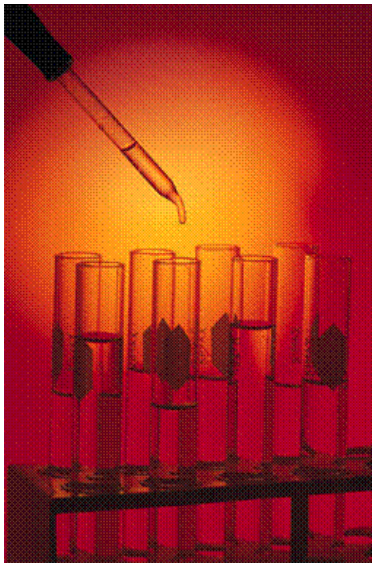
Quick Reference Guide to Urine Dipstick Analysis and Functional Urinalysis



Dicken Weatherby, N.D.

"The Perfect Companion to My In-Office Lab Testing System Reference Manual"

Urine Dipstick Analysis and Microscopy

Dicken Weatherby, N.D.

Bear Mountain Publishing • Jacksonville, OR

Urine Dipstick Analysis and Microscopy

Bear Mountain Publishing
1-541-899-1522

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Printed in the United States of America

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Urine Specific Gravity

Ranges: **Normal Value: 1.015** **High value: >1.015** **Low value: <1.015**

Clinical implications **HIGH**

Clinical Implication	Additional information
Abnormal solutes in urine	An ↑ S.G. with ↑ or normal urine volume. Need to check dipstick to confirm presence of protein or glucose.
Adrenal insufficiency	A high urinary chloride (1-13 drops of reagent) and a high specific gravity is an indication of adrenal insufficiency.
Increased mineral loss	A high specific gravity may be due to increased mineral solutes in the urine.
Diabetes mellitus	Large amounts of glucose or protein ↑ the S.G. to > 1.050. Note: Every 1% of glucose in the urine will ↑ the S.G. 0.004
Dehydration	Excess water loss from sweating, fever, vomiting
Other causes of S.G. increase	Hepatic disease, Congestive heart failure, Protein malnutrition, collagen vascular disease

LOW

Clinical Implication	Additional information
Congested lymphatic system	↓ S.G. and ↓ or normal urine volume indicates the kidney is having difficulty concentrating the urine and cleansing the blood due to a congested lymphatic system which can cause: swollen glands, allergy symptoms, low back pain, headaches and nausea. Symptoms worsen in women during menses and pregnancy, and may lead to vomiting.
Early chronic renal disease	↓ S.G. and ↑ volume
Diabetes insipidus	↓ S.G. and ↑↑ volume
Kidney inflammation and infection	↓ S.G. and ↓ volume Glomerulonephritis (inflammation without infection) Pyelonephritis (inflammation with infection)

Urine Bilirubin

Normal values: Zero

Clinical implications

Even trace amounts of urinary bilirubin are abnormal and therefore further testing is indicated.

Positive reading

Clinical Implication	Additional information	
Gall bladder dysfunction	Biliary stasis or gallstones. Further testing should be performed to assess this situation.	
Protein maldigestion	This can interfere with the transport of bilirubin into the small intestine.	
Oxidative stress	Excess red blood cell destruction, leading to increased bilirubin levels, may be caused by increased oxidative stress	
Liver detox stress	Consider phase II liver detoxification problems	
Liver dysfunction (Inflammation or infection causing conjugation problems)	• Infectious hepatitis • Cirrhosis of the liver • Metastatic disease of the liver • Congestive heart failure	• Gilbert's disease • Jaundice • Other liver diseases caused by toxic or infectious agents

Note: Urine bilirubin is negative in hemolytic diseases

More comprehensive diagnostic information can be obtained by comparing urine bilirubin with urine urobilinogen levels:

Bilirubin	Urobilinogen	Clinical Implication
↑	↑	Liver dysfunction, hepatocellular or partial obstruction
↑	Normal	Biliary stasis or gall stones
Negative	↑	Hemolytic
Negative	Normal	Negative

Urine Blood or Hemoglobin

Normal levels: None

Clinical implications

Hematuria

Non-Hemolyzed

Clinical Implication	Additional information
Conditions associated with hematuria	• Lower urinary tract infections • Kidney stones • Hypertension • Allergies • Urinary tract or kidney cancer • Glomerular infection or inflammation • Lupus • Heavy smokers • Trauma

Hemolyzed

Oxidative stress	Oxidation and breakdown of red blood cells causes an increase in hemolysed blood. Check Oxidata test.
Other conditions	• Liver pathology • Allergies

Urine Color

Normal values: The color of the urine is straw to amber

Color of Urine	Clinical Implications	
Colorless	• Large fluid intake • Diabetes insipidus • Untreated diabetes mellitus	• Alcohol ingestion • Severe iron deficiency • Chronic interstitial nephritis
Orange-colored	• Concentrated urine (inadequate fluid intake, excessive fluid loss, fever) • Bile • Drugs (pyridium, rifampin, aco-gantrisin, furoxone, dilantin)	• Diet (carrot juice, carotenes, riboflavin, food dyes) • Uric acid crystals
Brownish color or greenish yellow	• Bilirubin in urine • Biliverdin (oxidation of bilirubin on standing), drugs (methylene blue, elavil), indican, pseudomonas infection	
Red (straw to port wine)	• Blood, hemoglobin, or myoglobin, • Porphyria (port wine color), • Drugs: phenophthaleins, dorbane (laxative),	• Diet (beets, blackberries), • Herbs: cascara, senna, • Aniline dyes
Brown	• Blood (acid hematin), • Bilirubin and other bile pigments (yellow-brown to yellow green). • Urobilinogen, • Melanin (melanogin conversion by exposure to light in multiple myeloma, melanotic tumor, addison's disease),	• Indican, • Phenols, • Drugs (flagyl, nitrofurantoin, l-dopa, methyldopa, metronidazole, sulfonamides), lysol poisoning (brown-black), • Rhubarb
Blue hue	• Food dyes • Medication	• Pseudomonas infection • Some porphyries
Green	• Pseudomonas infection	

