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# Analysis of Urine as Indicators of Specific Body Conditions

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**Abstract.** Urinalysis can be defined as a procedure for examining various factors of urine, which include physical properties, particulate matter, cells, casts, crystals, organisms and solutes. Urinalysis is recommended to be a part of the initial examination of all patients as its cheap, feasible and gives productive results. This paper focuses on the analysis of urine collected at specific body conditions. Here we illustrate the urine profile of different persons having various body conditions, which include, having urinary tract infection, undergoing strenuous exercise, having back pain regularly, having very low urine output and a person who is on 24 hours of diet. Examination of urine collected from different persons having specific body conditions usually helps us in the diagnosis of various diseases, which it indicates.

## 1. Introduction

In clinical laboratory, urine analysis is the third major diagnostic screening test. In urinalysis we generally detect and analyse the various byproducts that are eliminated through urine as a result of normal as well abnormal metabolism that is taking place in an individual. Routine urinalysis is very useful for the diagnosis of urinary tract infection [1]. Urine analysis is one of the most feasible and easy screening method. Urine analysis requires limited time and expertise [2]. Kidneys function in excretion of toxic substances and metabolic byproducts out of the blood, regulate the water quantity and blood pressure in the body, maintain acid-base equilibrium, detoxify drugs, metabolize hormones, retain the proteins, electrolytes and other compounds in adequate quantity [3, 12].

The colour of urine has been considered to be one of the most vital tools for assessment of hydration [5]. Normally, the colour of fresh urine ranges from pale to dark yellow and it is clear in appearance. Normally the volume of urine ranges from 750 to 2000 ml/24hrs. Urinalysis is used as a diagnostic tool for a wide range of disorders. There might be severe renal diseases without the presence of symptoms [4]. By analysing the various constituents of the urine, the concentration, colour and volume we can diagnosis a variety of disease which include diabetes, urinary tract infection and other kidney diseases as well. The abnormal concentration of constituents found in urine include: glucose, red blood cells, bacteria, protein, bilirubin, white blood cells and even crystals. In case of urinary tract infection, the clarity of the urine is lost and it looks cloudy instead [3].

Urinalysis is a common test done for several reasons:

To analyse the overall health – Urinalysis is recommended by doctors as a routine medical examination [6], pregnancy check-up, pre-surgery preparation or for the diagnosis of diseases such as diabetes, kidney disease, hypertension and liver disease.



For diagnosis of various diseases - Doctors may recommend urinalysis if symptoms such as abdominal pain, painful urination, back pain [7], and blood in urine arise. Urinalysis proves to be a powerful tool in diagnosis of such symptoms.

For screening of a various diseases - Kidney diseases or urinary tract diseases should be regularly monitored by going for routine urinalysis.

In our present study we have used urine dipstick for the biochemical analysis of urine. Physical and microscopic analysis was also done in order to analyse the urine at specific body conditions. In case of hospitalized patients urine dipstick proves to be a quick, cheap and a useful test in predicting the various abnormal constituents in the urine [2].

## **2. Materials and Methods**

### *2.1. Sample collection*

Types of urine specimens collected for analysis at specific body conditions are from a person having severely low urine output. (Sample 1), having urinary tract infection confirmed by doctors (Sample 2), had been on 24 hours of fasting (Sample 3), has back pain regularly (Sample 4) and undergoing strenuous exercise (Sample 5).

Depending on the specific body conditions, the urine was collected at home or at the laboratory in a sterile container according to the prescribed timings. Midstream sample was collected for acquiring accurate results, using a clean-catch method. For the collection of the sample, the urinary opening was cleaned properly. In case of women, the labia was spread and cleaned from front to back while in case of men the tip of the penis was cleaned thoroughly. The concerned individual had then collected the midstream urine into a sterilized urine container. 1 to 2 ounces of urine was collected (30 to 59 milliliters) into the sterilized container and the sample was then tested immediately in the laboratory within 30 minutes.

### *2.2. Sample analysis procedure*

The equipments used for the examination of the samples included urine dipsticks, Zeiss AxioCam 105 color (Carl Zeiss Microscopy, Germany) optical microscope (40X), disposable gloves, disposable towel and other necessary equipments. The person concerned was informed about the timings as to when to collect the urine, how to collect the urine and the type of urine to be collected. Manufacturer's recommendations were checked and product (dipstick) expiry date was also checked. After the urine sample was collected, a part of the urine sample (5 ml) was taken in a test tube filling it only upto 1/3 rd of its capacity. Reagent dipstick ((Manufacturer-Standard Diagnostics, INC.) was taken from the container and immediately the cap was replaced. The dipstick was immersed into the rest of the urine sample in the sterile container. It was kept for 2 minutes and then removed for analysis. The edge of the strip was then wiped against the rim of the vessel in order to remove any excess urine and the dipstick was then analysed by holding at a slight angle to prevents pad-to-pad contamination. The reagent pads were read against the reference guide.

