



CHAITANYA DEGREE & PG COLLEGE FOR WOMEN

Affiliated to Andhra University

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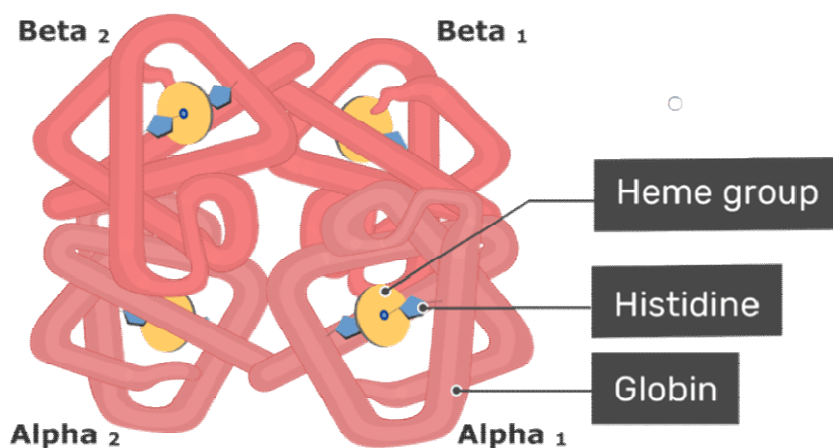
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Best Practices:1 – ESTIMATION OF HAEMOGLOBIN

AIM: Train the students to do haemoglobin estimation and create awareness about the clinical manifestation of abnormal levels of haemoglobin.

WHAT IS HAEMOGLOBIN?

Haemoglobin (Hb) is a red pigment present in the Red Blood Cells (RBC). It is made up of non-protein part called Heme and protein part called globin. Heme is a tetra pyrrole porphyrin ring which is coordinated with iron. The globin contains four polypeptide chains (two α and two β chains), each consisting of one heme pigment. Each haeme bears one iron molecule which can combine with one oxygen (O_2) molecule. Hb estimation is a part of routine blood tests. Each RBC contains about 280 million haemoglobin molecules and each haemoglobin can carry up four oxygen molecules.



One gram of haemoglobin carries 1.39 ml of oxygen. Haemoglobin plays a key role in transporting gases like oxygen and carbon dioxide, nutrients, vitamins, drugs and minerals to the entire part of the body. Besides all, it acts as a physiological buffer.

CLINICAL SIGNIFICANCE:

The levels of Hb are significant to establish conditions like anaemia, leukaemia, chronic infections, certain cancers, etc. Haemoglobin carries the O_2 from lung to tissue and the CO_2 from tissue to lungs and also plays a role in the regulation of blood flow and blood pressure.

FUNCTIONS OF HAEMOGLOBIN:

1. It transports oxygen from the lungs to the tissues by forming oxyhaemoglobin. Oxygen combines reversibly to an iron ion of the heme ring of the haemoglobin molecule.
2. It transports about 13% of the total carbon dioxide, waste products of metabolism. Carbon dioxide combines with amino acids in the globin part of haemoglobin.
3. It acts as a buffer in maintaining blood pH.
4. On breakdown it forms important bile pigments.

After the normal life span is over, the red blood cells are destroyed by the macrophages in the liver, spleen or red bone marrow into heme moiety (biliverdin and iron) and globin protein. The iron and globin are recycled to reuse and the biliverdin is converted into the bilirubin which is further converted into the stercobilin to be removed in the faeces.

The Colour of the faeces is yellow because of the presence of stercobilin.

NORMAL HEMOGLOBIN CONCENTRATION

- Men – 13 – 18 g/dl
- Women – 12 – 16 g/dl
- New born – 16 – 22 g/dl
- Children – 12 – 14 g/dl

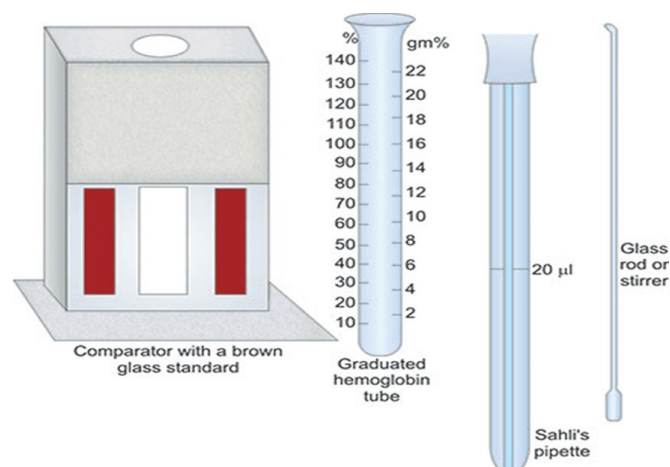
USES:

- Determine the presence and severity of anaemia
- Screening for polycythaemia
- To assess response to specific therapy in anaemia
- Estimation of Red cell indices
- Selection of blood donors

INSTRUMENTS:

Sahli's haemoglobinometer

it is a set of devices that includes a comparator, haemoglobin tube, haemoglobin pipette, and stirrer.



