Protocol for Self-Monitoring of Urine pH in Kidney Patients

Santa Barbara Nutrients offers this product as a convenience item for customers. Other suitable pH indicators can be used, too.

pH Test Paper (pH 4.5-8.5)

Santa Barbara Nutrients' pH paper is ideal for monitoring the pH value (acidity/alkalinity) of urine.

- The measurable pH range (4.5-8.5) is ideal for urine samples
- Fast, accurate results in seconds
- Easy to use and easy to read
- Flushable in toilet
- Inexpensive and suitable for frequent monitoring
- 15 feet of pH paper can be used for approximately 100 measurements
- Pocket-sized container can be taken anywhere
- Perfect for use at home, work or while traveling
- Consistent, high quality and made in the USA

The association between urine pH and tubular damage by renal crystal formation in ADPKD

Individuals with chronic kidney disease, including especially autosomal-dominant polycystic kidney disease (ADPKD), frequently have abnormally acidic urine pH *(Lucaya et al., 1993; Grampsas et al., 2000; Nishiura et al., 2009)* which also leads to a deficiency in urinary citrate levels (hypocitraturia) *(Lucaya et al., 1993; Grampsas et al., 2000; Nishiura et al., 2009)*. Metabolic acidosis (as defined by lower serum bicarbonate) is common in individuals with ADPKD and is associated with a greater risk of worsening kidney function *(Blijdorp et al., 2020)*. Metabolic acidosis is well-known to lead to urine acidification which, in turn, causes hypocitraturia because urinary citrate excretion is partially regulated by urine pH. The mechanistic reasons for these metabolic abnormalities leading to acidic urine and hypocitraturia in ADPKD are still poorly understood. Low urine pH is generally known as a predictor of chronic kidney disease *(Nakanishi et al., 2011)*.

Low urine pH is a well-known risk factor for forming uric acid kidney stones (Mulay et al., 2014; Pérez, 2018), and hypocitraturia is a well-known risk factor for forming calcium-based kidney stones such as those composed of calcium oxalate (Haghighatdoost et al., 2021). Kidney stones are much more common in ADPKD patients compared with the normal population (Torres et al., 1988, 1993; Levine and Grantham, 1992). The concentration of urinary citrate inversely correlates with faster disease progression in individuals with ADPKD (Torres et al., 2019). Additionally, it was shown that the formation of insoluble microcrystals (such as calcium oxalate and calcium phosphate crystals) in kidney tubules can trigger the formation of renal cysts and leads to accelerated PKD disease progression in animal models (Torres et al., 2019; Allison, 2019). This effect can be antagonized by supplementation with alkaline citrate which causes strong inhibition of renal cyst growth and disease progression in PKD animal models (Tanner, 1998; Tanner and Tanner, 2000, 2003, 2005; Torres et al., 2019). Nutritional supplementation with alkaline citrate has two principal effects: (1) it raises or normalizes the urine pH, and (2) it raises or normalizes the concentration of urinary citrate (Zuckerman and Assimos, 2009; Pearle et al., 2014; Holmes et al., 2016). Both effects support the kidneys' innate defense mechanism to antagonize the precipitation of microcrystals in kidney tubules.

Urinary citrate is known to antagonize the formation of calcium-based crystals (e.g. calcium oxalate and calcium phosphate (Zuckerman and Assimos, 2009, 2009; Pearle et al., 2014; Holmes et al., 2016) and may also antagonize the formation of struvite crystals (Espinosa-Ortiz et al., 2019). Urine alkalinization also inhibits the formation of uric acid crystals (Pak and Adams, 1987; Toblli et al., 2001) and has been shown to facilitate the urinary excretion of uric acid (Kanbara et al., 2010). Individuals with ADPKD have a high incidence of clinical gout (24%) and hyperuricemia (>60%) (Mejias et al., 1989; Errasti et al., 2003; Nishiura et al., 2009; Kocyigit et al., 2013), conditions that are associated with uric acid crystal formation in the kidneys and renal damage (Toblli et al., 2001). Hyperuricemia correlates with faster disease progression in ADPKD (Panizo et al., 2012).

In conclusion, metabolic abnormalities in ADPKD lead to metabolic acidosis accompanied by acidification of the urine, and

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hypocitraturia which increase the risk of uric acid and calcium crystal precipitation with the potential to worsen disease progression.

Santa Barbara Nutrients' KetoCitra™ is formulated to deliver citrate and ~50 mEq of alkali load/day to help normalize the urine pH and urine citrate concentration of patients. The first shipment of KetoCitra™ (for subscription customers through the SBN website) includes a free roll of pH indicator paper. Patients should be encouraged to regularly monitor their urine pH and discuss the results with their healthcare practitioner.

Why monitor the urine pH in ADPKD?

The urine pH can vary considerably depending on the kind of foods we eat and depending on certain health conditions. A perfectly neutral pH (neither acidic nor alkaline) has a value of 7. Most people in industrialized societies have acidic urine pH (for example, around pH 5 which is 100x more acidic than pH 7) due to the high consumption of acidifying foods such as grains and animal protein (meats, dairy, eggs). Additionally, health conditions, such as ADPKD, can lead to chronically acidic urine pH. A urine pH value near neutral (around pH 6-7.5) is ideal for most people unless they have been told by their healthcare practitioner that their urine pH should have a different value due to other underlying conditions.

Urine pH should be monitored in ADPKD to assess the effect of the dietary management of a patient. Changes in diet and lifestyle, management with KetoCitra™, or the ingestion of alkalizers – such as sodium bicarbonate – can all be beneficial in helping to normalize the urine pH. Over-alkalization should be avoided because highly alkaline urine increases the risk of calcium phosphate precipitation. For this reason, KetoCitra™ should not be combined with other alkalizers unless indicated.

When should the urine pH be measured?

Because the urine pH can vary significantly throughout the day depending on the intake of food and drink, it is best to initially measure several times per day to become familiar with one's pattern. Later on, for routine monitoring it may be sufficient to measure less frequently. For example, the ***second morning urine*** is frequently measured as a way of staying consistent and establishing a routine. Measuring spot urine only once at a doctor's office may be misleading because the result may be an outlier.

How to measure the urine pH using Santa Barbara Nutrients' pH paper?

1) When going to the bathroom, collect some urine in a cup.

2) Rip off 2 inches (5 cm) or less of pH paper from the roll and briefly dip it halfway into the fluid.

3) Immediately compare the color of the wet strip to the color chart on the pH paper container.

4) One should be able to estimate the pH with an accuracy of approximately 0.5 units. Make sure the lighting is good.

5) SBN's pH paper strip can be flushed in the toilet.

6) It may be a good idea to keep a written record to observe trends to be able to discuss the patient's observations with the healthcare practitioner.

What if the urine pH is too low or too high?

A patient should discuss their results with their doctor, dietitian, or other healthcare practitioner. In most cases, dietary changes can help to normalize the urine pH. KetoCitra™ may be used and the serving size and frequency can be adjusted depending on the observed urine pH. To ensure that the urine pH stays in the healthy range, it is important to keep monitoring the pH frequently and not only rely on a single spot urine measurement at a doctor's office.

Disclaimers

SBN's pH indicator paper is not an approved medical device and should not be used to diagnose any disease or health condition. Do not use this pH paper after the expiration date printed on the container. Store in a dry environment at normal ambient temperature.

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