

Ministry of Higher Education and Scientific Research

Al-Mustaqbal University College

Radiology Technique Department



Subject: Physiology

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Lecture Number: 3

Lecture Title: The plasma proteins

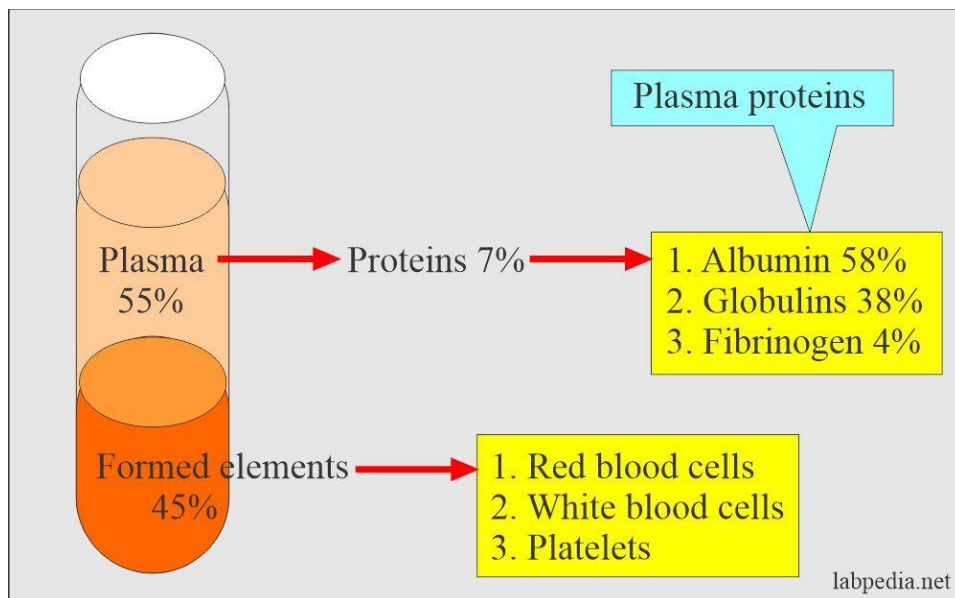
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The plasma:-

-Plasma is **homogenous, slightly alkaline** yellow **fluid**, Plasma is the largest part of your blood. It makes up more than half (**about 55%**) of its overall content. When separated from the rest of the blood, which contains, in addition to the waste substances produce from the tissues, dissolved gases, inorganic salts, protein, carbohydrate & lipids that are in transit to various parts of the body.

-**Serum** has the same composition as plasma **except** that its **fibrinogen & clotting factors have been removed.**



-Plasma proteins :-

-Plasma proteins are proteins present in the blood plasma and are produced by the liver.

-The plasma proteins consist of albumin, globulin & fibrinogen fractions.

-The globulin fraction is subdivided into numerous components, which are- $\alpha 1$; $\alpha 2$; B 1 ; B 2 & gamma globulins.

-The albumin; α & B globulins & fibrinogen are manufactured in the liver; while gamma globulin are manufactured in plasma cells.

- ❖ -Normally, total plasma proteins in human adults range in concentration from 6 to 8.0 gm /dl (dl = deciliter).



Major Types:

■ Albumin (60%)

Major component of osmotic pressure of plasma

■ Globulins (35%)

Antibodies (immunoglobulin) and transport proteins

■ Fibrinogens (4%)

Functions in blood clotting

■ Other (<1%)

Various roles (α -1-antitrypsin, coagulation factors, etc.)

1- Albumin:-

-Is the **major protein** of human plasma.

-Albumin, synthesized by the parenchymal cells of the liver is normally present at an average concentration of about four gm /dL/ (**range 3.5 –5.0 gm/dL/**).

-When the concentration of albumin is severely reduced (as in liver disease **because of protein synthesis is depressed**; or in nephritis **because large amounts of albumin are lost in the urine**), this **lead to decrease in the plasma oncotic pressure, so excess extracellular fluid may accumulate.**

➤ -In extracellular tissues, the fluid accumulation is described as **edema**.

-Whereas in closed body cavities it is described as either **ascites** (**in the peritoneal cavities**) or **effusion** (**in the pleural or pericardial cavities**).

-Albumin is also the **carrier** for substances; these substances include normal components of blood, such as **bilirubin & fatty acids** .

2- Fibrinogen :-

-Fibrinogen is six times more viscous than albumin & is mainly responsible for **blood viscosity**.

-It is also essential in blood clotting process.

-Serum has **no fibrinogen** so total plasma protein minus serum proteins give a measure of fibrinogen.

3-Immunoglobulins (Igs):-

-The antibodies are gamma globulins called immunoglobulins; usually they constitute about **20% of all plasma proteins**.

-There are five major groups of immunoglobulins in the serum, which are - IgA; IgG; IgM; IgD & IgE "(DAMGE)" which are produced by the lymphocyte – plasma cell system.

-All the immunoglobulins are composed of combinations of light & heavy polypeptide chains, most of which are a combination of two light & two heavy chains,

-**Antibodies** are proteins synthesized by plasma cells, due to immune responses, B- lymphocytes that have been stimulated by antigens to differentiate into plasma cells, which secrete different classes of immunoglobulins.

-Antibodies provide a major defense against infectious agents.

4-Haptoglobins :-

- Haptoglobin is composed of **two α - chains** & only **one form of B- chain** of polypeptides.

-The B- chain contains the site with which the molecule binds hemoglobin.

-The molecular weight is about 85,000 Daltons.

-Their **biological function** is in the metabolism of plasma Hb by preventing its glomerular filtration & confining its uptake to the liver.

5-Ceruloplasmin :-

-Ceruloplasmin is a copper – containing protein that has enzyme activities

-It is important in maintenance of Cu^{+2} homeostasis & serves in Cu^{+2} transport, & **carries 90%** of the copper present in plasma.

-Albumin carries the other 10% of plasma copper.

- ❖ -**Inherited Wilson's disease**, plasma ceruloplasmin is markedly reduced & Cu^{+2} levels increase in brain & liver with resultant neurological changes & liver damage.

6-Transferrin :-

-Two molecules of ferric iron bind to each molecule of transferrin.

-**The major function of transferrin** are the transport of iron in the circulation to sites where iron is required & prevention of loss of iron through the kidney.

-Transferrin transport iron to its storage sites & to the bone marrow to release the iron to the target cell.

7-Ferritin :-

-Ferritin contains approximately **23% iron**.

-Ferritin is the **storage form** of iron in the tissues, which is found principally in the **reticulo-endothelial cells** of the liver, spleen & bone marrow.

-Normally, there is **a little** ferritin in human plasma.

-However, in patients with excess iron, the amount of ferritin in plasma is markedly **elevated**.

-Enzymes of plasma :-

-Most plasma enzymes do not have metabolic roles in plasma, except for the enzymes concerned in blood coagulation.

-Serum enzyme levels are often useful in the diagnosis of particular diseases or abnormal physiological conditions, such as the level of plasma, **acid phosphatase** becomes very high in cases of prostatic cancer, & **high alkaline phosphatase** is found in cases of hepatic obstruction.

-Function of plasma proteins :-

(1):-They act as protein reserve to the body, & can be used to supply body protein in states of starvation.

(2):-The plasma proteins increase the viscosity of the blood.

(3):-They are important in transporting certain hormones, drugs & other substances in the blood.

(4):-They also have the ability to neutralize both acids & alkalis that is they act as a buffer.

(5):-Globulins act as a defense mechanism through formation of antibodies.