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Urine Sediments As A Diagnostic Tool in Unani System of Medicine: A Review

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ABSTRACT

The visual examination (naked-eye examination) of the urine is called uroscopy. It provides valuable insights into the health of the liver, kidney, and bladder, as well as into the vascular and systemic conditions affecting these organs. Urine is analyzed based on parameters such as color, consistency, turbidity or clarity, volume, froth, odor, and sediments. Among these, sediments serve as an important diagnostic and prognostic tool. The term "sediment" gives the impression of any substance that settles. However, in the Unani system of medicine, physicians use the terms *rasūb,* that is, "sediment" or "residue" to describe substances that are denser and appear distinct compared with the urine, even if they are suspended or floating. Urine sediments are waste of *hadm-e-uruqi* (vascular digestion) or *hadm-e-uzwi* (tissue digestion). The nature, quality, quantity, form, position, time, and admixture of sediments provide clues about the various states of the body. This study aimed to examine the significance of urine sediments in diagnosing diseases.

Keywords: *Rasūb,* sediments, tissue digestion, uroscopy, USM, vascular digestion

INTRODUCTION

In Unani medicine, urine is regarded as a "divine fluid by physicians" because it helps assess the state of human body, that is, health or disease (1). It is an important diagnostic tool in the Unani system of medicine (USM); hence, the Unani physicians have discussed uroscopy in detail in their literature. According to USM, the *laun* (color), *qiwām* (consistency), *miqdār* (quantity), *safayi wa kadurat* (clarity/transparency and turbidity/translucency), *raiha/boo* (odor), *zubda* (foam/froth), and *rasūb* (sediment) are the parameters to be observed in a sample of urine for diagnosis and prognosis (2–6).

Lams (feel) and *mazah* (taste) were also observed by Zakariyya Rāzī. However, these two were omitted later. Among these, *laun* (color), *qiwām* (consistency), and *rasub* (sediment) play a vital role in the diagnosis and prognosis of diseases (7).

METHODOLOGY

The data source included classical books of USM, manuscripts of USM and their translations available in the physical or digital form, books of modern medicine relevant to the topic, journals, proceedings, various digital libraries, and authentic websites. The data were analyzed for the relevant literary material, collected from the aforementioned sources, and compiled. Further, they were analyzed and systematized in a comprehensive manner.

RASŪB AL-BAWL (URINE SEDIMENTS)

Sediments are the denser substances in the urine, either floating, suspended, or settled at the bottom of the urine container. They are the waste of either the normal digestion or the humors, with the former being more common (3).

Formation of rasūb al-bawl

1. Sediments: They are the waste of the third and fourth phases of digestion. The food passes through four phases of digestion inside the body to ultimately be transformed into nutrients that replenishment and become part of the body's tissues. Waste production in each digestive phase is inevitable because no absolute food exists. In the first stage of digestion, the food changes to chyme, and feces are produced as waste. In the second stage, the chyme changes into humors inside the liver, producing urine as waste (2,4,6,8,9). In the

third stage, the humors undergo some changes inside the vessels. In the fourth and final stage of digestion, *quwwat ghādhiya* (nutritive faculty) transforms the humors according to the *mizāj* (temperament), *rang* (color), and *qiwām* (consistency) of the organs being nourished, providing nutrition or replenishment (2,4,6,8,9). The functions of *quwwat ghādhiya* include (a) *tahsīl* (attraction) by *quwwat muhasşila* (attractive faculty), (b) *ilsāq* (adhesion) by *quwwat mulasşiqa* (adhering faculty), and (c) *tashbīh* (assimilation) by *quwwat mushabbiha* (assimilative faculty) (3,6,8–10). If the food particles do not get transformed at the third or any other level of fourth stage of digestion, that is, *tahsīl, ilsāq*, and *tashbīh*, they become waste and hence may appear in urine as sediments.

2. Poor-quality foods: Sometimes poor-quality foods produce poor-quality humors that do not take part in nutrition or replenishment and hence become waste. Therefore, this waste is expelled in the form of urine sediment (4,11).

3. Weakness of quwā: a) The weakness of *quwwat jādhiba* (absorptive faculty), *quwwat māsika* (retentive faculty), quwwat *hādima* (digestive faculty), and *quwwat dāfi'a* (expulsive faculty) of vessels (2–4,9,11) results in an incomplete transformation of humors in the vessels. They are considered as waste and hence excreted in the form of urine sediments (3,12). b) The weakness of *quwat ghādhiya* at any level of tissue digestion, that is, *tahsīl, ilsāq,* and *tashbīh*, results in the formation of urine sediments.

