VISWASS SCHOOL & COLLEGE OF NURSING

GNM 1ST YEAR

ANATOMY & PHYSIOLOGY

UNIT-3

BLOOD

SHORT QUESTIONS AND ANSWERS

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1)Explain detail about plasma.(5)

Plasma:

The main constituent of plasma is water(90-92%), carrying a range of dissolved and suspended substances, including:

- Plasma proteins
- Inorganic salts(electrolytes)
- Nutrients, principally from digested foods
- Waste products
- Hormones
- Gases

Plasma proteins:

These are the most abundant substance in plasma by weight and play a part in a variety of roles including clotting, defence and transport. Collectively, they serve several functions:

- They are an important reserve supply of amino acids for cell nutrition. Cells called macrophages in the liver, gut, spleen, lungs and lymphatic tissue can break down plasma proteins so as to release their amino acids.
- These amino acids are used by other cells to synthesise new products.

- Plasma proteins also serve as carriers for other molecules. Many types of small molecules bind to specific plasma proteins and are transported from the organs that absorb these proteins to other tissues for utilisation.
- The proteins also help to keep the blood slightly basic at a stable pH.
- They do this by functioning as weak bases themselves to bind excess H+ ions. By doing so, they remove excess H+ from the blood which keeps it slightly basic.
- The plasma proteins interact in specific ways to cause the blood to coagulate, which is part of the body's response to injury to the blood vessels (also known as vascular injury), and helps protect against the loss of blood and invasion by foreign microorganisms and viruses.
- Plasma proteins govern the distribution of water between the blood and tissue fluid by producing what is known as a colloid osmotic pressure.
- There are three major categories of plasma proteins, and each individual type of proteins has its own specific properties and functions in addition to their overall collective role:

1. Albumins, which are the smallest and most abundant plasma proteins. Reductions in plasma albumin content can result in a loss of fluid from the blood and a gain of fluid in the interstitial space (space within the tissue), which may occur in nutritional, liver and kidney disease. Albumin also helps many substances dissolve in the plasma by binding to them, hence playing an important role in plasma transport of substances such as drugs, hormones and fatty acids.
2. Globulins, which can be subdivided into three classes from smallest to largest in molecular weight into alpha, beta and gamma globulins. The globulins include high density lipoproteins (HDL), an alpha-1 globulin, and low density lipoproteins (LDL), a beta-1 globulin. HDL functions in lipid transport carrying fats to cells for use in energy metabolism, membrane reconstruction and hormone function. HDLs also appear to prevent cholesterol from invading and settling in the walls of arteries. LDL carries cholesterol and fats to tissues for use in manufacturing steroid hormones and building cell membranes, but it also favours the deposition of cholesterol in arterial walls and thus appears to play a role in disease of the blood vessels and heart. HDL and LDL therefore play important parts in the regulation of cholesterol and hence have a large impact on cardiovascular disease.
3. Fibrinogen, which is a soluble precursor of a sticky protein called fibrin, which forms the framework of blood clot. Fibrin plays a key role in coagulation of blood, which is discussed later in this article under Platelets.

Amino acids:

These are formed from the break down of tissue proteins or from the digestion of digested proteins.

Waste products:

Being toxic end products of the break down of substances in the body, these are usually cleared from the bloodstream and are excreted by the kidneys at a rate that balances their production.

Nutrients

Those absorbed by the digestive tract are transported in the blood plasma. These include glucose, amino acids, fats, cholesterol, phospholipids, vitamins and minerals.

Gases

Some oxygen and carbon dioxide are transported by plasma. Plasma also contains a substantial amount of dissolved nitrogen.

Electrolytes

The most abundant of these are sodium ions, which account for more of the blood's osmolarity than any other solute.

2.Function of blood.(5)

Function of blood:

Blood has three main functions: transport, protection and regulation.

Transport

Blood transports the following substances:

- Gases, namely oxygen (O_2) and carbon dioxide (CO_2), between the lungs and rest of the body
- Nutrients from the digestive tract and storage sites to the rest of the body
- Waste products to be detoxified or removed by the liver and kidneys
- Hormones from the glands in which they are produced to their target cells
- Heat to the skin so as to help regulate body temperature

Protection

Blood has several roles in inflammation:

- Leukocytes, or white blood cells, destroy invading microorganisms and cancer cells
- Antibodies and other proteins destroy pathogenic substances
- Platelet factors initiate blood clotting and help minimise blood loss

Regulation

Blood helps regulate:

- pH by interacting with acids and bases
- Water balance by transferring water to and from tissues

Blood has a number of functions that are central to survival, including:

- supplying oxygen to cells and tissues
- providing essential nutrients to cells, such as amino acids, fatty acids, and glucose
- removing waste materials, such as carbon dioxide, urea, and lactic acid
- protecting the body from infection and foreign bodies through the white blood cells
- transporting hormones from one part of the body to another, transmitting messages, and completing important processes
- regulating acidity (pH) levels and body temperature
- engorging parts of the body when needed, for example, a penile erection as a response to sexual arousal

Another important function of the blood is its protective action against disease. White blood cells defend the body against infections, foreign materials, and abnormal cells.

The platelets in blood enable the clotting, or coagulation, of blood. When bleeding occurs, the platelets group together to create a clot. The clot becomes a scab and stops the bleeding, as well as helping to protect the wound from infection.

3)Explain about Haemoglobin.(5)

Haemoglobin:

- The oxygen-carrying pigment and predominant protein in the red blood cells. Hemoglobin forms an unstable, reversible bond with oxygen.
- In its oxygenated state it is called oxyhemoglobin and is bright red. In the reduced state it is called deoxyhemoglobin and is purple-blue.
- Each hemoglobin molecule is made up of four heme groups surrounding a globin group.
- Heme contains iron and gives a red color to the molecule.
- Globin consists of two linked pairs of polypeptide chains.
- The development of each chain is controlled at a separate genetic locus.
- Changes in the amino acid sequence of these chains results in abnormal hemoglobins.
- For example, hemoglobin S is found in sickle-cell disease, a severe type of anemia in which the red cells become sickle-shaped when oxygen is in short supply.
- When red blood cells die, the hemoglobin within them is released and broken up: the iron in hemoglobin is salvaged, transported to the bone marrow by a protein called transferrin and used again in the production of new red blood cells;
- the remainder of the hemoglobin becomes a chemical called bilirubin that is excreted into the bile which is secreted into the intestine, where it gives the feces their characteristic yellow-brown color.
- Hemoglobin is involved in the transport of other gases: It carries some of the body's respiratory carbon dioxide (about 20–25% of the tota)
- as carbaminohemoglobin, in which CO_2 is bound to the heme protein.
- The molecule also carries the important regulatory molecule nitric oxide bound to a globin protein thiol group, releasing it at the same time as oxygen.

Functions:

- Hemoglobin functions by binding and transporting oxygen from the capillaries in the lungs to all of the tissues in the body.
- It also plays a role in the transport of carbon dioxide from the tissues of the body back to the lungs.[1]
- Nitric oxide and carbon monoxide are also able to bind with hemoglobin, with carbon monoxide binding much more readily than oxygen (the reason why carbon monoxide poisoning is so serious).

Normal range:

- A hemoglobin level is usually checked as a part of a complete blood count (CBC), The normal range of hemoglobin varies depending upon on age and sex.
- The average range is 13.8 to 17.2 g/dl for an adult male and 12.1 to 15.1 g/dl for an adult female.