Urine Glucose

Normal value: Negative

Clinical implications **HIGH**

Clinical Implication	Additional information	
Glycosuria with high blood sugars	1. Diabetes mellitus (also ↑ S.G.) 2. Endocrine diseases 3. Infections	4. Extreme emotional stress 5. Obesity 6. Diabetes insipidus
Glycosuria without a high blood sugar	1. Renal tubule disease (lowered renal threshold) 2. Pregnancy 3. Heavy metal poisoning	4. Fanconi's syndrome (amino acid reabsorption defect) 5. Inflammatory renal disease

Urine Ketones

Normal value: Negative

Clinical implications **HIGH (Ketosis)**

Low carbohydrate, & high fat/protein diets	Ketones often get produced in these types of diets due to the lack of carbohydrate consumed (Zone and Atkins type diets)	
Liver dysfunction	Ketosis often occurs with a decreased liver glycogen. There may also be adrenal hypofunction, as cortisol is needed to stimulate the liver to release glycogen.	
Dietary conditions	1. Increased fat intake or inability to metabolize fats 2. Starvation and fasting 3. Prolonged vomiting	4. Anorexia 5. Increased protein intake
Carbohydrate maldigestion	This is especially true if the patient is eating carbohydrates and there are ketones in the urine	
Kidney disease or kidney failure	Renal glycosuria	
Blood sugar abnormalities	1. Diabetic acidosis	2. Severe hypoglycemia
Dehydration	Kidneys are unable to eliminate ketones efficiently	
Increased metabolic states	1. Hyperthyroidism 2. Fever	3. Pregnancy or lactation

Urine Leukocyte Esterase

Normal values: Zero. A color change occurs with > 5 WBCs/high powered field

	Clinical implications	Positive reading
Infection or inflammation	• Intestinal inflammation • Pyelonephritis (acute or chronic) • Cystitis or Urethritis	• Prostatitis • Kidney stones • Acute glomerulonephritis
Other causes for the presence of leukocyte esterase	• retained foreign body • Dehydration	• Fever • Stress

Urine Nitrites

Normal value: Negative for bacteria

	Clinical implications	Positive reading
Bacteriauria	A positive nitrite test indicates the presence of bacteria in the urine, suggesting a urinary tract infection. This test does not confirm an infection, so further testing in the form of microscopic evaluation of urine and urine culture needs to be performed.	

↑ Nitrites along with an ↑ Leukocyte esterase = infection

Urine Odor

Normal values: Urine is normally odorless

Ammonia/fetid	• Presence of bacterial overgrowth	• Loss of alkaline buffers in the body
Sweetish, brown, frothy	• Presence of bile (bile duct obstruction)	
Sweet	• Look for sugar problems • Biliary problems	• Diabetes
Fruity and sweet	• Ketoneuria	
Foul	• Fecal contamination, recto-urethral fistula	
Mousy, musty	• Phenylketonuria	
Maple syrup	• Maple syrup urine disease	
Any strong, unusual, persistent odor	• Maybe herbs or medications • Metabolic disorders	

Urine Protein

Normal Ranges: Negative or trace

Proteinuria

Glomerular damage	Proteinuria is usually the result of an increased glomerular filtration rate	
Renal diseases	• Nephritis/glomerulonephritis, • Nephrosis, • Malignant hypertension,	• Polycystic kidneys, • Chronic urinary tract obstruction
Non-renal diseases	• Allergies • Fever, • Acute infection, • Leukemia/multiple myeloma	• Toxemia • Diabetes mellitus • SLE
↑ Protein and ↑ Leukocytes	Usually an infection at some level in the urinary tract	

Urine Turbidity or Appearance

Normal values: Fresh urine is clear to slightly hazy

Hazy	1. Cooling of the sample, 2. Ph change,	3. RBC's
Cloudy urine- unable to see through the sample	1. Amorphous sediment or amorphous crystals , depending on urine ph (phosphates with alkaline urine, urates with acidic urine) 2. Pus, with WBC count > 200 cells / mm3 3. Blood, with RBC count > 500 cells / mm3 4. Epithelial cells 5. Bacteria 6. Fat - milky appearance	7. Chylomicrons - creamy color - obstruction of lymph vessels by parasites, thoracic duct obstruction, trauma, or tumor 8. Conjugated bilirubin - parenchymal liver disease, biliary tract obstruction 9. Urobilinogen - parenchymal liver disease, hemolytic disease 10. Oxalic or glycolic acids 11. Mucus

Urine Urobilinogen

Normal Ranges: Trace

HIGH

Clinical Implication	Additional information	
Increased destruction of blood cells	• Hemolytic anemia • Pernicious anemia • Malaria	• ↑ Xenotoxins • Infections • ↑ Oxidative stress
Hemorrhage into the tissues	• Pulmonary infarct	• Excessive bruising
Reduced conjugation of bilirubin by the liver **↑ Toxins in the body**	↑ Urobilinogen is a sign that the liver is not functioning very well	
Hepatic damage as a result of:	• Gall bladder disease- biliary obstruction • Cirrhosis	• Acute hepatitis
Check all conditions that affect blood break down		

