

# Urinalysis

Urine is the end product of a complicated and delicately balanced physiological process, many normal and pathological mechanisms may influence the constituents.

Urinalysis is performed for:

- 1- Acquiring a large amount of information about several body systems (as a screening method).
- 2- Evaluation of the kidneys, through detection of abnormal components in the urine that maybe of renal origin such as cast and protein.

## **Macroscopic Examination of the Urine**

### **I. Physical examination**

#### **(1) Urine volume (quantity):**

The amount of urine produced daily depends upon several physiological factors including:

- Water and other fluid intake,
- Environmental condition,
- Diet
- Size,
- The activity of the animal,
- The species of the animal.

\* **Increased daily urine volume called polyuria.**

\* **Decreased daily urine output called oliguria**

#### **(2) Color:**

The normal color is pale yellow to yellow-brown depend on the concentration of urochrome.

- **Pale urine** is seen in diabetes mellitus, diabetes insipidus, increased water intake.
- **Dark urine** due to the concentration of urochromes occurs in association with dehydration, fever, decreased blood pressure, and presence of bilirubin.
- **Red to red-brown** due to presence of hemoglobin and myoglobin

#### **3) Transparency:**

- The transparency (clarity, turbidity) of urine as observed in a test tube or urinometer cylinate should recorded as **clear, flocculent or cloudy**.
- Normal urine is clear when freshly voided in all animals except in the horses which is normally thick and cloudy due to the presence of calcium carbonate crystals and mucus.

- **Pathologically** cloudy urine observed when leukocytes, erythrocytes, epithelial cells, bacteria, mucus, fat and crystal are present

#### (4) **Odor:**

The odor of the urine is not diagnostic, although the urine of males of certain species (porcine, feline and caprine) has an especially strong odor.

- The normal odor of urine is derived from the volatile organic acids present.
- Fruity odor may be detected in urine associated with pregnancy disease, acetonemia and diabetes mellitus

#### (5) **Foam:**

When shaken after collection, normal urine produces a white foam that is limited in quantity.

- If there is proteinuria the amount of foam produced is in excess and slow to disappear

#### (6) **Specific gravity:**

- Specific gravity of urine is a measurement of the relative amount of solids in solution and is an indication of the degree of tubular reabsorption or concentration by the kidney
- **Increased specific gravity** physiologically occurs as a consequence to decrease in water intake or in animal held in a high environmental temperature.
- Several diseases caused increasing in specific gravity such as dehydration result from diarrhea, high fever, cystitis and diabetes mellitus,
- **low specific gravity** occurs in advanced uremia, diabetes insipidus and excessive fluid intake

## **II. Chemical Examination:**

### **Acid-alkaline reaction (pH):**

Normal values of the pH reaction of urine from any species of animal must be carefully considered as the diet and state of metabolism. In general bovine, ovine and caprine have alkaline urine, while canine and feline have acid urine.

- The hydrogen ion concentration can be determined by the use of litmus paper or hydrogen PH paper strips.
- Increased acidity of the urine may result from starvation, fever and acidosis.
- Alkaline urine occurs in cystitis, ingestion of salts such as sodium lactate, sodium bicarbonate, sodium citrate and nitrate

### **Protein:**

Protein in urine can be estimated through

**Roberts' test** as follows: Pour 2ml of 20% sulphosalicylic acid solution into a test tube. Carefully pour 6 drops of urine down the side of the tube from a dropping pipette to form a layer of urine above the acid. Development of white ring at the junction indicates the presence of protein

Proteinuria indicated ...

- Tissue destruction and necrosis
- Fever & severe inflammatory processes
- Renal diseases
- Diabetes mellitus

**Glucose:**

A number of methods are available for both qualitative and quantitative estimation of glucose

- in the urine. The simplest method is the use of **Benedict reagent**.  
Glucose increases in the case of diabetes mellitus.

**Ketone bodies:**

The **Ross test** has been widely utilized for the detection of ketone bodies in the urine

Indications...

- Primary ketosis
- Secondary ketosis

**Blood:**

Blood may be present in the urine (hematuria) or the pigment hemoglobin (hemoglobinuria).