Comparator: It is a rectangular plastic box with a slot in the middle which accommodates a haemoglobin tube. Brown standard glasses are provided on either side of the slot for colour matching. White opaque glass is present at the back to provide uniform illumination.

- **Haemoglobin tube:** Sahli's graduated haemoglobin tube is graduated in one side in gram percentage (g %) from 2 to 24, and on the other side in percentage (%) from 20 to 140. The tube is also called Sahli-Adams tube.
- **Sahli's pipette or haemoglobin pipette:** It contains only one mark at 20 μ l or 0.02 ml.
- **Stirrer:** It is a thin glass rod used for stirring the mixture inside the haemoglobin tube.

Reagents:

1. **N/10 Hydrochloric acid (HCl):** Mixing 36 grams HCl in distilled water to 1 litre gives 1 N HCl. diluting it 10 times will give N/10 HCl.
2. **Distilled water**

PROCEDURE:

1. Ensure that the hemoglobinometer tubes and pipette are clean and dry.
2. Fill the hemoglobinometer tube with N/10 HCl up to its lowest mark i.e. 2 g% or 10% mark with the help of a dropper.
3. Take blood up to mark in the Sahli's pipette (20 μ l). Wipe the extra blood outside the pipette and deliver it to N/10 HCl in the haemoglobin tube.
4. Mix and leave it for 10 minutes in order for a complete conversion of haemoglobin to haematin.
5. Add distilled water drop by drop and stir till colour matches with the standard glass of the comparator.
6. Take the reading at lower meniscus, which directly gives the haemoglobin concentration in 100 ml of blood.

Advantages and Disadvantages of Sahli's method

Advantages:

1. Easy to perform and convenient.
2. Not very time consuming. Can be performed within maximum 15 minutes.
3. Reagents and apparatus are cheap and easily available. Reagents are less harmful.
4. Can be used in mass surveys. Doesn't require electricity.

Disadvantages:

1. Acid haematin is a suspension, not a true solution. So, some turbidity may result.
2. This method can't measure all haemoglobins. It estimates only oxyhemoglobin and reduced haemoglobins. But **carboxyhemoglobin, methemoglobin and sulfhemoglobin** (which all constitute about 2-12% of total haemoglobin) are not converted to acid haematin.
3. **HbF** is not converted to acid haematin. Therefore, Shali's method is not suitable for measuring haemoglobin in infants up to 3 months.
4. WBC counts >100,000/cumm will produce turbid solution of acid haematin, which will increase the haemoglobin report by 5-10%.
5. Chances of visual error are high. Colour of acid haematin also fades gradually.



GPS Map Camera

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Best Practices: 2 - Total Dissolved Solids (TDS) in drinking water

AIM: Maintain the TDS levels of drinking water in the college premises.

What are TDS?

- TDS - Total Dissolved Solids
- Total concentration of dissolved substances in water
- TDS is made up of inorganic salts, as well as a small amount of organic matter
- Inorganic salts - include calcium, magnesium, potassium and sodium, which are all **cations**; carbonates, nitrates, bicarbonates, chlorides and sulfates, which are all **anions**

Sources of TDS

- Natural sources, sewage, urban run-off, industrial waste water and chemicals used in water treatment process and the nature of the piping or hardware used to convey the water, i.e., the plumbing

How to measure TDS??

- **Two principal methods** of measuring TDS - Gravimetric analysis and Electrical conductivity
- **Gravimetric methods** - most accurate and involve evaporating the liquid solvent and measuring the mass of residues left
- TDS meter is used to determine TDS levels in water by measuring **the specific conductivity** of the water due to the presence of ions in it ($TDS = k_e EC$, where EC is electrical conductivity in microsiemens per centimetre at 25° C; k_e - conversion factor, which varies between 0.55 and 0.8).

TDS level Chart for drinking water

Following table summarizes the permissible range of TDS in drinking water and reasons why the TDS level mentioned in water is not acceptable for drinking:

TDS levels in parts per million (ppm)	Remarks
Less than 50	Unacceptable as it lacks essential minerals
50 - 150	Acceptable for drinking. The TDS level is ideal for areas where the water polluted by sewage or industrial waste
150 - 250	Good. The water is ideal for people with cardiovascular disease
250 - 350	Good. The water is ideal for people with cardiovascular disease
350 - 500	Fairly acceptable
500 -900	Less acceptable
900 - 1200	Least acceptable. Avoid drinking water that has a TDS level of 900
1200 - 2000	Water is not acceptable for drinking.

Importance of TDS Measurement

Testing the water is important as it determines the quality of water that we receive and use for different purposes.

Taste- High levels of TDS in water affect the taste of drinking water. Water may taste bitter, salty or sulfuric depending on the type and level of dissolved solids present in water.