LOW

Clinical Implication	Additional information	
Anything that prevents bilirubin excretion into the intestines	• Gall stones • Biliary stasis	• Severe inflammation of biliary ducts • Cancer of the head of the pancreas
Antibiotic therapy	Antibiotics wipe out the normal digestive flora which may prevent the formation of urobilinogen from bilirubin	

Interfering Factors: **Diurnal variation:** Peak excretion occurs from noon to 4:00 PM

More comprehensive diagnostic information can be obtained by comparing urine urobilinogen with urine bilirubin levels:

Bilirubin	Urobilinogen	Clinical Implication
↑	↑	Liver dysfunction, hepatocellular or partial obstruction
↑	Normal	Biliary stasis or gall stones
Negative	↑	Hemolytic
Negative	Normal	Negative

Urine Volume

Ranges for a 24-hour sample:

Normal volume: 800-2000ml	**Polyuria:** > 2400ml	**Oliguria**: <800ml
Abnormal solutes: >1800ml with S.G.>1.020	**Poor kidney conc.:** <1400ml with S.G.<1.020	**The average value:** 1500 ml.

HIGH (>2400ml)

Clinical Implication	Additional information	
Eating a junk food diet	Junk food diets or Standard American Diets can have a diuretic effect on then body causing a mild polyuria	
Ingested diuretics	Taking of diuretic medications and the consumption of tea, coffee, soda, alcohol etc. can cause polyuria	
Other functional problems	1. Allergies	2. Underactive adrenals
Polyuria- with ↑ BUN and creatinine levels	1. Diabetic ketoacidosis,	2. Partial obstruction of urinary tract
Polyuria with normal BUN and creatinine levels	1. Diabetes mellitus 2. Diabetes insipidus	3. Certain tumors of brain and spinal cord

LOW (<800ml)

Clinical Implication	Additional information	
Renal causes	1. Renal ischemia 2. Glomerulonephritis and nephritis	3. Renal disease caused by toxic agent
Dehydration	Cause by prolonged vomiting, diarrhea or excess sweating	
Other causes of oliguria	Over active adrenals, edema, recovering from fever, urinary tract obstruction, cardiac insufficiency	

Urinary Microscopy

Discussion

Urine microscopy is performed on the sediment of urine that has been centrifuged. The sediment is evaluated for cellular elements (red and white blood cells and epithelial cells), casts, crystals and bacteria which might originate from anywhere in the genitourinary tract.

When would you run this test?

1. To investigate and further evaluate positive findings from the Urine reagent dipstick testing

	Discussion	Normal	Clinical implications	Interfering factors
RBCs	RBCs occasionally can be found in the urine. Persistent findings of even small amounts of erythrocytes should be investigated because they come from the kidney and may signal serious renal dysfunction. They are usually diagnostic for glomerular diseases.	0-2/HPF normal >2 is abnormal and needs to be investigated	• Renal or systemic disease • Trauma to kidneys • Kidney stones • Pyelonephritis • Cystitis • Prostatitis	Alkaline urine hemolyzes red blood cells Heavy smokers have small amounts of RBCs in urine Menstruation Strenuous exercise
Red cell casts	Red cell casts indicate acute inflammatory or vascular disorders in the glomerulus. Their presence in the urine may be the only manifestation of certain diseases.	Zero casts	• Acute glomerulonephritis (GN) • Associated with SLE	May appear after strenuous physical activity or contact sports Alkaline urine dissolves RBC casts
WBCs	WBCs may originate from anywhere in the genitourinary tract	0-4/HPF	• >50/HPF indicates acute bacterial infection within urinary tract (perform urine culture) • All renal diseases • Cystitis or prostatitis • Chronic pyelonephritis (PN)	Strenuous exercise Vaginal discharge- need clean catch
WBC casts	Always come from the kidney tubules Indicates renal parenchymal infection	Zero casts	• PN (most common cause) • Occasionally acute GN	
Epithelial cells	Cells from the kidneys, bladder or urethra and vagina (squamous)	0-2/HPF (renal) Squamous are common	• Acute tubular damage • Acute GN	

	Discussion	Normal	Clinical implications	Interfering factors
Epithelial cell casts	**Caused by the cast-off tubule cells in the kidney that slowly degenerates. Will appear in large numbers when there is damage to tubule epithelium**	Zero	• Nephrosis • GN	
Bacteria	**Increased amounts are seen with renal and urinary tract infections**	Small amounts in non-clean catch	20 or more bacteria per high powered microscope field may indicate a UTI (do urine culture)	Non-clean catch
Yeast	**Usually indicates vaginal contamination**	Zero	In males: immunosupression	Non-clean catch
Hyaline casts	**Formed from precipitation of protein within the tubules. Their presence depends on flow of urine, urine pH and if present degree of proteinuria.** Usually non pathological	0-2/LPF	non-pathological, form after exercise or in concentrated or highly acidic urine With proteinuria Indicates possible damage to glomerular membrane, which permits leakage of proteins: Nephritis Malignant HTN Chronic renal disease	

Urine Crystals

May present with no symptoms or are associated with kidney stone formation. The type of crystal formed varies with urine pH.

