Potassium Citrate

Potassium citrate is rapidly absorbed when given by mouth and is excreted in the urine as the carbonate. It is, therefore, effective in reducing the pain and frequency of micturition (urination) when these are caused by highly acidic urine. It is used for this purpose in dogs and cats, but is chiefly employed as a non-irritating diuretic. Potassium citrate is an effective way to treat/manage gout and arrhythmia, if the patient is hypokalemic. In common with other substances that render the urine alkaline, it may be used to reduce the danger of crystalluria during sulfonamide therapy. It is widely used to treat urinary calculi (kidney stones), and is often used by patients with cystinuria. It is also used in many soft drinks as a buffering agent.

Administration

Potassium citrate is usually administered by mouth in dilute aqueous solution. This is because of its somewhat caustic effect on the stomach lining, and the potential for other mild health hazards. The maximum allowable dose for elemental potassium is regulated to be no more than 100 milligrams (approximately 3% of the daily allowance). Potassium Citrate contains 32.28% Potassium.

What is potassium citrate?

Potassium is a mineral that is found in many foods and is needed for several functions of your body, especially the beating of your heart. Potassium citrate is used to treat a kidney stone condition called renal tubular acidosis. Potassium citrate may also be used for other purposes other than those listed in this medication guide.

What is the most important information about potassium citrate?

You should not use this medication if you have kidney failure, a urinary tract infection, uncontrolled diabetes, a peptic ulcer in your stomach, Addison’s disease, severe burns or other tissue injury, if you are dehydrated, if you take certain diuretics (water pills), or if you have high levels of potassium in your blood (hyperkalemia). You should not take potassium citrate tablets if you have problems with
your esophagus, stomach, or intestines that make it difficult for you to swallow or digest pills. Do not crush, chew, break, or suck on an extended-release tablet. Swallow the pill whole. Breaking or crushing the pill may cause too much of the drug to be released at one time. Sucking on a potassium tablet can irritate your mouth or throat. Avoid lying down for at least 30 minutes after you take this medication. Take this medication with a meal or bedtime snack, or within 30 minutes after a meal.

To be sure this medication is helping your condition; your blood may need to be tested often. Your heart rate may also be checked using an electrocardiograph or ECG (sometimes called an EKG) to measure electrical activity of the heart. This test will help your doctor determine how long to treat you with potassium. Do not miss any scheduled appointments.

You should not use this medication if you are allergic to it, or if you have certain conditions. Be sure your doctor knows if you have:

- high levels of potassium in your blood (hyperkalemia);
- kidney failure;
- a urinary tract infection;
- untreated or uncontrolled diabetes;
- Addison’s disease (an adrenal gland disorder);
- a large tissue injury such as a severe burn;
- a peptic ulcer in your stomach;
- if you are severely dehydrated;
- if you are taking a “potassium-sparing” diuretic (water pill) such as amiloride (Midamor, Moduretic), spironolactone (Aldactone, Aldactazide), triamterene (Dyrenium, Dyazide, Maxzide).
- Before using potassium citrate, tell your doctor if you are allergic to any drugs,
- If you have any kidney disease;
- congestive heart failure, enlarged heart, or history of heart attack;
• other heart disease or high blood pressure;
• diabetes;
• a blockage in your stomach or intestines;
• chronic diarrhea (such as ulcerative colitis, Crohn’s disease).

If you have any of these conditions, you may need a dose adjustment or special tests to safely take potassium citrate.

Pregnancy category C. This medication may be harmful to an unborn baby. Tell your doctor if you are pregnant or plan to become pregnant during treatment. It is not known whether potassium passes into breast milk or if it could harm a nursing baby. Do not use this medication without telling your doctor if you are breast-feeding a baby. During lactation it enters breast milk/compatible.

Take this medication exactly as prescribed by your doctor. Do not take it in larger amounts or for longer than recommended. Follow the directions on your prescription.

Avoid taking potassium supplements or using other products that contain potassium without first asking your doctor. Salt substitutes or low-salt dietary products often contain potassium. If you take certain products together you may accidentally get too much potassium. Read the label of any other medicine you are using to see if it contains potassium.

