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MATRIC NO: 18/MHS02/146

DEPARTMENT: NURSING SCIENCE

LEVEL: 200

COURSE CODE: PHYSIOLOGY 212

CHARACTERISTICS OF URINE

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

- **Colour**: 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.

CHARACTERISTICS	NORMAL VALUES
Color	Pale yellow to deep amber
Odor	Odorless
Volume	750–2000 mL/24 hour
pH	4.5–8.0
Specific gravity	1.003–1.032
Osmolarity	40–1350 mOsmol/kg
Urobilinogen	0.2–1.0 mg/100 mL
White blood cells	0–2 HPF (per high-power field of microscope)
Leukocyte esterase	None
Protein	None or trace
Bilirubin	<0.3 mg/100 mL
Ketones	None
Nitrites	None
Blood	None
Glucose	None

Component of urine

Primary Components

Human urine consists primarily of water (91% to 96%), with organic solutes including urea, creatinine, uric acid, and trace amounts of enzymes, carbohydrates, hormones, fatty acids, pigments, and mucins, and inorganic ions such as sodium (Na^+), potassium (K^+), chloride (Cl^-), magnesium (Mg^{2+}), calcium (Ca^{2+}), ammonium (NH_4^+), sulfates (SO_4^{2-}), and phosphates (e.g., PO_4^{3-}).

A Representative Chemical Composition of Urine

- Water (H_2O): 95%
- Urea (H_2NCONH_2): 9.3 g/l to 23.3 g/l
- Chloride (Cl^-): 1.87 g/l to 8.4 g/l
- Sodium (Na^+): 1.17 g/l to 4.39 g/l
- Potassium (K^+): 0.750 g/l to 2.61 g/l
- Creatinine ($C_4H_7N_3O$): 0.670 g/l to 2.15 g/l
- Inorganic sulfur (S): 0.163 to 1.80 g/l

Lesser amounts of other ions and compounds are present, including hippuric acid, phosphorus, citric acid, glucuronic acid, ammonia, uric acid, and many others. Total solids in urine add up to around 59 grams per person. Note compounds you ordinarily do **not** find in human urine

in appreciable amounts, at least compared with blood plasma, include protein and glucose (typical normal range 0.03 g/l to 0.20 g/l). The presence of significant levels of protein or sugar in urine indicates potential health concerns.

The pH of human urine ranges from 5.5 to 7, averaging around 6.2. The specific gravity ranges from 1.003 to 1.035. Significant deviations in pH or specific gravity may be due to diet, drugs, or urinary disorders.

Urine Chemical Composition

urine composition as well as some additional compounds:

- **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.