Type of crystal	Ph of urine	Clinical implication
Uric acid	5.0-6.5	gout, acute febrile conditions, chronic nephritis
Amorphous urates, sodium urate	5.0-6.5	salts of Na+, K+, Mg++, Ca++; normal
Calcium oxalate	Up to pH 7.5	Fat digestion problems, ethylene glycol poisoning, DM, liver disease, severe renal disease, ingestion of oxalate-rich foods
Cystine	5.0-6.5	pathological ; indicates an inherited metabolic condition
Leucine	5.0-6.5	pathological ; maple syrup or oathouse urine disease, liver disease
Tyrosine	5.0-6.5	pathological ; tyrosinosis, Oathouse urine disease, liver disease
Hippuric acid	5.0-6.5	no significance
Cholesterol	5.0-6.5	indicates excessive tissue breakdown - nephrotic syndrome, chyluria (fat in urine), filariasis, tumors
Triple phosphates	7.5-9.0	ammonium-magnesium-phosphate - with urinary calculi, chronic pyelitis, chronic cystitis, BPH with urinary retention
Amorphous phosphates	7.5-9.0	similar to amorphous urates ; no significance
Calcium carbonate	7.5-9.0	no significance
Calcium phosphate	7.5-9.0	may form calculi
Ammonium urate	7.5-9.0	found with bacterial infection if in freshly voided urine

Urine Dipstick Results form

Client's Name:___________________________________ Practitioner:_____________________

Pathology Screening With Reagent Test Strip		**Date:**
TEST	**NORMAL**	**ABNORMAL FINDINGS**
Color	Straw to amber	Colorless red green/yellow orange brown
Turbidity	Clear to hazy	Cloudy very cloudy mucous
Volume	1500 ml	< 800ml (oliguria) > 2400ml (polyuria)
Glucose	Negative	+1 +2 +3 +4
Bilirubin	Negative	+1 +2 +3
Ketones	Negative	+1 +2 +3
Blood	Negative	**Hemolyzed**: +1 (5-10) +2 (10-25) +3 (25-50) +4 (>50)
		Non-heme.: +1 (5-10) +2 (10-25) +3 (25-50) +4 (>50)
Protein	Negative	Trace (5-20mg) +1 (30mg) +2 (100mg) +3 (300mg) +4
Urobilinogen	Trace	+1 +2 +3 +4
Nitrites	Negative	Positive
Leukocytes	Negative	+1 (10-25) +2 (25-75) +3 (>75)

Pathology Screening With Reagent Test Strip		**Date:**
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Urobilinogen	Trace	+1 +2 +3 +4
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Leukocytes	Negative	+1 (10-25) +2 (25-75) +3 (>75)

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In-Office Lab Testing Assessment Patterns

Introduction

This section focuses on the patterns or combinations that exist between 2 or more elements and the diagnostic information that can be found with such an analysis.
When analyzing the patterns it might be useful to look back at each of the individual component.

The following is a glossary of terms that are used in describing some of these patterns:

Digestion: The breakdown of food particles in the GI tract
Absorption: Passage of food particles across the intestinal mucosa
Assimilation: Nutrients are assimilated into the blood stream
Utilization: Passage of nutrients from the blood through the cell membrane

1. **Assimilation and digestion**
2. **Acid/Alkaline Assessment**
3. **Electrolyte assessment**
4. **Calcium and mineralization**
5. **Macronutrient Maldigestion Patterns**
6. **Urine bilirubin with urine urobilinogen levels**

PATTERN	INTERPRETATION	CLINICAL IMPLICATIONA
↑ Indican **↑ Sediment**	Hypochlorhydria Pancreatic Insufficiency Leaky Gut Syndrome	1. High indican levels are a reflection of protein mal-digestion and an excess of undigested food particles. Both of these are signs of hypochlorhydria. 2. High sediment reflects poor breakdown of the absorbed nutrients due to leaky gut syndrome or pancreatic insufficiency (lack or decreased activity of digestive enzymes). Patients with this pattern may inform you that their appetite is extremely high and that they eat even when they are not hungry.
↑ Indican **↓ Sediment**	Maldigestion Malabsorption	This pattern indicates poor digestion and absorption of nutrients across the gut wall into the blood and cell. There may be damage to the small intestine mucosa, as a result of a bacterial overgrowth or other infection, causing decreased permeability or a reduced intestinal mucosal surface area. One of the symptoms of this might be an excessive appetite. The maldigestion may be from hypochlorhydria or pancreatic insufficiency.
N indican **↓ Sediment**	Malabsorption Deficient Dietary intake	This pattern indicates malabsorption without maldigestion. There may also be a relatively deficient dietary intake as a result of poor diet or a relative reduction in food intake. There may be damage to the small intestine mucosa.
N indican **↑ Sediment**	Leaky Gut Syndrome Vitamin/mineral deficiencies	This pattern indicates good digestion but an increased permeability. With increased sediment there is evidence of abnormal metabolites being absorbed through a leaky gut. The increase in abnormal metabolites may be due to a deficiency in minerals and vitamins that act as co-enzymes to the enzymatic processes of digestion. This is a pattern often seen in people who are eating large amounts of one food group
↑ Indican **↑ Calcium**	Hypochlorhydria	This pattern is associated with poor digestion, especially proteins, due to an inability to produce enough acidity in the stomach i.e. Hypochlorhydria. Since half of the circulating calcium is bound to protein, a protein deficiency resulting from an HCL deficiency could increase the ionized (diffusible) calcium, which is readily excreted in the urine.
↑ Indican **↓ Calcium**	Lowered systemic pH Bicarbonate deficiency ↑ Phosphorous loss	This pattern may suggest a high loss of phosphorous due to increased systemic acidity. This may be result from a deficiency in bicarbonate buffers. There is decreased calcium because it is being used to buffer excess hydrogen ions in the extracellular fluid.