4) Sometimes, due to its excessive quantity, the matter is excreted even without concoction and found in the urine in the form of *rasūb ghayr mahmūd* (6,13,14).

5) Other causes of the formation of urine sediments include excess dissolution of organs, any injury or wound of the urine tract, kidney or bladder stones, and so forth.

Classification of urine sediments

The urine sediments (Figure 1) are broadly classified into two types: benevolent and malevolent.

RASŪB MAHMŪD (BENEVOLENT SEDIMENTS)

These types of sediments are produced due to optimal *nudj* (concoction) of matter. Here the matter denotes either waste of the third and fourth stages of digestion or morbid matter of the disease (4,11,16,17). *Rasūb mahmūd* are seen in both healthy and disease states. In a healthy state, it is a sign of good digestion and optimum concoction of matter. In the disease state, this type of sediment helps in the prognosis of the disease. This indicates that previously *rasūb ghayr mahmūd* were being excreted; however, after complete concoction, the body then expels *rasūb mahmūd*. Therefore, it also indicates disease recovery state.

The characteristics of *rasūb mahmūd* are displayed in Table 1 (4,6,13).

RASŪB GHAYR MAHMŪD (MALEVOLENT SEDIMENTS)

Rasūb ghayr mahmūd are produced due to an incomplete concoction of matter. They are also the result of the dissolution of organs, ulceration of kidney or bladder, scaling of organs, kidney and bladder stones, excess of raw humor in vessels, and so forth (3,4,12).

Types of *rasūb ghayr mahmūd*

The *rasūb ghayr mahmūd* are of the following types:

1. Rasūb khurātī (flaky sediments)

The term *khurātī* is derived from the word *khurātā,* which means the scales of a grinding machine (15). *Rasūb khurātī* are of the following types:

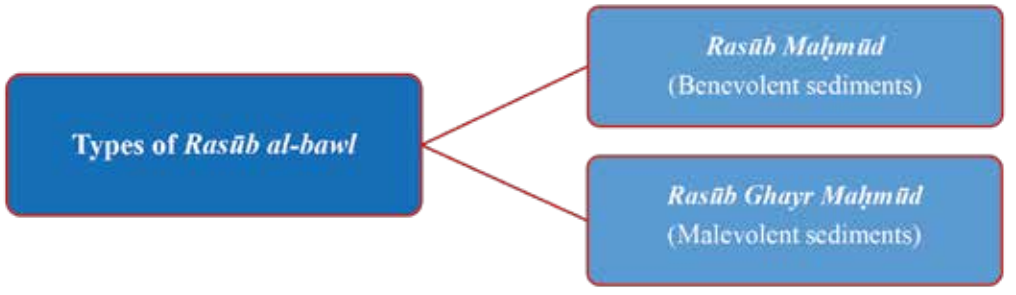

Figure 1 Types of *Rasūb al-bawl.*

Table 1 Characteristics of *rasūb mahmūd*

1.	**White color**	Most of the *ā'ḍā' aṣliyya* (simple organs) are white in color, and *rasūb maḥmūd* are produced usually during cellular digestion. Therefore, humors acquire the color of *ā'ḍā' asliyya*, but for certain reasons, these food constituents or humors cannot integrate into the organ. Hence, *ṭabī'at* (physis) expels them into the urine in the form of sediments (2,4,10,12,15).
2.	**Smooth texture**	The smooth texture indicates an absolute concoction, whereas roughness indicates an incomplete concoction. During concoction of the matter in the body, *ṭabī'at* (physis) attempts to bring uniformity in each particle in terms of shape, size, and texture of the matter so that it can be excreted (6,10,14).
3.	**Settled at the bottom**	Settled sediment indicates optimal concoction. Sediments and most of the *jauhar ada* are earthy in nature. Therefore, sediments settle at the bottom (6,8,10,13). The sediment floating on the surface or hanging in the middle of urine is not referred to as *maḥmūd* (15).
4.	**Proximity to each other**	Proximity of sediments indicates that no morbid air separates them. Due to optimal concoction, no air remains among particles, and it allows them to easily settle down, similar to soil particles (6,15).
5.	**Light weight**	Sediment particles become lightweight due to the heat produced during the concoction. As a result, they disperse and settle easily on being shaken (6,14).
6.	**Uniformity**	Uniformity and homogeneity are vital indicators of absolute concoction in a matter. Nonuniformity and heterogeneity of sediment particles (some components are thin, and others are thick) and jumbled sediments suggest inadequate action of physis on sediments (6).

