Supplementary Information

Title. The Aiko–Takeru (AT) Model: A Mathematical Framework for Non-Osmotic Vasopressin Regulation in Mammalian PKD

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Note. Supplementary materials are provided in a single file, as detailed in the following sections.

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Supplementary Methods

S1. AVP Sample Collection and Submission. Peripheral venous blood samples were collected at four timepoints: October 15, 2022; December 26, 2022; June 20, 2023; and January 28, 2025.

The first two samples were obtained at Hiroshima Cat Clinic (Hiroshima, Japan). After collection into EDTA tubes and immediate processing, the samples were submitted via Animal Medical Technology Co., Ltd. (Nagoya, Japan) to the Central Research Laboratory of BML Inc. (Saitama, Japan).

The latter two samples were obtained at the Veterinary Medical Center of the University of Tokyo. These samples were similarly collected into EDTA tubes, processed, and submitted via Sanritsu-Zelkova Clinical Laboratory Inc. (Tokyo, Japan) to the Central Research Laboratory of BML Inc. (Saitama, Japan).

S2. AVP Measurement Procedure. Plasma AVP concentrations were measured at the Central Research Laboratory of BML Inc. (Saitama, Japan) using a two-antibody radioimmunoassay (RIA) with assay reagents supplied by Yamasa Shoyu Co., Ltd. (AVP Kit Yamasa, product code 80114).

Radioactivity was quantified using a 50-well gamma counter (ARC-950, Aloka Co., Ltd., Japan). All measurements were performed in single-assay mode and reported in picograms per milliliter (pg/mL).

The required plasma volume was 1.5 mL. Samples were frozen until shipment. The reportable range was 0.8 pg/mL to the upper detection limit, with results reported to one decimal place. The analytical sensitivity and assay characteristics followed the manufacturer's validated specifications for the AVP Kit Yamasa.

S3. AVP Kit Yamasa (80114). The AVP Kit Yamasa (Yamasa Shoyu Co., Ltd., Chiba, Japan; product code 80114) is based on a two-antibody radioimmunoassay (RIA) principle using PEG precipitation.

The assay employs tritium-labeled AVP and anti-AVP antibodies. The antibody-bound fraction is separated from free antigen by polyethylene glycol (PEG) precipitation, followed by radioactivity measurement using a gamma counter.

The assay was originally developed for human plasma (EDTA-treated); the same protocol was applied to feline plasma samples in this study.

No feline-specific reference ranges or clinical validation data were available; therefore, AVP values were interpreted descriptively within the longitudinal case framework.

Reference ranges provided for human clinical testing were ≤ 4.0 pg/mL under water restriction and ≤ 2.8 pg/mL under free water intake.

Since feline-specific reference ranges are not available, these values were used only as descriptive reference values.