Acid/Alkaline Assessment

PATTERN	INTERPRETATION	CLINICAL IMPLICATIONS
↑ Resp. rate **↓ Breath hold** **↓ Urine pH** **↑ Saliva pH**	**Metabolic Acidosis**	1. Alkaline saliva- the respiratory system kicks in by increasing the rate and depth of breathing to blow off as much CO2 as possible. This will lower the carbonic acid levels in the body leading to an alkaline saliva. 2. Acidic urine- this represents the kidney excreting H+ 3. Increased respiratory rate- The body is attempting to blow off CO2 to decrease carbonic acid levels 4. Decreased breath holding time- acidosis causes a decreased oxygen transport and uptake, thus leading to a decreased ability to hold ones breath
↑/ ↓ Resp. rate **↓ Breath hold** **↓Urine pH** **↓ Saliva pH**	**Respiratory Acidosis**	1. Acid saliva- due to the increased levels of CO2 and carbonic acid 2. Acidic urine- due to the kidney excretion of H+ 3. Increased respiratory rate- The body is attempting to blow off CO2 to decrease carbonic acid levels that have built up as a result of the hypoventilation, which is a hallmark of respiratory acidosis 4. Decreased breath holding time- acidosis causes a decreased oxygen transport and uptake, thus leading to a decreased ability to hold ones breath
↑/↓ Resp. rate **↑ Breath hold** **↑ Urine pH** **↑ Saliva pH**	**Respiratory Alkalosis (Also known as stress or anxiety alkalosis)**	1. Alkaline saliva- due to the increased loss of CO2 and carbonic acid 2. Alkaline urine- due to the kidney retention of H+ 3. The respiratory rate may be increased or decreased- The body is attempting to blow off CO2 to decrease carbonic acid levels but the respiration patterns are often irregular 4. Increased breath holding time- alkalosis causes an increased oxygen transport and uptake, thus leading to an increased ability to hold ones breath
↓ Resp. rate **↑ Breath hold** **↑ Urine pH** **↓ Saliva pH**	**Metabolic alkalosis**	1. Acidic saliva- a slowing of the respiration rate will cause more carbonic acid in the extracellular fluids leading to an acidic saliva 2. Alkaline urine- due to kidney excretion of bicarbonate and retention H+ 3. Decreased respiratory rate- due to the suppression of the respiratory centers (the body is attempting to lessen the blow off CO2 to increase carbonic acid levels) 4. Increased breath holding time- alkalosis causes an increased oxygen transport and uptake, thus leading to an increased ability to hold ones breath

Electrolyte assessment

PATTERN	INTERPRETATION	CLINICAL IMPLICATIONS
↑ Adrenal score ↓ Urine chloride ↑ Urine pH	**Excess alkaline reserves**	The extracellular fluid is alkaline. Large amounts of chloride are reabsorbed resulting in a decreased urine chloride. The renal tubules release bicarbonate and hold onto H+ in order to buffer the excess alkalinity. The urine becomes alkaline. This is a normal variation.
↓ Adrenal score ↑ Urine chloride ↓ Urine pH	**Excess acid reserves** **Electrolyte insufficiency**	The extracellular fluid is acidic. The body copes by causing the renal tubules to reabsorb bicarbonate in order to buffer the acidity. Urine becomes more acidic. Chloride ion reabsorption is decreased resulting in a high urine chloride and a low adrenal score. This is a normal variation.
↑ Adrenal score ↓ Urine chloride ↓ Urine pH	**Potassium deficiency** **Salt deficiency**	The blood is deficient in potassium, from eating the standard American diet, too much refined sugar or diuretic use, produces this pattern. The body is excreting H+ and retaining chloride, which leads to an acidic urine. Because of the low pH the body excretes more potassium. If patient has this pattern and reports that their urine output is low consider sodium deficiency because the body is retaining chloride and excreting H+.
↓ Adrenal score ↑ Urine chloride ↑ Urine pH ↑ Calcium	**Excess salt**	In this pattern the body is excreting bicarbonate and chloride as well as calcium. This pattern is seen in people who consume excess amounts of salt.
↓ Adrenal score ↑ Urine chloride ↑ Urine pH ↓ Calcium	**Excess potassium**	This pattern is similar but different from the one above. In this pattern the body is excreting bicarbonate and chloride, but retaining calcium. This pattern is seen in salt deficient diets or people who are taking too much potassium.

Calcium and mineralization

PATTERN	INTERPRETATION	CLINICAL IMPLICATIONS
⇓ Urine pH **⇓ Calcium**	**Excess stomach acid**	Excess stomach acid- possible causes often associated with this pattern are: • Very high protein diet • Magnesium deficiency, because magnesium neutralizes HCl in the stomach. • Medications • Taking Betaine HCl • Acid retention due to kidney disease • Ketosis from fasting or diabetes
⇓Urine pH **⇑ Calcium**	**Complex carbohydrate deficiency** **Alkaline mineral deficiency**	Complex carbohydrate deficiency associated with the standard American Diet i.e. fast food diet high in sugar and protein (⇑ sugar can cause ⇑ calcium in the urine) Alkaline minerals are being depleted in order to alkalinize the cell. A pattern seen in respiratory acidosis and respiratory conditions such as asthma and emphysema. You may see this pattern after an acute asthma attack.
⇑ Urine pH **⇓ Calcium**	**Hypochlorhydria**	Hypochlorhydria can cause poor protein digestion leading to low calcium levels since half of the calcium is bound to protein. It is also suggestive of the following: • Poor protein and calcium digestion and transportation due to Hypochlorhydria • Poor reserve levels of calcium in the bones • Fatty acid deficiency.
⇑ Urine pH **⇑ Calcium**	**Protein deficiency**	This pattern can be due to protein deficiency due to low protein diet or poor protein absorption. Use of protease to increase absorption may be useful. The increase in calcium may be due to the intake of a non-ionizing form of calcium
N Urine pH **⇓ Calcium**	**Low calcium levels in body**	May be caused by insufficient intake of calcium or other factors that affect calcium digestion, absorption and utilization. Most of the unabsorbed calcium will be excreted in the stool.