Measure the liquid medicine with a special dose-measuring spoon or cup, not a regular table spoon. Liquid potassium should be mixed with at least 4 ounces (one-half cup) of cold water or fruit juice. Drink the mixture slowly, over 5 to 10 minutes in all. To make sure you get the entire dose, add a little more water to the same glass, swirl gently and drink right away.
Take this medication with a meal or bedtime snack, or within 30 minutes after a meal. Avoid lying down for at least 30 minutes after
you take this medication. While taking this medication, avoid strenuous exercise if you are not in proper condition for it.

Take the missed dose as soon as you remember. If it is almost time for your next dose, wait until then to take the medicine and skip the missed dose. Do not take extra medicine to make up the missed dose.

Overdose symptoms may include heavy feeling in your arms or legs, muscle weakness, limp feeling, slow or uneven heartbeat, chest pain, or feeling like you might pass out. Seek emergency medical attention if you think you have used too much of this medicine.

Do not stop taking this medication without first talking to your doctor. If you stop taking potassium suddenly, your condition may become worse.

**Potassium citrate side effects**

Serious side effects of potassium citrate include uneven heartbeat, muscle weakness or limp feeling, severe stomach pain, and numbness or tingling in your hands, feet, or mouth. Get emergency medical help if you have any of these signs of an allergic reaction: hives; difficulty breathing; swelling of your face, lips, tongue, or throat. Stop using this medication and call your doctor at once if you have any of these serious side effects:

- confusion, anxiety, feeling like you might pass out;
- uneven heartbeat;
- extreme thirst, increased urination;
- leg discomfort;
- muscle weakness or limp feeling;
- numbness or tingly feeling in your hands or feet, or around your mouth;
- severe stomach pain, ongoing diarrhea or vomiting;
- black, bloody, or tarry stools;
• coughing up blood or vomit that looks like coffee grounds.

Less serious side effects may include:

• mild nausea or upset stomach;
• mild or occasional diarrhea; or
• appearance of a potassium citrate tablet in your stool.

This is not a complete list of side effects and others may occur. Tell your doctor about any unusual or bothersome side effect.

Potassium citrate Dosing Information

Usual Adult Dose for Nephrolithiasis:
Initial:
If urinary citrate <150 mg/day: 60 mEq/day, administered in three to four divided doses daily with meals, or within 30 minutes after meals or bedtime snack.

If urinary citrate >150 mg/day: 30 mEq/day, administered in three divided doses daily with meals.

Maximum dosage: 100 mEq/day
Usual Adult Dose for Renal Tubular Acidosis:
Initial:
If urinary citrate <150 mg/day: 60 mEq/day, administered in three to four divided doses daily with meals, or within 30 minutes after meals or bedtime snack.

If urinary citrate >150 mg/day: 30 mEq/day, administered in three divided doses daily with meals.

Maximum dosage: 100 mEq/day
Usual Pediatric Dose for Nephrolithiasis:
Study (n=8)
9.7 +/- 1.2 years: 2 mEq/kg/day in three divided doses, then titrated upwards, at 2 months intervals, to 3 mEq/kg/day, and to a final dose of 4 mEq/kg/day.

Usual Pediatric Dose for Renal Tubular Acidosis:
Study (n=8)
9.7 +/- 1.2 years: 2 mEq/kg/day in three divided doses, then titrated upwards, at 2 months intervals, to 3 mEq/kg/day, and to a final dose of 4 mEq/kg/day.

What other drugs will affect potassium citrate?

The following drugs can interact with potassium citrate. Tell your doctor if you are using any of these:

