NAME: UWAOGU KELECHI OYINDAMOLA

DEPARTMENT: NURSING

MATRIC NUMBER: 18/MHS02/192

COURSECODE: PHS212

COURSE TITLE: PHYSIOLOGY

Question

Write a short note on the characteristics (and components) of urine

Physical Characteristics

Physical characteristics that can be applied to urine include color, turbidity (transparency), smell (odor), pH (acidity – alkalinity) and density. Many of these characteristics are notable and identifiable by vision alone, but some require laboratory testing.

- Color: Typically yellow-amber, but varies according to recent diet and the concentration of the urine. Drinking more water generally tends to reduce the concentration of urine, and therefore causes it to have a lighter color. Dark urine may indicate dehydration. Red urine indicates red blood cells within the urine, a sign of kidney damage and disease.
- Smell: The smell of urine may provide health information. For example, urine of diabetics may have a sweet or fruity odor due to the presence of ketones (organic molecules of a particular structure) or glucose. Generally fresh urine has a mild smell but aged urine has a stronger odor similar to that of ammonia.
- The pH of normal urine is generally in the range 4.6 – 8, with a typical average being around 6.0. Much of the variation occurs due to diet. For example, high protein diets result in more acidic urine, but vegetarian diets generally result in more alkaline urine (both within the typical range of 4.6 – 8).
- Density: Density is also known as “specific gravity.” This is the ratio of the weight of a volume of a substance compared with the weight of the same volume of distilled water. The density of normal urine ranges from 0.001 to 0.035.
- Turbidity: The turbidity of the urine sample is gauged subjectively and reported as clear, slightly cloudy, cloudy, opaque or flocculent. Normally, fresh urine is either clear or very slightly cloudy. Excess turbidity results from the presence of suspended particles in the urine, the cause of which can usually be determined by the results of the microscopic urine sediment examination. Common causes of abnormal turbidity include: increased cells, urinary tract infections or obstructions.

Abnormalities in any of these of physical characteristics may indicate disease or metabolic imbalances. These problems may seem superficial or minor on their own, but can actually be the symptoms for more serious diseases, such as diabetes mellitus, or a damaged glomerulus.

COMPONENTS OF URINE

Over 99 percent of urinary solutes are composed of only 68 chemicals which have a concentration of 10 mg/L or more. 42 compounds are actually involved. They may be classified as follows:

- Electrolytes such as sodium, potassium, calcium, magnesium and chloride
- Nitrogenous chemicals such as urea and creatinine
- Vitamins
- Hormones
- Organic acids such as uric acid
- Other organic compounds

TOTAL DISSOLVED SOLIDS

Total dissolved solids in urine constitute between 24.8 to 37.1 g/kg. Urinary solids are primarily made up of organic matter, largely volatile solids. Urine has large amounts of nitrogen, phosphorus, and potassium. Nitrogen content in urine is high, mostly in urea, which makes up more than 50 percent of the total organic acids. This includes urea from protein metabolism, sodium and potassium both of which come from food. Dry solids thus comprise 14-18 percent nitrogen, 13 percent carbon, and 3.7 percent each of potassium and phosphorus. The largest excretion of these substances from the body is through urine.

Nitrogen Excretion

Nitrogen in urine is excreted mostly as urea, with about 11 g per day being the average excretion of nitrogen. It is most significantly affected by dietary protein intake, with a correlation of 0.91 existing between protein in diet and urinary nitrogenous components. About 80 percent of the

dietary intake of nitrogen is balanced by the urinary excretion of nitrogenous compounds.
Urinary urea concentration ranges from 9 to 23 g/L.
Creatinine is another important nitrogenous compound in urine, and its level depends on the body mass and muscle mass, as well as age. Gender differences may be correlated with these. On average, creatinine production in the body is about 1.6 g/day.
Nitrate is a third nitrogenous compound in urine, with increased concentrations if the person has a high protein diet.
In addition to causing alterations in urinary nitrogen concentrations, protein in diet also affects the levels of other minerals such as phosphorus and potassium. Additionally, an extremely low intake of protein may affect calcium levels.

Calcium in Urine

Calcium excretion is affected by protein intake, as above, and is heavily influenced by sodium excretion. A low sodium diet, therefore, will decrease calcium excretion and vice versa.
A normal urinary sample from an adult collected over 24 hours should receive a calcium level of 100 to 250 mg.

Other Ions

Other less common ionic groups in urine include ammonium, sulfates from amino acids, and phosphates depending on parathyroid hormone levels.

Overall Solute Concentrations

The concentration of the following constituents in urine may be regarded a s a careful approximation:

- Urea: 9.3 g/dL
- Creatinine: 0.670 g/ L
- Sodium: 1.17 g/L
- Potassium: 0.750 g/L
- Chloride: 1.87 g/L

Abnormal Types of Urine

There are several conditions that can cause abnormal components to be excreted in urine or present as abnormal characteristics of urine. They are mostly referred to by the suffix -uria. Some of the more common types of abnormal urine include:

- Proteinuria—Protein content in urine, often due to leaky or damaged glomeruli.
- Oliguria—An abnormally small amount of urine, often due to shock or kidney damage.
- Polyuria—An abnormally large amount of urine, often caused by diabetes.
- Dysuria—Painful or uncomfortable urination, often from urinary tract infections.
- Hematuria—Red blood cells in urine, from infection or injury.
- Glycosuria— Glucose in urine, due to excess plasma glucose in diabetes, beyond the amount able to be reabsorbed in the proximal convoluted tubule.