Macronutrient Maldigestion Patterns

PATTERN	INTERPRETATION	CLINICAL IMPLICATIONS
↑ Adrenal score ↓ Urine chloride ↑ S.G.	**Protein maldigestion**	This pattern indicates a difficulty in digesting protein either from a deficiency in protease enzyme or hypochlorhydria. This is associated with a loss of muscle mass, poor recovery time after exercise, hypoglycemia/blood sugar dysregulation, and poor utilization of calcium and magnesium, which must bind with amino acids to be fully assimilated. People with this pattern may also have intestinal mucosal integrity problems causing ileocecal valve problems, constipation and other lower bowel problems. This may be due to glutamine deficiencies.
↑ Adrenal score ↓ Urine chloride ↓ S.G.	**Fat maldigestion**	This pattern indicates a difficulty in dealing with fats either from a deficiency in lipase enzymes or poor bile emulsification. Your patients may talk about having a fat intolerance. This is associated with a deficiency in essential fatty acids, fat soluble nutrient deficiencies and liver and/or gallbladder problems.
↓ Adrenal score ↑ Urine chloride ↑ S.G.	**Fiber and carbohydrate maldigestion**	This pattern indicates fiber and carbohydrate maldigestion and metabolism, which may result from a deficiency in amylase or cellulase, or a high carbohydrate, low protein, low sodium and low fat diet. This pattern is associated with irritable bowel like symptoms, such as diarrhea. With this combination the pituitary increases the stimulation of ADH and GH to retain electrolytes. The patient may suffer from poor circulation, cold hands and feet, and a low sex drive.
↓ Adrenal score ↑ Urine chloride ↓ S.G.	**Sugar maldigestion**	This pattern is common in people who have problem digesting and handling sugar. Patients may consume large amounts of carbohydrates and say that they are sugar intolerant. This pattern is associated with the following conditions: • Sugar handling difficulties • Malabsorption, • Decreased cell permeability Sugar intolerance may also lead to depression, insomnia, emotional instability, and panic attacks.

Urine bilirubin with urine urobilinogen levels

PATTERN	INTERPRETATION	CLINICAL IMPLICATIONS
↑ bilirubin ↑ Urobilinogen	Liver dysfunction	This pattern has its origin in the liver with possible hepatocellular dysfunction or partial obstruction
↑ Bilirubin N Urobilinogen	Biliary Stasis	This pattern is associated with more of a gallbladder origin either biliary stasis with congested bile or gall stones
Neg Bilirubin ↑ Urobilinogen	Hemolytic in origin	This pattern is more hemolytic in origin. There is an increase in red blood cell destruction due to hemolytic anemia, oxidative stress, ↑ xenotoxins.

Other patterns:

Increased Oxidative Stress	↑ Oxidata test ↓ Lingual ascorbic acid test ↑ Urinary urobilinogen ↑ Hemolysed blood in urine

CONDITIONS AND TERRAIN ASSESSMENT TESTS

CONDITION	HIGH	LOW
Adrenal hyperfunctioning	↑ Adrenal score	↓ Urine chloride
Adrenal hypofunctioning	↑ Urine chloride	↓ Adrenal score
Alkaline mineral insufficiency	↑ Saliva pH ↑ Calcium oxalate sediment ↑ Urine chloride	↓ Saliva pH ↓ Adrenal score
Antioxidant insufficiency	↑ Oxidata test	↓ Lingual ascorbic acid
Bowel toxemia	↑ Indican	
Carbohydrate maldigestion	↑ Calcium phos. sediment ↑ Urine chloride ↑ Specific gravity ↑ Urine ketones	↓ Urine pH ↓ Saliva pH ↓ Adrenal score
Complex carbohydrate deficiency	↑ Urine Calcium	↓ Urine pH
Deficient dietary intake	Normal Indican	↓ Total sediment
Dysbiosis	↑ Indican	
Electrolyte insufficiency	↑ Urine chloride	↓ Adrenal score ↓ Urine pH
Electrolyte stress	↑ Adrenal score ↑ Urine pH	↓ Urine chloride
Essential fatty acid deficiency		↓ Saliva pH
Excess protein intake	↑ Indican ↑ Uric acid sediment ↑ Urine ketones	↓ Urine calcium ↓ Urine pH

CONDITION	HIGH	LOW
Fat maldigestion	↑ Indican ↑ Calcium oxalate sediment ↑ Adrenal score	↓ Urine pH ↓ Saliva pH ↓ Urine chloride ↓ Specific gravity
Gallbladder insufficiency	↑ Calcium oxalate sediment ↑ Urine Bilirubin	
Hypochlorhydria	↑ Saliva pH ↑ Indican ↑ Uric acid sediment ↑ Urine chloride ↑ Urine pH	↓ Adrenal score ↓ Urine calcium
Hypothyroidism, Subclinical		↓ Basal body temp ↓ Iodine ↓ Achilles return reflex
Immune dysfunction	↑ Urine pH	
Iodine insufficiency		↓ Iodine
Kidney stress	↑ 1st AM Urine pH ↑ Urine chloride ↑ Oxidata test	↓ Adrenal score
Leaky gut syndrome	↑ Total sediment ↑ Indican	
Liver stress	↑ 1st AM Urine pH ↑ Urine bilirubin ↑ Urine ketones ↑ Urine urobilinogen	
Low calcium levels		↓ Urine calcium
Low redox potential		↓ Oxidata test
Malabsorption	↑ Indican ↑ Adrenal score	↓ Saliva pH ↓ Total urine sediment ↓ Urine chloride

