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NURSING SCIENCE

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CHARACTERISTICS(COMPONENTS) OF URINE

Urine: A liquid excrement consisting of water, salts, and urea, which is made in the kidneys then released through the urethra.

- Amber color ,ph 4.5 to 8.0, specific gravity is 1.003-1.032
- urine include color, turbidity (transparency), smell (odor), pH (acidity – alkalinity) and density.

Since the ph, specific gravity, volume and others varies within a physiological range it means that concentration of urine varies and there could be diluted or concentrated urine.

- **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 ithe symptoms for more serious diseases, such as diabetes mellitus, or a damaged glomerulus.

- The composition of urine is related to the current composition of the blood, and the current regulation of nephrons. Filtrate is comprised of all blood components that are able to pass through the filtration membrane of the nephron.
- The filtration membrane blocks molecules from entering the filtrate based upon their size and charge. As a result, large elements like blood cells, platelets, antibodies, and albumin are excluded, as are some charged molecules.
- Filtrate production, the components in filtrate are modified by the nephron tubules until the final composition of urine has been attained in the collecting ducts. In the tubules, a good deal of water, electrolytes, and nutrients are removed from the filtrate and returned to the blood in the peritubular capillaries and vasa recta.
- Some additional wastes are also removed from the blood in those same capillaries and transported into the tubular filtrate. Both filtrate generation and nephron activity governing final urine composition are tightly regulated.

Typical constituents of filtrate and urine

All typical blood components able to pass through the filtration membrane, such as ions, glucose, amino acids, vitamins, hormones, and wastes create a filtrate composition very similar to plasma, but missing large and negatively charged molecules.

The glomeruli create about 180 liters of this filtrate every day, yet you excrete less than two liters of waste you call urine. The nephron tubules are responsible for returning the vast majority of needed constituents to the blood. The actual constituents in the final

urine depend highly, and represent a concentrated solution of both waste and excess nutrients.

Nitrogenous wastes

Nitrogen wastes are produced by the breakdown of proteins during normal metabolism. Proteins are broken down into amino acids, which in turn are deaminated by having their nitrogen groups removed. Deamination is the process by which amino groups are removed from amino acids.

The amino (NH_2) groups are subsequently converted into ammonia (NH_3), ammonium ion (NH_4^+). The liver rapidly converts these toxic molecules into less toxic urea

- Uric acid is produced by the metabolism of purines (a type of nucleic acids). Creatinine is a metabolite of creatine phosphate in muscles. These four nitrogenous wastes are removed from the blood by nephrons. Human urinary wastes typically contain primarily urea with small amounts of ammonium and creatinine, and very little uric acid.
- The chemical structure of ammonia, urea, uric acid, and creatinine. For the molecular structures, nitrogen = blue, carbon = black, oxygen = red, and hydrogen = white.
- Characteristics of the urine change, depending on influences such as water intake, exercise, environmental temperature, nutrient intake, and other factors ,Some of the characteristics such as color and odor are rough descriptors of your state of hydration.

Normal Urine Characteristics

Characteristic	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

Abnormal constituents of urine

Normally, only traces of protein are found in urine, and when higher amounts are found, damage to the glomeruli is the likely basis.

- Cells are not normally found in the urine. The presence of leukocytes may indicate a urinary tract infection. Leukocyte esterase is released by leukocytes; if detected in the urine, it can be taken as indirect evidence of a urinary tract infection (UTI). The presence of erythrocytes in the urine suggests trauma to the urinary system, a pathological condition such as kidney stones, or damage to the glomeruli.
- Protein does not normally leave the glomerular capillaries, so only trace amounts of protein should be found in the urine, approximately 10 mg/100 mL in a random sample. If excessive protein is detected in the urine, it usually means that the glomerulus is damaged and is allowing protein to “leak” into the filtrate.

Ketones are by products of fat metabolism. While normally present at low levels, finding excessive ketones in the urine suggests that the body is using fat as an energy source in preference to glucose.

- In diabetes mellitus when there is not enough insulin (type I diabetes mellitus) or because of insulin resistance (type II diabetes mellitus), there is plenty of glucose, but without the action of insulin, the cells cannot take it up, so it remains in the bloodstream.

- Instead, the cells are forced to use fat as their energy source, and fat consumed at such a level produces excessive ketones as byproducts.

These excess ketones will appear in the urine. Ketones may also appear if there is a severe deficiency of proteins or carbohydrates in the diet.

- Glucose is normally present in filtrate. However, it should be reabsorbed by the proximal convoluted tubules. Presence of glucose in urine suggests that the blood has a tremendous excess of glucose that is overwhelming glucose transporters in the proximal convoluted tubules.