i. Rasūb safā'ihī (flat peel–like sediments): These sediments resemble scales *(safā'ihī)*. One of the types of *rasūb safā'ihī* are thin and white, similar to the inner membrane of an egg (4,10,15). They only come from the bladder and indicates bladder irritation. Red-colored *rasūb safā'ihī* suggests kidney irritation because the kidney is the only red-colored organ in the urinary system (4,15).

ii. Rasūb karsanī (vetch sediments): These sediments are denser and narrower than the *rasūb-e-safā'ihī.* They are red in color and round in shape and consist of fleshy components (2,15). *Rasūb karsanī* indicate burned or necrotic fragments of hepatic tissue or burned blood of the liver (10,15). Sometimes vetch sediments may originate from kidneys. They are more cohesive and fleshier compared with sediments originating from other organs, which are not so fleshy and easily crumbled. To identify the site of origin of *rasūb karsanī*, Zakariyya Rāzī suggested that if *rasūb karsanī* are found in concocted urine, it indicates kidneys as the source of *rasūb karsanī*; if not, it indicates organs other than the kidneys as the source (2,4,18).

iii. Rasūb Nukhālī (wheat husk–like sediments): These sediments are narrower and denser than the *rasūb safā'ihī* (4,10,15). However, these sediments are not red like *rasūb karasnī*. Some physicians believe that the term nukhālī is derived from *nukhala* (bhoosi/straw) (15). The *rasūb nukhālī* usually originate from *jarab al-mathāna* (bladder scabies). Sometimes, they may also originate from other organs: dissolution of *ada asli*, for example, *urūq,* as well as from ulcers of the bladder (4,15).

The association of *rasūb nukhālī* with black urine, burning micturition, weakness in the body, and normal condition of the organs of the urinary system is an indication of dissolution of humors (18).

iv. Rasūb Dashīshī/Sawīqī (gritty sediments): Rasūb dashīshī are similar to rasūb nukhālī, but thicker (2,4,15). *Rasūb dashīshī* are classified based on color as follows:

a. White color: These sediments originate from urinary organs such as the bladder and ureter and may lead to jarab al-mathāna (irritation of the bladder) (15).

b. Bluish white (safed mayal ba kamudat): These sediments originate from *ā'dā' asliyya* that are distant from the urinary organs (15).

c. Red color: These sediments are caused by either the burning of blood or the scaling of the liver and kidney (15).

All flaky sediments that do not originate from the kidneys, bladder, or urinary tract indicate a bad prognosis (15).

2. *Rasūb lahmī* (fleshy sediments)

These sediments look like flesh fragments in the urine and primarily originate from either the kidneys or other muscular organs of the body. When the source of *rasūb lahmī* is the kidneys, it appears fleshier, and the urine is well concocted, showing no sign of dissolution within the body (2). If these sediments are found in unconcocted urine along with positive signs of general muscle wasting, it indicates general tissue degradation (2–4).

3. *Rasūb dasmī* (fatty sediments)

Rasūb dasmī indicate the dissolution of *ā'dā' ghayr asliyya* such as *lahm* (flesh), *shahm* (soft/liquid fat), and *sameen* (solid fat). These sediments originate only from these three organs. Dissolved constituents of these organs get mixed with urine and are excreted. In freshly voided urine, which is hot, *rasūb dasmī* are well mixed with urine and do not appear distinct. Once the urine becomes cold, rasūb dasmī get condensed and appear distinct in urine. Till rasūb dasmī do not appear distinct, it is referred to as *dasūmat* or *dehniyat,* not sediment (2,3,19).

4. *Rasūb middī/Reemi* (purulent sediments)

These sediments indicate the pus discharged from an ulcer or wound or ruptured mature swelling. The ulcer, wound, or swelling is located in either the urinary organs or organs other than the urinary system (2,4,20).

