

# Examination of the concentrating ability of the kidneys

Impaired renal concentrating ability is one of the first signs of renal disease. When investigating it, we proceed as follows:

- First, we examine **osmolality in a morning sample** of urine. A healthy person should produce urine with an osmolality of **about 600 mmol/kg** after overnight fluid withdrawal. This value is indicative of good renal concentrating ability and if it is reached, no further investigation is pursued.
- **Adiuretin test** reflects the ability of the distal tubule and collecting duct to respond to adiuretin (vasopressin) by producing concentrated urine. The patient is injected with 10 µg (2 drops) of 1-deamino-8-D-arginine vasopressin (DDAV), a synthetic analogue of adiuretin, into each nostril after nighttime fluid withdrawal. It is characterized by an exaggerated antidiuretic effect, while other pharmacological effects are suppressed. The patient collects urine at four one-hour intervals and the osmolality of each urine sample is measured. If it exceeds the value given in the table, this indicates good renal concentrating capacity and the experiment is terminated. At the same time as the urine, blood is taken, in which the serum osmolality is examined. From the values of urine and serum osmolality, we calculate an osmotic index ( $U_{osm}/S_{osm}$ ), that more accurately reflects the concentration capacity of the kidneys.

Physiological values of urine osmolality and osmotic index after adiuretic administration

Age	$U_{mmol/kg\ H_2O}$	$U_{osm}/S_{osm}$
15-20	970	3,34
21-50	940	3,24
51-60	830	2,86
61-70	790	2,72
71-80	780	2,69

Another option is to assess urine osmolality under conditions of varying fluid withdrawal duration, which is currently rarely performed.

The concentration capacity of the kidneys is impaired mainly in diseases affecting the renal tubules and interstitium, where the upstream concentration gradient is disrupted.

The **dilution capacity of the kidneys** after distilled water loading can also be investigated. The test reflects the ability to produce urine whose osmolality is significantly lower than that of serum.