

Staff Guide:

Dietary Recommendations for Patients with Autosomal Dominant Polycystic Kidney Disease (ADPKD)



This teaching sheet is intended as a reference sheet for **staff** working in a BC Kidney Care Clinic.

Sodium

- Recommend < 2300mg/day, which is the tolerable upper limit (UL) for all Canadians.
- ADPKD = sodium-sensitive hypertension
- Important to start sodium restriction early in disease course.
- Higher sodium intake is associated with higher urine osmolality and therefore an increased release of vasopressin → impacts the growth of cysts
- Higher baseline sodium intake is associated with greater decline in GFR and greater increase in total kidney volume.

Determining sodium intake from a 24-hour urine collection:

- Goal urine sodium = <100mmol/day (2300mg/day)
- Urine sodium is a surrogate marker for sodium intake in a steady state (input= output)
- A 24-hour urine collection should be done prior to starting Tolvaptan therapy to identify those who may have higher sodium intake and therefore greater chance of having more aquaretic symptoms (thirst, increased urination, nocturia, etc).
- When on Tolvaptan a 24-hour urine collection should be done q 6 months and ideally prior to clinic visit so dietary interventions can happen in a timely manner.

Note: to determine if a 24-hour urine collection is complete, monitor 24-hour urine creatinine. This is a waste product of muscle breakdown and for women we would expect ~6-14mmol/d and for men ~9-22mmol/d.

Protein

- Recommendation = 0.8g/kg/day ideal body weight (use BMI 25).
- Limited human clinical trials, most studies done on genetic rodent models of PKD.
- Diets containing more than 0.8g/kg may negatively affect PKD → can cause higher renal perfusion and kidney hyper-filtration, stimulates renin activity and elevates blood pressure.
- Protein type rather than amount may be of greater importance, i.e. plant vs. animal sources. However, further research is needed. Animal studies have suggested beneficial effects of soy protein on PKD progression.
- A diet high in animal protein can increase dietary acid load, risk of kidney stones, and gout.
- Important to evaluate protein intake (amount and type) at early stages of the disease.
- Best if protein is spread out amongst meals to limit solute load to avoid spikes in urine osmolality.



Determining Protein Intake from 24H urine test:

- Urine urea is an indicator of total protein intake
- Maroni Equation uses 24-hour urine urea, 24-hour urine protein, and body weight to calculate total protein intake
 - Target = 0.8g/kg ideal body weight/day

$$\text{Protein Intake (g/d)} = 6.25 (\text{UUN g/d} + (\text{BW}_{\text{ef}} \times 0.031)) + \text{Urine Protein g/d (if } >5\text{g/d)}$$

Urine Urea Nitrogen (UUN) in g/d = 0.028 x Urine Urea (mmol/d)

BW_{ef} = Edema free body weight (kg)

Urine protein – enter 0 unless > 5g/day

- A quick way to determine excessive protein intake is to take 24-hour urine urea and divide by ideal body weight, however this does not give you an exact amount of protein consumed.

If 24-hour urine urea/IBW is > 5 mmol/kg = excessive protein intake.

- A 24-hour urine collection should be done prior to starting Tolvaptan therapy to identify those who may have higher protein intake and therefore greater chance of having more aquaretic symptoms (thirst, increased urination, nocturia, etc).
- When on Tolvaptan a 24-hour urine collection should be done q 6 months and ideally prior to clinic visit so dietary interventions can happen in a timely manner.

Fluid

- Water prescription is individual, however, in general it is suggested that 3-4L of water per day efficiently and safely lowers serum vasopressin.
- Water prescription needed to lower urine osmolality will be in relation to solute intake of meals (sodium, protein). As someone reduces their solute intake (especially sodium), they should not need as much

water to reduce urine osmolality and therefore, will have reduced urination.

- Important to drink fluid consistently throughout the day and in the night when waking to urinate to keep vasopressin levels low.
- Important to drink water with meals to limit release of vasopressin in response to sodium intake.
- Water should be the first choice, but other sugar-free, caffeine-free, low-sodium drinks can be acceptable.
- Alcohol has an unknown effect on cyst growth. However, alcohol is known to increase blood pressure and should be limited to moderate amounts (1-2 drinks/day).
- Goal is to maintain urine osmolality of < 280 mOsm/kg.
- When taking Tolvaptan avoid grapefruit juice.

Phosphorus

- A moderate phosphorous restriction of 800mg/day is recommended.
- Avoidance of food additives:
 - Foods with hidden phosphorus include frozen fish and meats, deli meat, processed cheese, enriched milk substitutes, powdered drink mixes, baking mixes and ready to bake foods, among others.
 - Important to read nutrition labels.

Potassium

- No need to restrict potassium.
 - Diets high in potassium can help reduce dietary acid load.
 - Increased dietary acid loads (urinary acid excretion) have been shown to accelerate cyst growth in animals and lead to a more rapid decline in kidney function in CKD.
 - Potassium intake has beneficial effects on blood pressure control.

- Recommend to increase fruits, vegetables, whole grains, and plant-based proteins.

GI Symptoms

- Due to increased kidney volume patients may experience pain, early satiety, nausea, constipation, and/or reflux.
- Use caution when assessing weight history as tissue/fat loss may be masked by increased kidney (+/- liver) volume due to cyst growth.
- For low appetite encourage small, frequent meals. Liquids may be better tolerated.
- For constipation a high fibre diet with adequate intake of fruits, vegetables, whole grains, and fluid is recommended.