5. *Rasūb mukhāti* (mucoid sediments)

They indicate an excess of thick, raw phlegmatic humor, that is, phlegm in the body. The origins of *rasūb mukhāti* are as follows:

1. Phlegm increases in the body and is excreted with the urine.
2. When (phlegmatic diseases) near the urinary system bohran a crisis, this matter is excreted through the urine. An increased amount of these sediments in urine, especially in the final stages of diseases such as arthritis and sciatica, is a positive sign and indicates recovery.
3. When the kidneys become cold, these sediments are found in the urine (2,4,15). The difference between the pus-like sediments and the mucoid sediments is that the former is foul-smelling and is often accompanied by some signs of swelling; the particles of these sediments aggregate and disperse easily. The latter are turbid and thick, and their particles do not aggregate and disperse easily (15).

6. *Rasūb sha'ari* (hair-like sediments)

When the morbid matter of thick consistency in a tubular structure is acted upon by heat, it coagulates and acquires an elongated shape similar to hair. Subsequently, it passes into the urine in the form of sediments. It may reach a length of several hand-spans. It may be white or red and is formed in the kidneys (2,4,10). It denotes the presence of *ghalīz akhlāt* (viscous humors) in the body. If the matter contains blood, rasūb sha'ari is red; otherwise, it is white (3,4,8,12,21,22).

7. *Rasūb khamīrī* (yeast-like sediments)

These sediments look like yeast soaked in water. They are thicker, larger in size, and white without any luster. These sediments indicate indigestion and weakness of the stomach and intestine. Sometimes, their appearance in urine indicates consumption of yogurt and cheese (4,10).

8. *Rasūb ramlī* (sandy sediments)

They always indicate that a stone is formed, is still forming, or is dissolved in the kidneys or bladder. The red sandy sediments originate from the kidneys, whereas the white sandy sediments originate from the bladder. Zakariyya Rāzī mentioned that red sandy sediments indicated the dominance of heat in kidneys. Another type of sediment, known as raml, is small and resembles millet grains. These sediments are loose, contain soft components, and act as precursors to stone formation (2,4,18).

9. *Rasūb ramādī/khakastari* (ashy sediments)

These sediments indicate the presence of phlegm or pus that has changed its color due to prolonged stagnation (2). Zakariyya Rāzī believed that these sediments indicate the dominance of phlegm or black bile (2,4,10).

10. *Rasūb ilqī* (leechy sediments)

These sediments look like a blood clot. If they are well mixed with the urine, it indicates liver weakness. On the contrary, if they are not well mixed with the urine, they indicate wounds and ulcers of the urinary tract and reproductive organs (2,4,10,13).

Different types of malevolent sediments and their implications for diseases are listed in Table 2.

Table 2 Types of malevolent sediments and their indications

Rasūb ghayr maḥmūd		**Indications**
1. *Rasūb khurātī* (flaky sediments):		
i.	*Rasūb safā'iḥī* (flat peel–like sediments)	Bladder irritation
ii.	*Rasūb karsanī* (vetch sediments)	Burned or necrotic fragments of hepatic tissue or burned blood of liver, sometimes from kidneys
iii.	*Rasūb nukhālī* (wheat husk–like sediments)	*Jarab al-mathāna* (bladder scabies), sometimes from the dissolution of *ada asli*, for example, *urūq*, bladder ulcers, and so forth
iv.	*Rasūb dashīshī/Sawīqī* (gritty sediments)	*Jarab al-mathāna,* burning of blood or scaling of the liver and kidneys
2. *Rasūb laḥmī* (fleshy sediments)		Either the kidneys or other muscular organs of the body
1.	*Rasūb dasmī* (fatty sediments)	Dissolution of *ā'ḍā' ghayr aṣliyya* such as *lahm* (flesh), *shaḥm* (soft/liquid fat), and *sameen* (solid fat)
2.	*Rasūb middī/Reemi* (purulent sediments)	Discharge of pus from an ulcer or wound or ruptured mature swelling
3.	*Rasūb mukhāṭi* (mucoid sediments)	Increased phlegm in the body, the final stages of diseases such as arthritis and sciatica a good sign indicating recovery, cold temperament of kidneys
4.	*Rasūb sha'ari* (hair-like sediments)	Presence of *ghalīz akhlāṭ* (viscous humors) in the body
5.	*Rasūb khamīrī* (yeast-like sediments)	Indigestion and weakness of the stomach and intestine
6.	*Rasūb ramlī* (sandy sediments)	Always indicate that a stone is formed, is still forming, or is dissolved in the kidneys or bladder
7.	*Rasūb ramādī/ Khakastari* (ashy sediments)	Presence of phlegm or pus that has changed its color due to prolonged stagnation
8.	*Rasūb ilqī* (leechy sediments)	Liver weakness, and wounds and ulcers of the urinary tract and reproductive organs

11. *Miqdar-e-rasūb* (quantity of sediments)

An excess of sediment indicates that the cause of disease is strong. If the quantity of sediment is less, it indicates that the cause is weak. The absence of sediments indicates an incomplete concoction and urinary tract obstruction (10). Lean and thin individuals, especially those who regularly exercise or work in a physically demanding occupation, have less sediments in their urine and recover from disease with very less or no sediments in their urine. Sediments are mostly found in the urine of obese sedentary people (4,12,15).