For determining the urine colour, the urine taken in the test tube was placed against a white background, under fluorescent lighting. It was then compared against an original urine colour scale [5] and the colour was noted. The urine in the test tube was then centrifuged at 5000 RPM for 6 minutes. The residue was kept following the removal of the supernatant. For microscopic analysis, 20 $\mu$ l of the residue was taken on a clean, grease free slide and a coverslip was placed on it. It was then observed under the microscope at 400X. The remaining urine and the dipstick was disposed of and the microscopic results were documented.

## **3. Results**

After the examination of the urine samples the results were reported. Sample 1 was from the person who had low urine output. Sample 2 was from the patient having urinary tract infection as confirmed by the doctors. Sample 3 was from the person who had been on 24 hours of fasting. Sample 4 was from the person having back pain regularly and Sample 5 was from a person undergoing strenuous exercise. The results were reported according to the visual examination, physical characteristics analysis, biochemical test and microscopic analysis. The effectiveness of

urinalysis has been highlighted in this paper. Especially the microscopic analysis turns out to be of immense clinical importance. The presence of crystals, casts, blood, bacteria altogether contribute to the abnormal constituents of the urine.

The presence of all these constituents indicate glomerular disease, intestinal kidney disease, kidney infections, diabetes mellitus and many other diseases. On the other hand, even many symptoms which people tend to ignore ultimately lead them towards the development of chronic infections with time. In case of the visual and physical characteristics analysis, the volume in case of all the samples except sample 1 was low. The colour and appearance was pale yellow and clear in all the samples except, sample 2, where it was yellow and cloudy and sample 5, where it was slightly reddish yellow and clear. All the urine samples has a mild smell except, sample 1, which had a strong smell and sample 3, which had a characteristic fruity smell (Table 1).

In case of the biochemical test (Dipstick analysis), both protein and glucose was absent in all the samples (Figure 1 and Table 2).

In case of the microscopic analysis (Figure 2 and Table 3), Sample 1 (A) showed the presence of mucus and pus cells. Sample 2 (B), showed the presence of pus cells, bacteria, RBCs and epithelial cells. In Sample 3 (C), there were presence of epithelial cells, few bacteria and RBCs and in Sample 4 (D) and Sample 5 (E) the presence of bacteria, epithelial cells and RBCs were seen.

**Table 1.** Visual examination and physical characteristics analysis results:-

Sample	Volume of Urine Output	Colour and Appearance	Smell
1	Low	Pale yellow and clear	Strong smell
2	Normal	Yellow and cloudy	Mild smell
3	Normal	Pale yellow and Clear	Characteristic fruity smell
4	Normal	Pale yellow and cloudy	Mild smell
5	Normal	Slightly reddish yellow and clear	Mild smell



**Figure 1.** Biochemical Test (Dipstick) Result - In all the samples both glucose and protein showed negative results.

**Table 2.** Biochemical Test Results from the Dipstick analysis

Sample	Protein	Glucose
1	Not Present	Not Present
2	Not Present	Not Present
3	Not Present	Not Present
4	Not Present	Not Present
5	Not Present	Not Present

**Table 3.** Microscopic analysis result of the urine samples

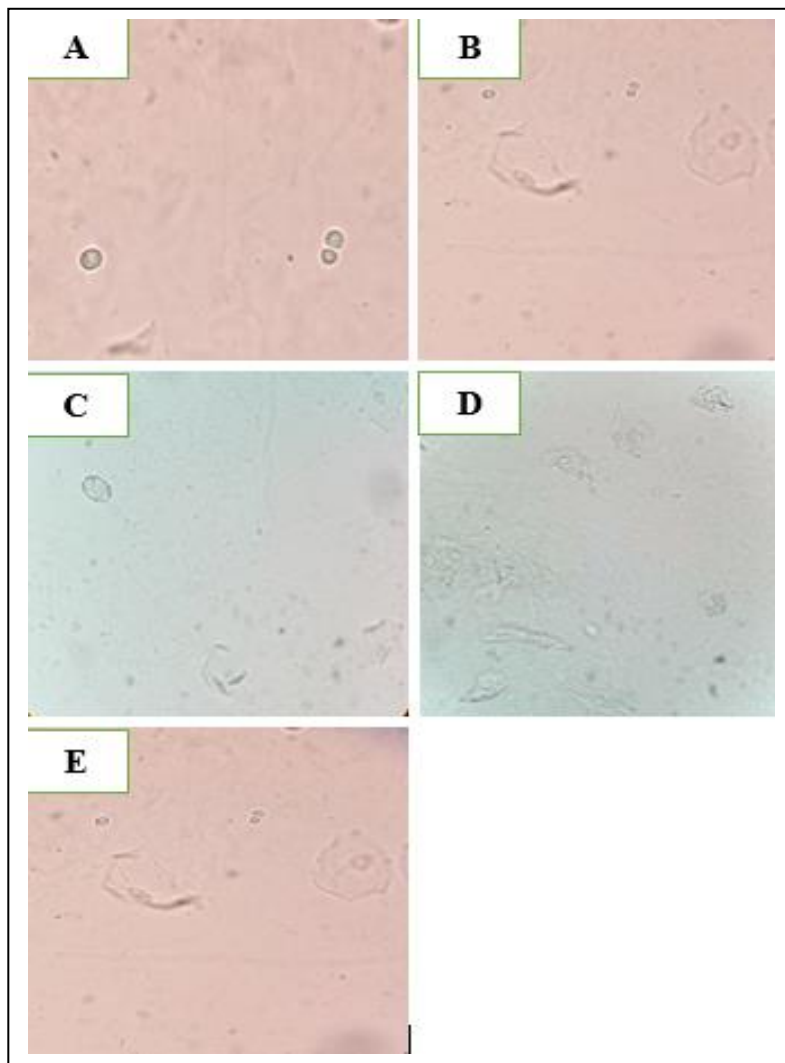
Sample	Pus Cells	Bacteria	Red Blood Cells	Epithelial Cells	Mucus
1	7 - 8	Present	6 - 7	5 - 6	Present
2	8 - 10	Present	5 - 6	4 - 5	Not present
3	2 - 3	Present (few)	1 - 2	1 - 2	Not present
4	8 - 10	Present	4 - 5	6 - 8	Not present
5	3 - 4	Present	10 - 11	4 - 5	Not present