CONDITION	HIGH	LOW
Maldigestion	↑ Saliva pH ↑ Indican ↑ Oxidata test	↓ Urine pH ↓ Total sediment
Metabolic acidosis	↑ Respiration rate ↑ Saliva pH	↓ Breath holding time ↓ Urine pH ↓ Calcium
Metabolic alkalosis	↑ Breath holding time ↑ Urine pH ↑ Calcium	↓ Respiration rate ↓ Saliva pH
Oxidative stress	↑ Oxidata test ↑ Urine chloride ↑ Urine bilirubin ↑ Urine urobilinogen ↑ Urine blood- hemolysed	↓ Adrenal score ↓ Lingual ascorbic acid
Pancreatic insufficiency	↑ Total sediment	↓ Urine pH ↓ Saliva pH
Protein deficiency	↑ Urine pH ↑ Urine calcium	
Protein maldigestion	↑ Urine pH ↑ Indican ↑ Uric acid sediment ↑ Adrenal score ↑ Specific gravity ↑ Urine bilirubin	↓ Urine chloride
Respiratory acidosis	↑ Respiration rate ↑ Urine calcium	↓ Respiration rate ↓ Breath holding time ↓ Urine pH ↓ Saliva pH
Respiratory alkalosis	↑ Respiration rate ↑ Breath holding time ↑ Saliva pH ↑Urine pH	↓ Respiration rate ↓ calcium

INDIVIDUAL TESTS

Acid-base Terrain

Tests used to identify patterns of acid/alkaline imbalance

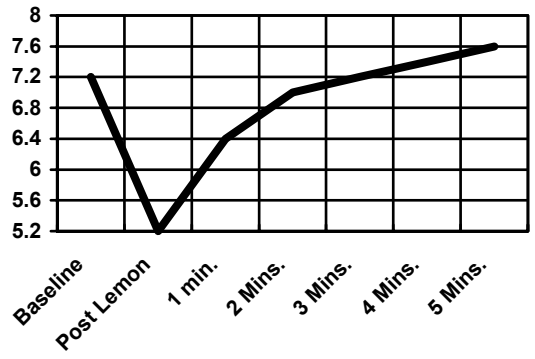
↑ Breath hold	↑ Resp. Rate	↑ Urine pH	↑ Saliva pH
• Metabolic alkalosis • Respiratory alkalosis	• Metabolic acidosis • Respiratory acidosis (compensation) • Respiratory alkalosis (acute) • Sympathetic stress	• Bacterial infection • Suseptibility to yeast and viruses • Protein maldigestion • Alkalosis (respiratory and metabolic) • Calcium metabolism problems	• Metabolic acidosis • Respiratory alkalosis • Maldigestion • Hypochlorhydria • Sympathetic dominance • Alkaline mineral insufficiency • Dental tartar

↓ Breath hold	↓ Resp. Rate	↓ Urine pH	↓ Saliva pH
• Metabolic acidosis • Respiratory acidosis • Anemia • Antioxidant insufficiency • Anxiety • Stress	• Metabolic alkalosis • Respiratory acidosis (acute/primary cause) • Respiratory alkalosis (Compensation)	• Maldigestion • Carbohydrate and fat maldigestion • Pancreatic insufficiency • Acidosis (respiratory and metabolic) • Inflammation • Arthritis	• Metabolic alkalosis • Respiratory acidosis • Malabsorption • Carbohydrate maldigestion • Pancreatic insufficiency • EFA deficiency • Fat digestion problems • Alkaline mineral insufficiency • Dental caries

Identifying Imbalances in Secondary buffering systems

Dr. Bieler's salivary pH acid challenge

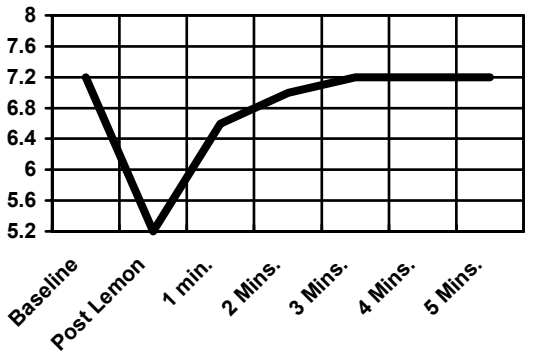
Normal patterns



The initial salivary pH of 7.2 drops immediately after the acid challenge and takes a few minutes to climb up into the alkaline range. The slow climb up to 7.6 at 5 minutes indicates healthy mineral reserves

Baseline	Lemon	1	2	3	4	5
7.2	5.2	6.4	7.0	7.2	7.4	7.6

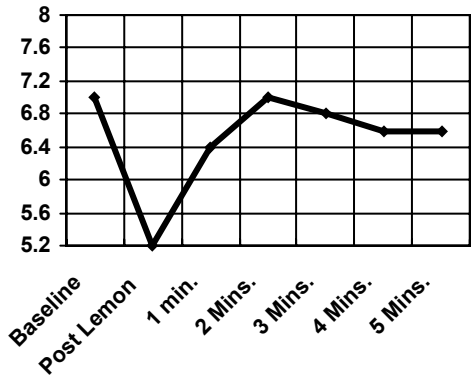
Alkaline Reaction



The alkaline reaction is a fairly normal reaction to a sudden increase of acid into the body but there are the beginnings of a tendency to drift towards mineral insufficiency. The Mineral reserves are intact but the buffering systems are not able to drive the pH as alkaline as the normal curve.