12. *Alwān al-rasūb* (colors of the sediments)

The classification of colors of the sediments is presented in Table 3.

13. *Qiwām wa amezish rasūb* (consistency and composition)

The softness and homogeneity of the sediments are good signs. The discreteness of the particles indicates the presence of *ghalīz riyāh* and impaired digestion. Soft and uniform sediments are considered good compared with rough and discrete sediments (4,10,13).

14. *Maqam-e-rasūb* (position of sediments)

Sediments are of three types based on the position (Table 4). These are *rasūb ghamam, rasūb moallaq*, and *rasūb rasib*.

15. *Zamana rasūb* (time required in sedimentation)

If the sediment settles rapidly in the vessel, it is considered a good sign, suggesting complete maturation.

Table 3 Colors of the sediments

1. White color	White is considered the best color for sediments, representing overall maturation. White sediments indicate a balanced maturation ratio, much like smooth, white pus signifies the maturation of a swelling (10,15).
2. Red color	After white, red is the next best color of sediments. It indicates the dominance of blood, which is regarded as the *ashraf* (noble) humor in the body and is highly compatible with physis (2,15).
3. Yellow color	Yellow is considered good after red. It results from excess heat in the body, signifying the dominance of bilious humor in the body and an increased disease severity (10,15).
4. *Zarnikhi* color (silver gray color)	*Zarnīkhī* color is considered good after yellow, signifying the burning of black bile (10,15).
5. Black color	Black sediments are considered least favorable and can appear as either *rasūb moallaq*, *rasūb ghamam*, or *rasūb rasib*. They may indicate severe burning/oxidation, extreme coldness, or a depletion of innate heat (10,15). Black urine with black sediments is highly unfavorable. However, black sediments alone is less concerning.(3,10).

Table 4 Position of sediments

***1. Ghamam/Taafi*:** (floats on the surface of urine)	It is also known as *ashab/sahab* (2–4,10). If sediments are extremely thin and light (in weight), they are called *sabaab*. It indicates incomplete concoction and presence of *ghalīẓ riyāḥ*, causing the sediments to ascend and float on the surface (3). However, it indicates recovery from disease in the case of lean individuals (12).
***2.Rasūb Moallaq*:** (suspends in the middle of the vessel)	It is a good sign, especially if its apex points downward. If the apex points upward, it indicates incomplete concoction, prolongation of disease, and mental disturbance. It also indicates the presence of *ghalīẓ riyāḥ*, but the quantity of *ghalīẓ riyāḥ* is lesser, and the degree of concoction is more compared with *rasūb ghamam* (3,4,10).
***3.Rasūb Rasib*:** (settles at the bottom of the vessel)	It signifies the completion of the concoction process in the case of *rasūb maḥmūd* and incomplete concoction in the case of *rasūb ghayr maḥmūd*. *Rasūb rasib* have different indications because they are *rasūb maḥmūd* or *rasūb ghayr maḥmūd/mazmum* (15) (2–4,6). *Rasūb rasib* is considered bad in the case of phlegmatic and black bilious diseases, whereas *rasūb mollaq* is considered good in these diseases (3,4). However, in the case of bilious diseases, the *rasūb rasib* is considered good and *rasūb mollaq* is considered bad (4,10,12).

Slow or incomplete sedimentation indicates a lack of maturation (3,10).

16. Examination of urine sediments in modern pathology

The urine sediment analysis is a component of routine urinalysis, which involves microscopic examination following centrifugation. The supernatant is discarded, and the remaining sample (sediment) is obtained and viewed under the microscope. Its function is to identify insoluble materials in urine. The urine contains formed elements from the blood, kidney, lower genitourinary tract, and external contamination. It must be examined for both identification and quantification of the elements present because some of these components have no clinical significance whereas others are considered normal unless they are present in high concentrations (23).