One of the very common example of this type is the regular back pain which people tend to ignore, it might be a bladder infection which on remaining untreated for several days spreads to the kidney and ultimately leads to back pain. As there is no risk in undergoing a urine test, it is recommended that one should always go for it on a routine basis, which might help one from taking early precautions against various diseases.

#### 4. Discussions

Urinalysis is used to diagnose cystitis [10], pyelonephritis [8], prostatitis [9], glomerulonephritis [11], pyuria, rhabdomyosis, metabolic disorders, diabetes mellitus, bleeding disorders, inherited disorders and several other diseases. Urinalysis proves to be an effective tools when it is combined with other tests to diagnose diseases like kidney stones, inflammation of kidney structures and even to detect drugs misuse. In this study, in case of Sample 1, the presence of mucus indicates that the patient might have kidney stones (Initial Stage). Presence of epithelial cells, bacteria and RBCs indicate Urinary Tract Infection [13, 14]. Sample 2 showed the presence of bacteria, epithelial cells and pus cells, which indicate urinary tract infection [13,14] and so a cloudy appearance was observed in the urine. Sample 3 showed normal results as the number of pus cells, epithelial cells and bacteria are very few. Sample 4 showed the presence of bacteria, pus cells, epithelial cells, RBCs in many numbers which indicates a urinary tract infection [13,14] as well. Usually a bladder infection which remains untreated for a long time spreads to the kidneys and that ultimately leads to the back pain. Sample 5 showed the presence of the high number of RBCs which indicate genital-urinary tract infection, which has been due to strenuous exercise, otherwise the presence of few epithelial cells, pus cells and bacteria are normal.

The visual examination results also indicated various symptoms of the specific body conditions. Sample 1 had a strong pungent smell, which indicates that the person has urinary tract infection and has undergone dehydration [15]. The cloudy appearance [15] in case of Sample 2 and Sample 4 is an indication of the Urinary Tract Infection. In Sample 3 the utilization of fat by the body during fast, which ultimately gave rise to ketone bodies as by products into the urine. These ketone bodies resulted in a Characteristic fruity smell [15] in the urine. The colour of sample 5 was slightly reddish yellow, indicating the presence of red blood cells [16], which in turn indicates Urinary Tract Infection or Genital- Urinary Tract bleeding due to strenuous exercises.



**Figure 2.** Micrographs of all the Samples. Sample 1(A) shows the presence of mucus and pus cells. While for Sample 2 (B) it shows the presence of Pus cells, bacteria, RBCs and epithelial cells. For Sample 3 (C), there are presence of epithelial cells, few bacteria and RBCs and in Sample 4 (D) and Sample 5 (E) the presence of bacteria, epithelial cells and RBCs are seen.

#### 4.1. Clinical significance of urinalysis

Bacteriuria is usually indicated by the reduction of nitrate to nitrite by bacteria resulting in change of colour of the solution or on a reagent strip. In case such change in colour is detected it should be dealt seriously and proper medication should be allotted for the same to avoid further spread of the disease. Diseases such as glomerulonephritis, polycystic kidney disease, diabetes mellitus come in association with the presence of red blood cells (RBCs) in the urine. On the other hand inflammatory processes as well as urinary tract infection is associated with the presence of white blood cells. Pyuria is usually caused by collagen vascular disease and allergic interstitial nephritis. Casts formation takes place in the renal tubules and usually consists of a matrix of translucent protein. The presence of red blood cells or white blood cells in the casts lead to the conclusion that the cells originated within the kidney [4].

## 5. Conclusions

Physical, chemical, and microscopic examinations are very important for complete urine analysis. Usually midstream urine is required for acquiring accurate results in urinalysis. Here in this study, the urine profile was analysed at specific body conditions such as regular back pain, painful urination, which should not be ignored and proper measures should be taken immediately. One should necessarily consult a doctor. Though dipstick might give false-positive and false-negative results, but it is an easy and effective method for analysing abnormal constituents in urine. Thus such test should be followed by confirmatory tests before prescribing any medications to a patient.

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