Baseline	Lemon	1	2	3	4	5
7.2	5.2	6.6	7.0	7.2	7.2	7.2

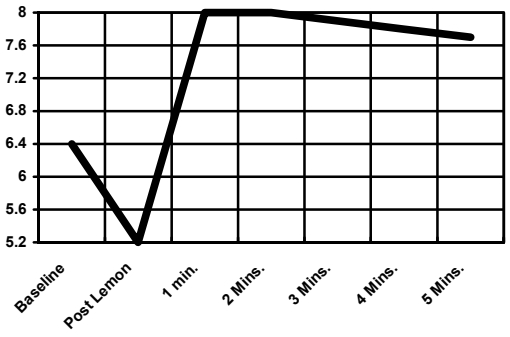
2. Mineral insufficiency



In the mineral insufficiency pattern the initial salivary pH of 7.2 drops immediately with the acid challenge and takes a few minutes to climb up to the alkaline range.
The slow climb up to a pH of 6.8 at 2 minutes starts to look like the normal curve, but it fails to completely alkalinize the saliva. This is an indication of mineral insufficiency.
There are mineral reserves present but they are not replete enough to fully buffer the acidity.
The more the curve begins to drop the weaker the reserves are.

Baseline	Lemon	1	2	3	4	5
7.0	5.2	6.4	7.0	6.8	6.6	6.6

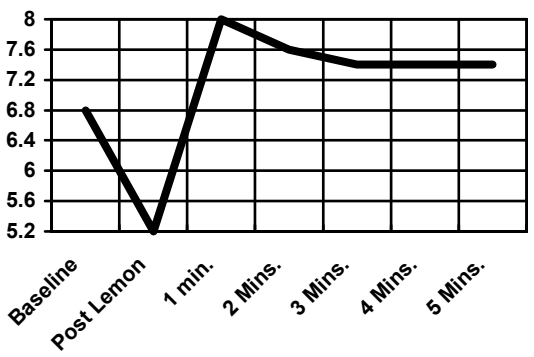
3. Hypersympathetic overload with mineral insufficiency



Starting point is acidic at 6.4. This pattern is already displaying signs of buffering problems before the test has started.
The alkaline spike after 1 minute indicates that ammonia is being used as a buffer. Ammonia, and not minerals, is being released. You may notice the ammonia response in the urine, which may have an ammonia smell.
This patient will complain of being wiped out and fatigued. They probably do not sleep well, are stressed and complain of feeling depleted. Any types of stress reduction techniques are essential for these people along with adrenal restoration. They often complain of not being able to relax. Notice also that the curve does not come down very quickly. The ammonia is quite a long term buffer.

Baseline	Lemon	1	2	3	4	5
6.4	5.2	8	8	7.9	7.8	7.7

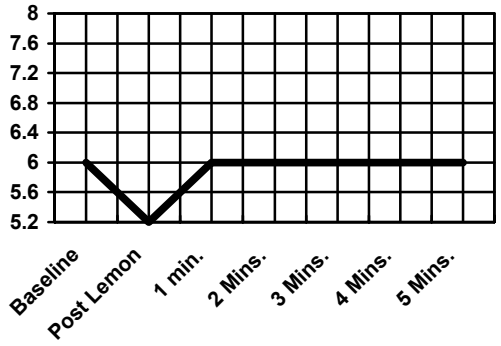
4. Hypersympathetic overload with signs of mineral sufficiency



This curve looks similar to the curve above in the hyper sympathetic patient. There is still the ammonia spike but after 2 minutes there is signs of mineral reserve activity coming online because the pH is beginning to drop into the normal range.

Baseline	Lemon	1	2	3	4	5
6.8	5.2	8.0	7.6	7.4	7.4	7.4

5. Loss of alkaline reserves



This pattern is an indication of a loss of buffering capacity, at least in the short term. There is probably cell rigidity and the kidneys are probably no longer reclaiming acidity. The first morning urine pH may be alkaline. Check the urine dipstick for any abnormalities and run a blood chemistry screen and CBC

Baseline	Lemon	1	2	3	4	5
6.0	5.2	6.0	6.0	6.0	6.0	6.0

Gastrointestinal Terrain

↑ Bowel Toxicity Test	↑ Sediment	Alkaline Gastro-test	↑ Urine Calcium
• Bowel toxemia • Dysbiosis • Hypochlorhydria • Maldigestion • Malabsorption • High protein intake	**Total**: • Poor assimilation • Pancreatic insufficiency • Leaky Gut Syndrome **Calcium phosphate:** • Carbohydrate, sugar and starch maldigestion **Uric acid:** • Protease deficiency • Hypochlorhydria • Protein maldigestion • Excess protein intake **Calcium oxalate:** • Fat maldigestion • Lipase deficiency • Poor fat emulsification • Calcium and magnesium deficiency **↓ Total sediment** • Malabsorption	• Hypochlorhydria • Achlorhydria (>5.0) Use bicarbonate challenge to test acid reserves	• Excess calcium supplementation • Calcium mobilized from bone • High refined sugars in diet • Hyperparathyroidism **↓ Urine calcium** • Low calcium in body • Excess protein intake • Malabsorption • Hypoparathyroidism

Hormonal Terrain

High Urine chloride/Low adrenal test score (1-13)	Low urine chloride/High adrenal test score (>25)
• Adrenal hypofunctioning • Hypochlorhydria • Kidney stress • Alkaline mineral insufficiency • Oxidative stress	• Adrenal hyperfunctionining • Electrolyte stress/increased toxicity • Malabsorption syndrome • Diarrhea/excess vomiting

Oxidative Stress Terrain

Low Redox	+2 Oxidative stress	+3 Oxidative stress
• Loss of high energy electron intermediates • Low electron potential • Susceptible to degenerative diseases • Premature tissue aging	• Liver stress • Kidney stress • Pancreas stress • Blood sugar problems • Adrenal stress • Lymphatic congestion • Fatigue	• Lymphatic stress • Xenotoxins • Greatly reduced ATP production • Maldigestion • Blood sugar dysregulation