The urine sediments are examined microscopically for (1) cells, (2) casts, (3) crystals, (4) bacteria, (5) yeast, and (6) parasites (Table 5) (24,25).

DISCUSSION AND CONCLUSIONS

In USM, the sediments are observed by the naked eye directly under the sunlight. They are examined for their color, quantity, size, shape, and position.

Table 5 Position of sediments

1. Cells (RBCs, WBCs, epithelial cells, etc.)	In the urine of healthy people, a few (five) RBCs per high-power field (hpf) may be present. However, the presence of RBCs indicates bleeding at any point in the urogenital system from the glomeruli to the ureters.(25,26) Neutrophils are the most prevalent. Lymphocytes and eosinophils are also important clinically. An increased number of neutrophils in the urine sediments indicates inflammation somewhere along the urogenital system. A few renal epithelial cells are found in the urine of healthy people because of normal exfoliation. More than 15 renal tubular epithelial cells per 10 hpfs indicate active renal disease or tubular injury. In females, the appearance of a considerable number of squamous cells is usually indicative of vaginal infection (25).
2. Casts	Urinary casts are cylindrical formations from tubular cells secreting coagulated protein (Tamm–Horsfall protein). Protein denaturation and precipitation of Tamm–Horsfall protein, which is the organic matrix that cements the casts, are facilitated by a low urine flow rate, a high urinary salt concentration, and a low urine pH. (27) Casts such as hyaline casts are seen in the urine after exercise or heat exposure, but they can also be seen in pyelonephritis or chronic renal disease. Clumping, or conglutination, of cells embedded in a protein matrix appears to be the cause of the cellular cast, implying a disease process, regardless of the etiology or severity. Red cell casts are almost always indicative of glomerulonephritis or vasculitis. The presence of WBC casts indicates a kidney infection rather than a urinary tract infection. Bacterial casts are made up of microorganisms in a protein matrix (hyaline). They are a sign of acute pyelonephritis or an infection in the kidney (25,26).
3. Crystals	Identification of crystals in the urine is particularly important in patients with stone disease because it may help determine the etiology. Although other types of crystals are seen in normal patients, the identification of cystine crystals establishes the diagnosis of cystinuria. Crystals precipitated in acidic urine include calcium oxalate, uric acid, and cystine. Crystals precipitated in alkaline urine include calcium phosphate and triple-phosphate (struvite) crystals.(25,28)
4. Bacteria	Bacteria should not be present in normal urine; the presence of five or more bacteria/HPF in a fresh, uncontaminated specimen suggests the presence of a UTI (25).
5. Yeast	The most frequent yeast cells identified in urine are *Candida albicans*. Yeasts are frequently identified in the urine of patients with diabetes or as contaminants in women with vaginal candidiasis (26,29).
6. Parasites	*Trichomonas vaginalis* is a prevalent cause of vaginitis in women and urethritis in men in extremely rare situations (26).

The sediments are of two types. The first type is *rasūb mahmūd*, which are excreted in both health and disease and indicate a concoction of the matter. The matter is either waste produced in the third and fourth stages of digestion or morbid matter of the disease. The second type of sediment is *rasūb ghayr mahmūd,* which are produced due to an incomplete concoction of either disease matter or waste of the digestive process. It is also produced by dissolution, ulceration, scaling of organs, and so forth.

In contrast, modern medicine employs centrifugation and microscopic analysis to assess sediments for various types of elements such as casts, crystals, foreign bodies, and so forth. They are excreted in both health and disease, but the increased quantity in urine always indicates an underlying disease condition of the kidneys. The Unani physicians have also the same opinion about urine sediments. According to the USM, the excretion of sediments may indicate any impending disease, for example, *rasub ramli* in case of kidney stones, and *rasub nukhali* in case of *qurūh al kulya wa mathāna, jarab al kulya wa mathāna,* and so forth. A physician needs to be aware of the type of diseases involving sediments. The excretion of sediments depends upon the pathogenesis of diseases, and therefore, sediments do not appear in every disease.

This study can help us understand the definition, formation, types, and importance of urine sediments in health and disease conditions. Consequently, the diagnosis, prognosis, and treatment based on the Unani doctrine becomes easier for the physician. Urine sediments are among the least studied components, and the present study is novel in performing a detailed literature survey. It is concluded that urine sediments are the most significant parameter and an important tool for disease diagnosis and prognosis in USM. Further, observational studies should be conducted in the future for validating this concept.

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