- eplerenone (Inspra);
- digoxin (digitalis, Lanoxin);
- candesartan (Atacand), losartan (Cozaar, Hyzaar), valsartan (Diovan), or telmisartan (Micardis);
- glycopyrrolate (Robinul);
- mepenzolate (Cantil);
- quinidine (Quinaglute, Quinidex, Quin-Release);
- atropine (Donnatal, and others), benztropine (Cogentin), dimenhydrinate (Dramamine), methscopolamine (Pamine), or scopolamine (Transderm-Scop);
- a bronchodilator such as ipratropium (Atrovent) or tiotropium (Spiriva);
- bladder or urinary medications such as darifenacin (Enablex), flavoxate (Urispas), oxybutynin ( Ditropan, Oxytrol), tolterodine ( Detrol), or solifenacin (Vesicare);
- irritable bowel medications such as dicyclomine (Bentyl), hyoscyamine (Anaspaz, Cystospaz, Levsin, and others), or propantheline (Pro-Banthine);
- an ACE inhibitor such as benazepril (Lotensin), captopril (Capoten), fosinopril (Monopril), enalapril (Vasotec), lisinopril
(Prinivil, Zestril), moexipril (Univasc), perindopril (Aceon), quinapril (Accupril), ramipril (Altace), or trandolapril (Mavik);

Any type of diuretic (water pill) such as bumetanide (Bumex), chlorothiazide (Diuril), chlorthalidone (Hygroton, Thalitone), ethacrynic acid (Edecrin), furosemide (Lasix), hydrochlorothiazide (HCTZ, HydroDiuril, Hyzaar, Lopressor, Vasoretic, Zestoretic), indapamide (Lozol), metolazone (Mykrox, Zarxolyn), or torsemide (Demadex).

This list is not complete and there may be other drugs that can interact with potassium citrate. Tell your doctor about all your prescription and over-the-counter medications, vitamins, minerals, herbal products, and drugs prescribed by other doctors. Do not start a new medication without telling your doctor.

Citrate supplementation is widely used in the prevention of recurrent nephrolithiasis with hypocitraturia. Potassium citrate is the most commonly used citrate agent for this indication. In patients with chronic diarrheal syndromes, the absorption of potassium citrate can be affected.

Citrate inhibits renal stone recurrence by preventing crystal growth, aggregation, and nucleation. It is a strong chelator of calcium and one of the most common therapeutic agents used to prevent calcium oxalate, uric acid, or cystine stones because of its ability to alkalize urine and decrease urinary supersaturation for calcium oxalate. Gastrointestinal absorption of citrate is less efficient from a tablet preparation of potassium citrate than from a liquid preparation. Chronic diarrhea leads to decreased absorption and increased loss of the citrate from the gastrointestinal tract, leading to decreased urinary excretion.

We describe a patient with nephrolithiasis and chronic diarrhea who had severe hypocitraturia despite citrate supplementation by the slow-release tablet preparation and a normal urinary citrate level after
she was switched to the liquid preparation. We hypothesize that the decreased gastrointestinal transit time from her diarrhea led to inadequate absorption of citrate from the slow-release wax-matrix tablets.

Citrate is a byproduct of normal oxidative pathways in the body that is normally excreted in the urine. Tubular absorption of citrate varies with the mitochondrial pH gradient; alkalosis increases and acidosis decreases the urinary citrate output. Therapeutic agents affecting citrate excretion work by producing an alkaline load. The induced alkaline load in turn increases urinary pH and raises urinary citrate by augmenting citrate clearance without measurably altering ultrafilterable serum citrate.

The mean normal urinary citrate excretion is 640 mg/24 hours. Hypocitraturia (< 320 mg/24 hours) occurs in between 13% and 63% of patients with recurrent calcium nephrolithiasis; it typically occurs in these patients in the absence of changes in acid-base balance, which is termed idiopathic hypocitraturia.

Hypocitraturia may be the only cause of renal stones in 5% to 10% of patients. Possible etiologies include distal renal tubular acidosis, intestinal diseases with malabsorption and diarrhea, enteric hyperoxaluria, hypokalemia, excessive dietary intake of animal proteins, and extreme physical exercise. Fegan and colleagues measured the gastrointestinal absorption of citrate in patients with nephrolithiasis and idiopathic hypocitraturia to determine if citrate malabsorption could account for the low urinary citrate. They found no significant difference in gastrointestinal citrate absorption between nephrolithiasis patients with hypocitraturia and normal volunteers, suggesting that hypocitraturia might not be due to impaired gastrointestinal citrate absorption.

