

Name; JacksonAbara Emmanuella Odegwa

Department;Nursing

Matric No; 18/MHS07/027

Course code;PHS 212

Assignment; Explain urine formation and concentration

Urine produced is 95% water and 5% nitrogenous wastes. Wastes such as urea, ammonia, creatinine are excreted in urine. Apart from these, the potassium, sodium and calcium ions are also excreted.

The kidneys filter unwanted substances from the blood and produce urine to excrete them. There are three main steps of urine formation: glomerular filtration, reabsorption, and secretion. These processes ensure that only waste and excess water are removed from the body.

Waste is excreted from the human body mainly in the form of urine. Our kidneys play a major role in the process of excretion. Constituents of normal human urine include 95 percent water and 5 percent solid wastes. It is produced in the nephron which is the structural and functional unit of the kidney. Urine formation in our body is mainly carried out in three phases namely;

- Glomerular filtration,
- Reabsorption
- Secretion.

Glomerular Filtration

Glomerular filtration occurs in the glomerulus where blood is filtered. This process occurs across the three layers- epithelium of Bowman's capsule, endothelium of glomerular blood vessels, and a membrane between these two layers. As blood is pushed through the tiny capillaries, the high-pressure forces some things to pass through the capillary walls. The walls act as a sieve or a filter. Hence, it is called filtration.

Water, sugar, salts, amino acids, nitrogenous wastes, and other tiny things enter the kidney as a substance called the filtrate. Cells and large blood proteins that cannot fit through remain in the blood vessels. The filtrate entering the kidney is like pre-pre-urine.

Blood is filtered in such a way that all the constituents of the plasma reach the Bowman's capsule, except proteins. Therefore, this process is known as ultrafiltration.

Reabsorption

The filtrate enters the kidney in the proximal tubule. This region of the kidney is special because many things can be removed from the filtrate. These valuable things are recollected, or reabsorbed, by the body.

Glucose, certain salts, vitamins, hormones, and amino acids are restored to the body and will not be included in urine. Sometimes, if the body has too much of something then the extra sugar or salt will stay in the filtrate. For example, diabetics with high levels of blood glucose may have glucose in their urine since it cannot all be reabsorbed. The filtrate after reabsorption is like pre-urine

Around 99 percent of the filtrate obtained is reabsorbed by the renal tubules. This is known as reabsorption. This is achieved by active and passive transport.

Secretion

The next step in urine formation is the tubular secretion. The filtrate then passes through a really neat structure called the Loop of Henle where it gains and loses water and salt. As it leaves the Loop of Henle, it enters the distal tubule, where secretion occurs. Tubular cells secrete substances like hydrogen ion, potassium ion, etc into the filtrate. By this process, the ionic, acid-base and the balance of other body fluids are maintained. The secreted ions combine with the filtrate and form urine. The urine passes out of the nephron tubule into a collecting duct.

Urine concentration

For the cells in the body to function properly they must be working in the optimal environment. This includes a correct and optimal fluid osmolarity, which is the concentration of electrolytes and other solutes in the plasma. This is sometimes referred to as the water balance, since, to a large extent, extracellular fluid sodium concentration and osmolarity are regulated by the amount of extracellular water.

The kidneys are the body's primary tool to maintain its water balance. They can/will preserve or excrete water based on the osmolarity in the body. By concentrating the ultra-filtrate in the tubular system (and thereby concentrating the urine) the body will excrete less water and by

diluting the ultra-filtrate the body will excrete more water. This enables the body to maintain a very exact osmolarity at all time.

Normal body osmolarity is approximately 300 mOsm/L. The kidney has an ability to vary this tubular osmolarity (urine osmolarity) between 50-1200 mOsm/L. The body utilizes two different mechanisms to maintain an optimal osmolarity in the blood: ADH (anti-diuretic-hormone) and countercurrent multiplier mechanism