

Urinalysis

Urinalysis consists of the physical, chemical and microscopic examination of the urinary byproducts of metabolism ([Table 13.4](#)):

- Physical assessment: an evaluation of the colour, clarity, odour and concentration of the urine.
- Chemical assessment: an evaluation of nine substances that provide valuable information about health and disease.

TABLE 13.4 Urinalysis: Clinical Significance of Results*

Test Category

Normal Result

Clinical Significance

Appearance

Clear

Cloudy urine can indicate the presence of pus, RBCs, bacteria or the ingestion of certain foods (e.g. fats, urates and phosphates)

Colour

Amber yellow (depends on concentration)

Dark red: bleeding from kidneys

Bright red: bleeding from lower urinary tract

Dark yellow to brownish: suggestive of urobilinogen or bilirubin

Green: infection

Note: Some foods, such as beetroot and rhubarb, and some medications can affect the colour of urine

Odour

Aromatic

Strong, sweet smell of acetone (pear drops): diabetes

Foul odour: infection

pH 4.6–8 (average 6)

Acid–base imbalance affects the pH of urine. Overly acidic or alkaline urine is associated with the formation of kidney stones

Specific gravity

Newborn: 1.002–1.020 Adult: 1.005–1.030

Note that specific gravity decreases with age. Normal adult levels generally fall in the range 1.010–1.025

Protein

0–8 mg/dL

50–80 mg/24 hours (at rest)

<250 mg/24 hours (during exercise)

Protein levels are a sensitive indicator of kidney function. Normal results show little or no protein in the urine. A high level of protein in the urine is one of the key indicators of kidney disease

Bilirubin None

Conjugated bilirubin is water soluble and can be excreted via the urine if blood levels are high. This normally indicates a blockage or obstruction of the biliary ducts

Urobilinogen 0.01–1.0 Ehrlich units/mL

Absence: may be due to complete obstructive jaundice or treatment with broad-spectrum antibiotics

Low levels: congenital enzymatic jaundice (hyperbilirubinaemia syndromes) or medication that decreases urine pH

Elevated levels: can indicate haemolytic anaemia or liver disease

Ketones None

Ketones are produced when fat, not glucose, is used as the body's main source of energy. This may be an indication of diabetes, starvation, insulin overdose or severe stress

Nitrites None

The presence of nitrites in the urine indicates a urinary tract infection. Gram-negative bacteria (e.g. *Escherichia coli*) convert nitrates to nitrites, and thus a positive result confirms the presence of bacteria in the urinary tract

Leucocyte esterase

Negative

This enzyme is released by white blood cells. A positive result is an indication of a urinary tract infection

Crystals None

The presence of crystals indicates kidney stone formation has occurred or is imminent

Casts None

These are clumps of material or cells that form in the distal and collecting tubules of the kidney. The clumps are tube shaped, thus the name 'casts'. Different types of cast indicate different conditions

Glucose

Fresh specimen: none

24-hour specimen: 50–300 mg/24 hours

Normally, all the glucose is reabsorbed by the proximal renal tubules. Glucose

appears in the urine when the blood glucose level exceeds the capability of the renal system to reabsorb the glucose (about 180 mg/dL). The presence of glucose in the urine is known as glycosuria, and this may indicate diabetes mellitus, kidney disease (which affects the renal tubules) or other causes of glucose intolerance. The diagnosis must be confirmed by further testing (e.g. fasting glucose, glucose tolerance test, further kidney function testing)

Note: Glycosuria is not always abnormal. It can occur immediately after eating large amounts of carbohydrates

White blood cells (WBCs) 0–4 per low power field

The presence of ≥ 5 WBCs in the urine indicates a urinary tract infection involving the kidneys or bladder, or both

Note: Vaginal discharge may contaminate the specimen and give misleading results

WBC cast None

These are clumps of WBCs that form in the distal and collecting tubules of the kidney. The clumps are tube shaped, thus the name ‘casts’. WBC casts are indicative of inflammation or infection and can indicate pyelonephritis (direct infection of the kidney) and other kidney disease

Red blood cells (RBCs) ≤ 2

The presence of RBCs in the urine is known as haematuria, which can be microscopic or gross. The most common causes of RBCs in the urine are disease of the bladder, ureter or urethra

RBC cast None

These are clumps of red blood cells that form in the distal and collecting tubules of the kidney. The clumps are tube shaped, thus the name ‘casts’. RBC casts are highly indicative of glomerular damage

* Reference ranges are from The Royal College of Pathologists of Australia Manual. [\[8\]](#)