Health Purposes- Water with high TDS is completely safe to drink. However, some substances such as lead, or copper can lead to health hazards.

Maintenance of Filters- Water filtration systems are affected by a high level of TDS. Testing the water purifier systems regularly will ensure that the filters work properly

Cooking- Though high TDS doesn't affect health, it can alter the taste of your food.

Cleaning- High TDS in water leaves ugly spots on your utensils. This type of water also fades the color of your clothes, leading to a buildup in your sinks, tubs, and faucets.

Plumbing and Appliances- High amounts of dissolved calcium and magnesium salts can cause scale to form in pipes and appliances, reducing their lifespan. The above are the reasons to measure total dissolved solids in water.

- Soaps and detergents do not produce as much lather with hard water as with soft water
- High amounts of dissolved solids can corrode pipes, and have a metallic taste
- Causes water filters to wear out sooner, because of the amount of minerals in the water.

Impact of Low TDS

- However, a very low concentration of TDS has been found to give water a flat taste and lacks essential minerals

Ways to Reduce or Remove TDS in Water

Elevated levels of TDS can be reduced by the following ways

- **Reverse osmosis (RO)** - Reverse Osmosis removes TDS by forcing the water, under pressure, through a synthetic membrane. The membrane contains microscopic pores which will allow only molecules smaller than 0.0001 microns to pass through. As the molecules of dissolved metals and salts are large compared to the water molecules, water squeezes through the membrane leaving the metals and salts behind.
- **Distillation** - The process involves boiling water to produce water vapor. The water vapor rises to a cool surface where it is condensed back into the liquid form. The dissolved salts are unable to vaporize and remain in the boiling solution.

Best Practices:3 – Glucometer

AIM: Giving awareness to students, staff and non-staff members of our college about the importance of monitoring blood glucose levels.

BIOLOGICAL SIGNIFICANCE OF BLOOD GLUCOSE:

1. Glucose is a simple sugar which acts as an energy source in the brain, muscles and some other body organs and tissues.
2. It is one of the important components of macromolecules like glycoprotein and glycolipid. This gives shape and structure to the cell.
3. The human body has the mechanism to regulate the Blood sugar level.
4. High or low levels of blood glucose is associated with diseased conditions.

Key Facts about Diabetes Mellitus:

1. The number of people with diabetes rose from 108 million in 1980 to 422 million in 2014. Prevalence has been rising more rapidly in low- and middle-income countries than in high-income countries.
2. Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation.
3. In 2019, diabetes and kidney disease due to diabetes caused an estimated 2 million deaths.
4. Diabetes can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications.

WHY TO MONITOR BLOOD GLUCOSE LEVELS:

Determining Blood glucose levels will be useful to get the following information:

1. Diagnosis of Diabetes Mellitus
2. Monitor the effect of diabetes medications on blood sugar levels
3. Track the progress in reaching overall treatment goals
4. Check the impact of a particular diet and exercise on blood sugar levels
5. Understand how other factors, such as illness or stress, affect blood sugar level

Regular monitoring of blood glucose levels is important for people those who suffer with diabetes.

Regular testing can also help you avoid getting long-term health problems that can stem from the condition, like:

- Heart disease
- Stroke
- High blood pressure
- High cholesterol
- Blindness
- Kidney disease
- Skin problems

Symptoms

Symptoms of diabetes may occur suddenly. In type 2 diabetes, the symptoms can be mild and may take many years to be noticed.

Symptoms of diabetes include:

- feeling very thirsty
- needing to urinate more often than usual
- blurred vision
- feeling tired
- losing weight unintentionally

Over time, diabetes can damage blood vessels in the heart, eyes, and kidneys and nerves.

People with diabetes have a higher risk of health problems including heart attack, stroke and kidney failure.

Diabetes can cause permanent vision loss by damaging blood vessels in the eyes.

How to monitor blood glucose levels:

Digital glucometer is used to monitor blood glucose levels regularly.

Glucometer:

A device for measuring the concentration of glucose in the blood, using a small drop of whole blood placed on a disposable test strip.

Working Principle of Glucometer:

The glucometer works on the well-established principle of amperometry, where the peak current obtained during an electrochemical reaction, maintaining a constant potential between the electrodes, is taken as an indicator of the concentration of the analyte.

A typical amperometric sensors consist of 3 electrodes – the working electrode (WE), Reference Electrode (RE), and counter electrodes (CE). Glucometer test strips are commercially available today and enzymatic electrochemical biosensors, which are disposable.

Amperometric glucose biosensors are prepared by immobilizing glucose oxidase molecules onto an electrochemical interface. The enzyme catalyzes the conversion of glucose to gluconic acid and hydrogen peroxide.

Prevention:

Type 1 diabetes are not preventable because they are caused by an issue with the immune system. Some causes of type 2 diabetes, such as your genes or age, aren't under your control either.