Alkaline citrate supplements have been shown to dramatically decrease the recurrence of nephrolithiasis and are widely used for the prevention of recurrent nephrolithiasis with calcium stones.
Administration of alkaline citrate increases both the urinary citrate and the urinary pH. The increased urinary citrate complexes with calcium and decreases calcium ion activity and, thus, the urinary supersaturation and crystallization of calcium oxalate and calcium phosphate. The increase in urinary pH decreases calcium ion activity by increasing calcium complexation to dissociated anions and increases the ionization of uric acid to more soluble urate ion, leading to fewer uric acid stones.

Citrate supplements are available as sodium and potassium salts, but potassium is the preferred citrate compound because the sodium salt can increase urinary calcium excretion. In the United States, potassium citrate is available in 3 preparations as tablets, crystals for oral solution, and oral solution. Patients often prefer tablets to potassium-containing liquids. The gastrointestinal absorption of citrate is less efficient from a tablet preparation of potassium citrate than from a liquid preparation. In their study, Fegan and colleagues compared the gastrointestinal citrate absorption of the tablet and the liquid preparation of potassium citrate and noted that citrate absorption from the tablets was 91% compared with 98% for a liquid preparation. They proposed this was probably due to a delayed release of citrate from the wax matrix.

The rise in urinary citrate excretion is directly dependent on the dosage of the oral potassium citrate. In the setting of normal renal function, the rise in urinary citrate following a single dose begins by the first hour and lasts for 12 hours. With multiple doses, the rise in citrate excretion reaches its peak by the third day and averts the normally wide circadian fluctuation in urinary citrate, thus maintaining the urinary citrate at a higher, more constant level throughout the day. For patients with calcium stone formation, urinary citrate levels should be maintained at or above 350 mg/L. After multiple doses, the potassium citrate tablet at a dosage of 60 mEq/day raises the urinary citrate by approximately 400 mg/day.
Patients with chronic diarrhea have an ongoing loss of base and often have decreased urinary citrate excretion from impaired gastrointestinal absorption, but they respond well to citrate supplementation.

Conclusion

In patients with chronic diarrheal syndromes, the absorption of potassium citrate from the slow-release wax-matrix tablet preparations can be affected. Though patients prefer the tablet preparation of potassium citrate to the liquid preparation, those with chronic diarrhea should be prescribed the liquid preparation to ensure adequate absorption of citrate.

How It Works

Potassium citrate attaches to calcium in the urine, preventing the formation of mineral crystals that can develop into kidney stones. Potassium citrate also prevents the urine from becoming too acidic. This helps prevent uric acid or cystine kidney stones from forming. Potassium citrate may be used to replace potassium that is lost when a thiazide medication is used to prevent kidney stones.

Potassium citrate may prevent the formation of:

- Calcium stones in people who have too little citrate in their urine.
- Uric acid stones or cystine stones in people who have urine that is too acidic.
- Potassium citrate may be used to replace potassium that is lost when a thiazide medication is used to prevent kidney stones.

In one study, potassium citrate reduced calcium stones by 90%. How well it works to prevent or reduce uric acid and cystine stones is less well known.
Side Effects
The liquid form of potassium citrate may cause nausea, vomiting, diarrhea, or gas.

You can also control the level of acid in your urine by taking baking soda. But potassium citrate has fewer side effects.

You will have to monitor your urinary acidity (pH) to keep the pH between 6.0 and 7.0 while taking potassium citrate. If your urine pH is much lower than 6.0 or higher than 7.0, kidney stones are more likely to form.

You may be able to reduce or prevent side effects commonly caused by potassium citrate, such as nausea, bloating, or gas, by adding water to the medicine or taking it with food.

Drinking 4 fl oz (118.3 mL) of frozen concentrate lemonade in 1 qt (1 L) of water per day is also a way of increasing potassium citrate in your body.

Potassium citrate is one form of the mineral potassium, a positively charged ion that plays a role in fluid and electrolyte balance in the body.

Potassium is also essential in controlling muscle activity, particularly contraction and coordination of muscles. It plays an important role in nerve transmission and maintaining heart rhythm as well. In addition, potassium helps to convert glucose into glycogen, which is stored as the body’s short-term energy reserve. Deficiencies of potassium can cause muscular problems and confusion.