**Benizidine test.**

**Bile salt:** *Hay's test:*

**Urobilinogen:** *Ehrlicks' benzaldehyde test:*

**Microscopic Examination of the Urine**

The portion of urine that has been used in a microscopic examination is the sediment

**Component of Urinary Sediment:**

Urinary sediment can generally be divided into organized and un-organized elements

**Organized Sediment:**

**(1) Epithelial cells:**

*a- squamous epithelial cells:*

They are the largest of cells that appear in the urine sediment, derived from superficial layer of the urethra and vagina. They have an irregular outline, and contain a small round nucleus. They found as a single cells, or as sheets.

***b- transitional epithelial cells:***

They have various forms including round, oval and spindle shape.

They have intermediate size between the squamous cells and renal cells

**2) Leukocytes or pus cells:**

They are granulated cells, smaller than epithelial cells, contain nucleus.

- Normal urine contains 1-2 white cells/HPF, but 5-9/HPF indicates urethritis, cystitis, nephritis, vaginitis and metritis.

**(3) Erythrocytes:**

They are yellow to orange cells, smaller than leukocytes, contain no nuclei.

- In normal urine 1-2 RBC in each high power field, but presence of larger numbers of red cells more than 5-9/HPF denotes hemorrhage

in genito-urinary tract

**(4) Casts:**

Casts are principally formed in the lumen of the distal tubules ascending loop of Henle and collecting tubules of the kidneys. There are several types of casts:

- ***Hyaline cast.*** It is composed of protein and mucoprotein. It is homogenous, semitransparent colorless, cylindrical structure and having rounded end. It can be seen only in a dark field.
- ***Granular cast.*** It is hyaline cast contain granules either fine or coarse. It is derived from the disintegration of tubular epithelium.
- ***Waxy cast.*** It is similar in appearance to hyaline cast, being typically homogenous and appears more opaque than the hyaline cast, grayish or colorless. It indicates a chronic lesion of the tubules
- ***Epithelial cast.*** It is formed from the desquamated cells derived from the renal tubules. Cells within these cast vary in size and often oval, elongated or flat.
- ***Erythrocytic cast.*** It is a homogenous, cylindrical mass, having a deep yellow to orange color.
- ***Leukocytic cast.*** It is characterized by the presence of mucous pus cells adherent to or within a hyaline matrix.
- ***Fatty cast.*** Contain small droplets that appear as refractile bodies, usually colorless but can be stained with Sudan III.

**4) Mucous strands:**

They are derived from the mucous glands of the urinary tract. They appear as long, translucent shreds. They are normal in horses.

**(5) Bacteria:**

They are seen as small objects displaying true motility under high power. Normally there will be no bacteria seen in urine collected under sterile condition.

**(6) Yeast:**

Unnucleated round and oval bodies, larger than bacteria but smaller than leukocytes. They exist in urine as contamination.

**(7) Protozoa:**

Trichomonads and Giardia are usually the result of fecal contamination.

**(8) Spermatozoa:**

It appears as a contamination of urine with varying amount of semen.

**(9) Parasites ova:**

Urine sample contaminated by fecal matter may contain a variety of parasites ova.

**Unorganized Sediment:**

**(1) Fat droplets:**

They appear as round, highly retractile bodies of various size. Positive identification of fat droplets can be made by the addition of Sudan III to the urinary sediment.

**(2) Crystal:**

The type of crystal observed in urine depends upon the pH, solubility and concentration of the crystalloid and colloids

- Alkaline urine will contain triple and amorphous phosphate, calcium carbonate, especially in the horse, and on rare occasions, ammonium urate crystals.
- Acidic urine contains amorphous urate and uric acid, calcium oxalate and hippuric acid may be present, but are less common.

**Urine Culture**

Normal urine is sterile, but it may become contaminated with members of the skin microbes near the end of its passage through the urethra. Urine itself is a good culture medium.

**The followings should be considered during urine collection for culture:**

- Urine specimen should be collected in the morning.
- Urine specimen should be collected by the cytocentesis or catheterization.
- All specimens should be processed by the laboratory within 2 hours of collection, or be kept refrigerated at 4°c.

**The examination procedure include the following steps**

- Examine gram-stained smear.
- Culture the urine on suitable media such as MacConky agar, blood agar, incubate at 37°c for 24 hours under aerobic condition.
- Susceptibility tests on clinically significant
- bacterial isolates.

