- Plasma protein level

- Alterations are not specific for liver function.
- Hyperproteinemia with hypoalbuminemia and hyperglobulinemia indicate acute inflammation.
- Hypoproteinemia with hypoalbuminemia indicate severe liver disease Edema

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II-TESTS BASED ON SPECIFIC BIOCHEMICAL FUNCTION

B- Prothrombin time

The liver converts vitamin K to prothrombin.

Prolonged prothrombin time occurs in:

- Obstructive jaundice where absence of bile from the intestine prevents absorption of vit. K.
- Severe hepatic disease that interfere with the synthesis of prothrombin in the hepatocytes.

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II-TESTS BASED ON SPECIFIC BIOCHEMICAL FUNCTION

C- Galactose tolerance test.

- Inject definite amount of galactose i/v.
- Estimate concentration of blood galactose at various intervals post injection.
- Slowly decreased galactose level in blood means liver disease.

D- Serum cholesterol level

- Serum cholesterol is decreased in severe hepatic dysfunction.

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III-TESTS BASED ON SERUM ENZYME ACTIVITY

1. Enzymes released from the hepatocytes

Aspartate aminotransferase (AST)

Alanine aminotransferase (ALT)

Lactate dehydrogenase (LDH)

Gama glutamyl transferase (GGT).

Sorbitol dehydrogenase (SD)

Glutamic dehydrogenase (GD)

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1. Enzymes released from the hepatocytes

1. Aspartate aminotransferase (AST)

- The activity of AST is high in the liver of all domestic animals, but it is not specific for the liver, this because AST activity is high also in the skeletal muscles, heart and kidney. AST cannot be used alone for diagnosis of a hepatic disease.

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1. Enzymes released from the hepatocytes

2. Alanine aminotransferase (ALT)

- The activity of ALT is high in the liver of human, cat, dog and rodents. Serum ALT is used for diagnosis of liver diseases in these species. However, liver ALT is low in case of herbivorous animals (Horse, cattle, ovine, caprine).

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1. Enzymes released from the hepatocytes

- Serum AST and ALT activities increased after hepatocellular injury or necrosis and also in case of acute and chronic inflammation.
- Measuring serum AST activity alone cannot be used for diagnosis of hepatic disease. The source of serum AST can be traced if the source is skeletal muscles, this can be done through measuring creatine phosphokinase (CK), which is released from the skeletal muscles in response to trauma or disease.

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1. Enzymes released from the hepatocytes

3. Lactate dehydrogenase (LDH)

- It is difficult to interpret the source of total LDH in blood, as the enzyme being widely distributed. It is released from the liver, cardiac muscles, skeletal muscles, kidney and erythrocytes.

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1. Enzymes released from the hepatocytes

4. Gamma glutamyl transferase (GGT)

- GGT is present in high concentration in the liver and kidney.
- Serum GGT is elevated in diseases affecting the hepatobiliary system associated with cholestasis. High urinary GGT activity is used for diagnosis of kidney diseases.
- It is released in blood in case of liver diseases and released in urine in case of kidney diseases.

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1. Enzymes released from the hepatocytes

4. Gamma glutamyl transferase (GGT)

- The enzyme is hepatobiliary, being released from both the hepatocytes and bile ducts.
- The increased blood levels of GGT together with AST and with normal CK level indicate liver disease.
- Elevated level of GGT in urine indicates kidney disease.

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1. Enzymes released from the hepatocytes

5. Sorbitol dehydrogenase (SDH)

- SDH activity is high in the liver and kidney, and used in the evaluation of hepatocellular injury in most animal species including dog, horses and ruminants.
- SDH disappear rapidly from serum and its activity must be measured within 8-12 hours from sampling.

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1. Enzymes released from the hepatocytes

6. Glutamic dehydrogenase (GD)

- Glutamate dehydrogenase is an indicator of damage to liver cells.
- GD is more liver specific than AST. Generally, it is less sensitive than GGT for detecting liver damage in horses.
- Serum GD is elevated in case of hepatic necrosis in ruminants.

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III-TESTS BASED ON SERUM ENZYME ACTIVITY

2. Enzymes released from the bile duct

Alkaline phosphatase (ALP)

Gama glutamyl transferase (GGT)

3. Liver specific enzymes

Gama glutamyl transferase (GGT)

Glutamic dehydrogenase (GD)

Sorbitol dehydrogenase (SD)

Alanine aminotransferase (ALT)...Human, dog and cat

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2. Enzymes released from the bile duct

Alkaline phosphatase (ALP)

- ALP is principally released from the liver and bones.
- Serum ALP is elevated in cases of diseases affecting the bile duct including cholangitis, biliary cirrhosis and obstruction.
- High serum GGT and ALP activities are good indicators for diseases affecting the biliary system and cholestasis.
- Higher serum GGT with normal ALP is characteristic for diseases affecting the hepatocytes.

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