

Difference Between Direct and Indirect Bilirubin

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Key Difference - Direct vs Indirect Bilirubin

Bilirubin is the catabolic product of [haemoglobin](#). Bilirubin exists in two main forms; conjugated and unconjugated form. The [metabolism](#) of bilirubin takes place predominantly in the [liver](#). Bilirubin enters the liver in the unconjugated form and thereby converted to the conjugated form after some metabolic conversions. The [conjugated bilirubin](#) is also referred as direct bilirubin, and unconjugated bilirubin is referred to as indirect bilirubin. Direct Bilirubin or the conjugated form of bilirubin is covalently modified bilirubin that has increased solubility. This is due to the conjugation reaction with glucuronic acid, which takes place in the liver. Indirect Bilirubin is the type of bilirubin that is not attached or conjugated to any other chemical compound. Indirect bilirubin is bound to albumin, which is the common carrier protein of bilirubin. The **key difference** between the Direct and Indirect bilirubin is that **direct bilirubin is the bilirubin that is conjugated with glucuronic acid while the indirect bilirubin is not conjugated to the liver and it attaches to the carrier protein albumin.**

What is Direct Bilirubin?

Direct bilirubin is covalently modified indirect bilirubin. This covalent modification is done to decrease the toxicity of bilirubin and to increase the solubility of bilirubin. Increasing the solubility of bilirubin makes it easy for the excretion process of bilirubin. The conjugation of bilirubin takes place with glucuronic acid as follows. UDP [glucose](#) is used as the starting compound for conjugation of bilirubin with glucuronic acid.

The normal levels of direct bilirubin lie in the range of 0.1 to 0.3 mg/dL or 1.0 to 5.1 mmol/L. If the [serum](#) direct bilirubin levels increase above the range, it is referred to as direct hyperbilirubinemia. The immediate causes of this are [gallstones](#) and gallbladder tumors, rotor syndrome, Dubin – Johnson syndrome and certain drugs.

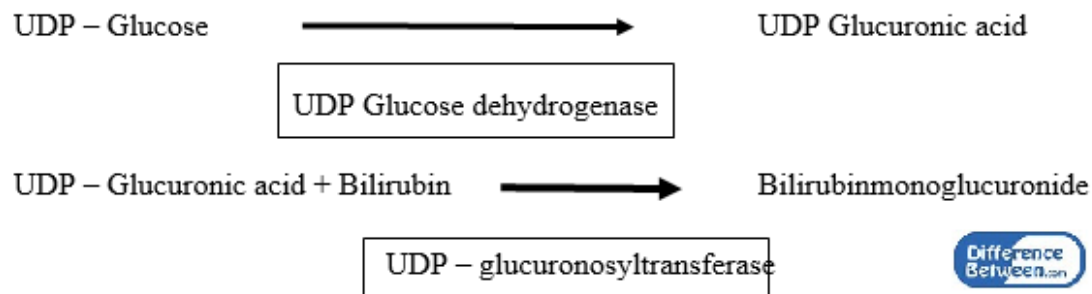


Figure 01: Formation of Direct Bilirubin

Genetic disorders and [enzyme](#) deficiencies can also lead to increased direct bilirubin levels in the serum. Direct bilirubin is combined with bile and is sent to the [intestines](#), and is excreted. Although under hyperbilirubinemia conditions, bilirubin is excreted in the [urine](#). Under this circumstance, the urine appears red.

What is Indirect Bilirubin?

Indirect bilirubin or unconjugated bilirubin is the immediate breakdown product of haemoglobin. This is the unmodified type of bilirubin. Under normal conditions, the serum indirect bilirubin levels should be around 0.2 to 0.7 mg/dL or 3.4 to 11.9 mmol/L.

Indirect bilirubin is soluble in [lipids](#). Therefore, it is lipophilic. Indirect bilirubin is insoluble in water, and it is highly hydrophobic. Indirect bilirubin can cross the [plasma membrane](#) easily. The toxicity of indirect bilirubin is high, especially to the [nervous system](#). Therefore, indirect bilirubin is converted to a more soluble, non-toxic form which is the conjugated form. Indirect albumin is associated with [albumin](#), which is the main transport protein for bilirubin.

Increased level of indirect bilirubin in serum can be due to the several reasons such as increased RBC hemolysis (Erythroblastosisfetalis), conditions such as sickle cell anaemia, [hepatitis](#), [cirrhosis](#) and due to the effect of some drugs etc.

What are the Similarities Between Direct and Indirect Bilirubin?

- Both are forms of bilirubin which are breakdown products of haemoglobin.
- Both function as biochemical compounds for liver tests.
- Increase in both components can lead to hyperbilirubinemia.

What is the Difference Between Direct and Indirect Bilirubin?

Direct Bilirubin vs Indirect Bilirubin	
Direct Bilirubin or the conjugated form of bilirubin is covalently modified bilirubin that has increased solubility.	Indirect Bilirubin is the type of bilirubin that is not attached or conjugated to any other chemical compound.
Modifications	
Direct bilirubin is covalently modified and is conjugated with glucuronic acid via an enzymatic reaction.	Any covalent modification does not modify indirect bilirubin.

Solubility	
Direct bilirubin has an increased solubility in water.	Indirect bilirubin is less soluble in water and more soluble in lipids.
Carrier Protein	
Does not require a carrier protein	Bound to albumin for transportation
Toxicity	
Direct bilirubin is less toxic.	Indirect bilirubin is more toxic.

Summary - Direct vs Indirect Bilirubin

Direct and indirect bilirubin are the two forms of bilirubin in serum. They are measured as a part of the liver function test. Direct bilirubin is the more soluble, less toxic and is the conjugated form of bilirubin. Direct bilirubin is conjugated with glucuronic acid. Indirect bilirubin is the unconjugated form of bilirubin. It is highly toxic and is less soluble in water. Therefore, it is bound to albumin for transportation purposes. Increased direct and indirect bilirubin levels indicate metabolic disorders and diseases associated with the liver. This is the difference between direct and indirect bilirubin.

Reference:

1. "Bilirubin -Part 1- Total, Direct and Indirect Bilirubin." Bilirubin -Part 1- Total, Direct and Indirect Bilirubin | Labpedia.Net. [Available here](#)
2. Indirect and direct bilirubin: origins, properties and metabolism. [Available here](#)

How to Cite this Article?

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