How to Change Osmolality with Diet?

Optimize Dietary Protein Restriction

- Follow protein recommendations based on ideal body weight.
- Choose plant-based protein foods more often: tofu, beans, peas, lentils, nuts and nut butters, seeds.
- Avoid snacking on high protein foods (ie: nuts), ok as a source of protein at meals.
- Avoid double protein in the same meal (ie: adding cheese).
- Limit dairy to 1 cup per day
 - Choose almond, coconut, oat, or rice milk as lower protein alternatives. Watch out for PO4 additives.
- Best if protein is spread out amongst meals to limit solute load.
- Load your plate with fresh fruits, vegetables, and whole grains to help with satiety.

Optimize Dietary Sodium Restriction

- Choose fresh ingredients and minimally processed foods.

- Cook more at home and limit frequency of restaurant meals.
- Limit salt and high sodium sauces in cooking and avoid adding salt at the table.
- Avoid processed and ready-to-eat foods.
- Learn to read nutrition labels for ingredients and % Daily Value (%DV)
 - General rule: < 5% DV = a little and >15% DV = a lot

Nocturia

- To reduce nocturia, limit intake of protein and sodium in particular at the end of the day. Excess solute load will require higher fluid intake to lower osmolality → increased urine volume → increases urination day and night.
- Suggest larger meal at lunch instead of supper to reduce solute load and try meat-alternatives at dinner.
- Avoid snacking on high salt/protein foods after dinner.

Tolvaptan

- Tolvaptan is a medication used in ADPKD to reduce cyst formation by blocking vasopressin receptor.
- Side effects include: thirst, polyuria, nocturia, frequent urination, and polydipsia. These are known as aquaretic symptoms.
- Nutrition therapy plays a key role in reducing symptom burden.
 - Those with high sodium and or protein intake have excess polyuria to maintain normal osmolality.
- Impact on quality of life (frequent need to urinate)
- A 24H urine test should be done before starting treatment to identify those at risk of polyuria when starting Tolvaptan and to help target diet therapy (i.e. lower sodium and/or protein) to lessen symptoms and increase patient compliance with Tolvaptan therapy.

References:

Paul, B. M., & Vanden Heuvel, G. B. Kidney: polycystic kidney disease. *Wiley interdisciplinary reviews. Developmental biology* (2014) 3(6), 465–487. doi:10.1002/wdev.152

Torres VE et al. Dietary Salt Restriction is beneficial to the management of Autosomal Dominant Polycystic kidney disease. *Kidney International* 2017;91:493-500

Chebib F, Torres V. *Recent Advances in the Management of Autosomal Dominant Polycystic Kidney Disease*. CJASN Nov 2018, 13 (11) 1765-1776; DOI: 10.2215/CJN.03960318

Torres, VE, Grantham, JJ, Chapman AB et al. Potentially Modifiable Factors affecting the progression of autosomal dominant polycystic kidney disease. *Clin J Am Soc Nephrol* 2011;6:640-647

Maditz, K, Gigliotti, JC, Tou, JC. Evidence for a role of proteins, lipids and phytochemicals in the prevention of polycystic kidney disease progression and severity. *Nut Review* 2013;71(12):802-814

Amro OW, Paulus JK, Noubary, F, Perrone, RD. Low Osmolar Diet and Adjusted Water Intake for Vasopressin Reduction in Autosomal Dominant Polycystic Kidney Disease: A Pilot Randomized Controlled Trial. *Am J Kidney Dis*. 2016;68 (6): 882-891

Taylor JM, Hamilton-Reeves JM, Sullivan DK et al. Diet and polycystic kidney disease: A pilot intervention study. *Clin Nutr* 2017; 36(2):458-466

Wong ATY, Mannix C, Grantham JJ et al. Randomised controlled trial to determine the efficacy and safety of prescribed water intake to prevent kidney failure due to autosomal dominant polycystic kidney disease (PREVENT-ADPKD). *BMJ Open* 2018;8(1):e018794

El-Damanawi, R, Lee M, Harris T et al. Randomised controlled trial of high versus ad libitum water intake in patients with autosomal dominant polycystic kidney disease: rationale and design of the DRINK feasibility study. *BMJ Open*. 2018;8(5):e022859

Girardat-Rotar, L, Puhon, MA, Braun, J, Serra, AL. Long term effect of coffee consumption on autosomal dominant polycystic kidneys disease progression: results from the Suisse ADPKD, a Prospective Longitudinal Cohort Study. *J Nephrol* 2018;31: 87-94

Maroni B.J, Steinman T.I, Mitch WE. A method for estimating nitrogen intake of patients with chronic renal failure. *Kidney Int*. 27 (1): 58-65. *Kidney international* (1985). 27. 58-65. 10.1038/ki.1985.10.

Devuyst O, Chapman AB, Shoaf SE, Czerwiec FS, Blais JD. Tolerability of Aquaretic-Related Symptoms Following Tolvaptan for Autosomal Dominant Polycystic Kidney Disease: Results From TEMPO 3:4. *Kidney Int Rep*. 2017;2(6):1132–1140. Published 2017 Jul 21. doi:10.1016/j.ekir.2017.07.004