Potassium is abundant in whole foods, particularly fresh fruits and vegetables. The recommended daily amount of potassium for adults is 4700 mg.
For people who do not get enough potassium in their diets or those who have conditions that make potassium loss possible, a supplement, such as potassium citrate, may be useful. Though there are several other forms of supplemental potassium, potassium citrate is considered to be one of the most absorbable forms of the mineral.

Specifically, potassium citrate is often used to prevent kidney stones by making urine less acidic, which discourages their development. Potassium citrate is also used to treat gout and is sometimes combined with antibiotics to make them more effective. Further, since diets that are low in potassium are associated with elevated blood pressure, potassium citrate may be useful in preventing or reducing hypertension as well as protecting against cardiovascular disease and stroke.

In addition, supplements of potassium citrate can be used to replenish the mineral under certain conditions that may cause depletion of potassium. These include prolonged use of certain medications, diabetic acidosis, and severe vomiting or diarrhea. Use of potassium citrate should be monitored in people with conditions that may cause high blood levels of potassium. Such conditions include kidney disease, diabetes, adrenal insufficiency and serious infection.

Also, people with stomach ulcers, obstructed intestines or urinary tract infections should be carefully monitored when taking potassium citrate.

Potassium citrate can be taken with or without food, but taking it with food can minimize the chances of stomach upset. If potassium citrate is taken for kidney stones or electrolyte imbalance, drinking plenty of fluids may also help the condition.

Use
Prevention of uric acid nephrolithiasis; prevention of calcium renal stones in patients with hypocitraturia; urinary alkalinizer when sodium citrate is contraindicated

**Contraindications**

Severe renal insufficiency; sodium-restricted diet (sodium citrate); untreated Addison’s disease; severe myocardial damage; acute dehydration; patients with hyperkalemia; patients with delayed gastric emptying, esophageal compression, intestinal obstruction or stricture, or those taking anticholinergic medication; patients with active urinary tract infection.

**Warnings/Precautions**

Use caution in patients with CHF, hypertension, edema, or any condition sensitive to sodium or potassium intake. Citrate is converted to bicarbonate in the liver. This conversion may be blocked in patients who are severely ill, in shock, or in hepatic failure. Use caution with potassium-sparing diuretics and drugs that slow GI transit time.

**Adverse Reactions**

>10%: Gastrointestinal: Diarrhea, nausea, stomach pain, flatulence, vomiting (oral)

1% to 10%:
- Cardiovascular: Bradycardia
- Endocrine & metabolic: Hyperkalemia, metabolic alkalosis in patients with severe renal failure
- Neuromuscular & skeletal: Weakness
- Respiratory: Dyspnea

<1% (Limited to important or life-threatening): Arrhythmias, chest pain, heart block, hypotension

**Pharmacodynamics/Kinetics**
Metabolism: Hepatic to bicarbonate

Dosage
Adults: Oral: 10-20 mEq 3 times/day with meals up to 100 mEq/day

Administration
Swallow tablets whole with a full glass of water.

Dietary Considerations
May be taken with meals.

Patient Education
Take as directed; do not take more than directed. Swallow tablet whole with full glass of water or juice and stir before sipping slowly, with or after meals (do not take on an empty stomach). Take any antacids 2 hours before or after potassium. Consult prescriber about advisability of increasing dietary potassium. Report tingling of hands or feet; unresolved nausea or vomiting; chest pain or palpitations; persistent abdominal pain; feelings of weakness, dizziness, listlessness, confusion; acute muscle weakness or cramping; blood in stool or tarry stools; or easy bruising or unusual bleeding.

Nursing Implications
Intact wax matrix may appear in the feces.

Cardiovascular Considerations

Hypokalemia is highly arrhythmogenic, particularly in the setting of ischemia or digitalis toxicity. ECG evidence of hypokalemia includes flattening of the T wave. As the T wave shrinks, U waves may appear. There is no prolongation of the QT interval. Hyperkalemia may present as tall peaked symmetrical T waves. S-T elevation may present in severe hyperkalemia. QRS complex progressively widens with eventual apparent sine waves on the ECG. Hyperkalemia will also induce cardiac slowing and AV conduction abnormalities.
Dental Health: Effects on Dental Treatment
No significant effects or complications reported