Regulation of Urine Concentration and Volume

Antidiuretic hormone (ADH) is produced by the pituitary gland to control the amount of water that is reabsorbed through the collecting ducts. Urine is produced not only to eliminate many cellular waste products, but also to control the amount of water in the body. In a way, urine volume regulation is part of homeostasis, in that it directly regulates blood volume, because greater amounts of urine will reduce the volume of waters in blood.

There are a few complex systems involved in regulating blood volume and urine production, such as the intricate renin–angiotensin system, and the simpler anti-diuretic hormone (ADH) feedback system.

Anti-Diuretic Hormone Feedback

An anti-diuretic is a substance that decreases urine volume, and ADH is the primary example of it within the body. ADH is a hormone secreted from the posterior pituitary gland in response to increased plasma osmolarity (i.e., increased ion concentration in the blood), which is generally due to an increased concentration of ions relative to the volume of plasma, or decreased plasma volume.

The increased plasma osmolarity is sensed by osmoreceptors in the hypothalamus, which will stimulate the posterior pituitary gland to release ADH. ADH will then act on the nephrons of the kidneys to cause a decrease in plasma osmolarity and an increase in urine osmolarity.

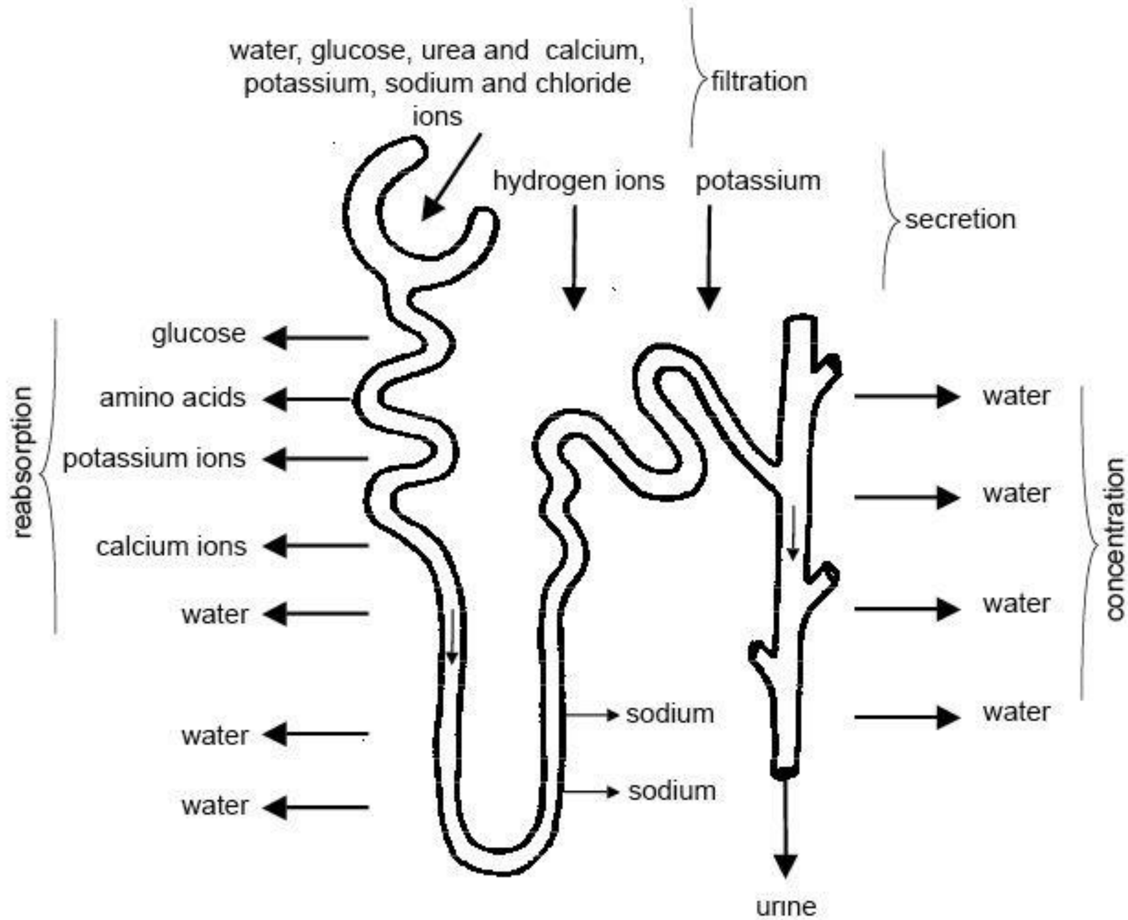
ADH increases the permeability to water of the distal convoluted tubule and collecting duct, which are normally impermeable to water. This effect causes increased water reabsorption and retention and decreases the volume of urine produced relative to its ion content.

After ADH acts on the nephron to decrease plasma osmolarity (and leads to increased blood volume) and increase urine osmolarity, the osmoreceptors in the hypothalamus will inactivate, and ADH secretion will end. Due to this response, ADH secretion is considered to be a form of negative feedback.

Diuretics

A diuretic is any substance that has the opposite effect of ADH— they increase urine volume, decrease urine osmolarity, lead to an increased plasma osmolarity, and often reduced blood volume. Many substances can act as diuretics, albeit with different mechanisms.

A common example is alcohol and water ingestion, which directly inhibit ADH secretion in the pituitary gland. Alternatively caffeine is a diuretic because it interferes with sodium reabsorption (reducing the amount of water reabsorbed by sodium cotransport) and increases the glomerular filtration rate by temporarily increasing blood pressure. Many medications are diuretics because they inhibit the ATPase pumps, thus slowing water reabsorption further.



water, glucose, urea and calcium, potassium, sodium and chloride ions
filtration
hydrogen ions
potassium
secretion
reabsorption
glucose
amino acids
potassium ions
calcium ions
water
water
water
sodium
sodium
water
water
water
water
concentration
urine