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COLLEGE OF EDUCATION, NURSING AND HEALTH PROFESSIONS

# Apelin-sarcopenia mitigation profile characterized by hydration status

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## ABSTRACT

Sarcopenia, the age-dependent loss of muscle mass and function, is mechanistically driven in part by circulating reductions in the hormone apelin (AP). AP can be used as an early diagnostic support tool for sarcopenia, while recognizing chronic physical activity in older adults contributes to greater circulating AP. AP is also a known fluid balance hormone and is thought to increase in concentration with elevated water intake and oppose the actions of AVP. Further, water intake influences intracellular hydration, and cell swelling from increased osmotic pressure may act as a metabolic signal for muscle growth. **PURPOSE:** To examine the impact of routine fluid intake on circulating AP concentrations as a potential metric for hydration-related sarcopenia mitigation. **METHODS:** Seventy-eight healthy, non-smoking, young adults (age 20 ± 1 y; height, 170 ± 10 cm; body mass, 74.6 ± 17.9 kg) reported to our lab for five consecutive mornings for observation. Subjects provided daily fasted morning blood samples for quantification of AP, osmolality (Posm) and copeptin (measured as an AVP surrogate), 24-hour urine collection for quantification of osmolality, and 24-hour dietary intake logs for quantification of total water intake (TWI) from all beverages and foods. Repeated measures ANOVA was used to determine changes in AP across days. Relationships between 5-day average AP and all other variables were determined by linear regression. **RESULTS:** AP did not change over the five days of observation (1.57 ± 0.62 ng·ml$^{-1}$) despite moderate variation in hydration practices. However, AP was significantly related to copeptin (8.25 ± 4.62 pmol·L$^{-1}$; $r^2$ = 0.08, p = 0.01) and Uosm (604.7 ± 217.8 mOsm·kg$^{-1}$; $r^2$ = 0.07, p = 0.02), but not to Posm (291.5 ± 4.3 mOsm·kg$^{-1}$), or TWI (2,548 ± 1029 ml·d$^{-1}$). **CONCLUSION:** In accordance with AP being noted as a potent diuretic, hydration status indicated by copeptin and Uosm mildly contributed to AP production in young adults. Therefore, an increase in routine fluid consumption may be a viable strategy in mitigating sarcopenia via the mechanistic influence of AP. Further, many older adults are chronically hypohydrated, and it may be that increased fluid intake combined with physical activity, a potent AP stimulus in older adults, may be even more effective in this regard.

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## INTRODUCTION

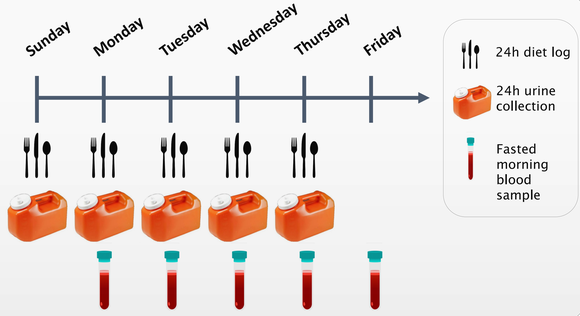
**Accumulating associative and mechanistic relationships between hydration practices and health outcomes demand broader investigative scope. Recent demonstration of skeletal muscle contraction-induced production of the hormone apelin (AP) mitigated and reversed the sarcopenia profile in aging rodents and humans. However, this work did not address AP's increased production with water intake and subsequent opposition of AVP's actions. Further, water intake influences intracellular hydration, and cell swelling from increased osmotic pressure may act as a metabolic signal for muscle growth (via protein assembly to reduce osmotic pressure). Due to a growing older population and concomitant need to improve skeletal muscle health for promotion of functional independence and reduced financial burden, great value exists in solidifying clinical diagnostic tools and effective health promotion practices.**

## PURPOSE

**To examine the impact of routine fluid intake and hydration status on circulating AP concentrations as a potential metric for hydration-related sarcopenia mitigation.**

## METHODS

**Seventy-eight healthy, non-smoking, young adults (age 20 ± 1 y; height, 170 ± 10 cm; body mass, 74.6 ± 17.9 kg) reported to our lab for five consecutive mornings for observation.**




**Data derived:**

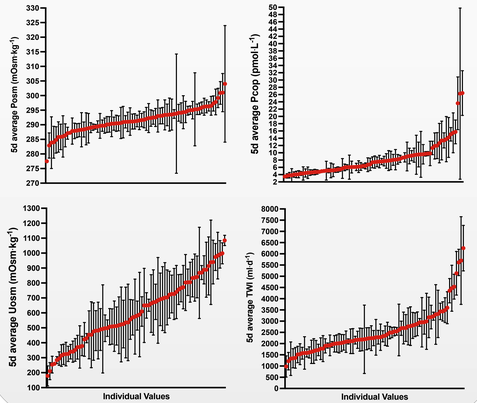
- Plasma apelin (AP; via ELISA: Phoenix Pharmaceuticals EK-057-23))
- Plasma osmolality (Posm)
- Plasma copeptin (Pcop; via BRAHMS Kryptor)
- Urine osmolality (Uosm)
- Total water intake (TWI; from all beverages and foods)

**Statistics:**

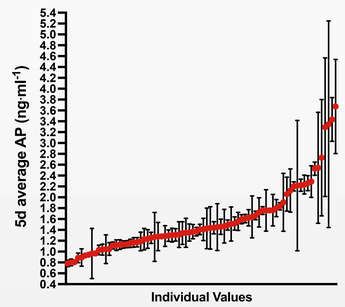
- Repeated measures ANOVA (α = 0.05)
  - Change in AP, Posm, Pcop, Uosm, TWI across days
- Linear regression (α = 0.05)
  - Relationships between 5d average AP and 5d average for all other hydration variables

## RESULTS

**A broad range of hydration status (i.e., Posm, Pcop, and Uosm) and TWI permitted observation of potential relationships with AP.**

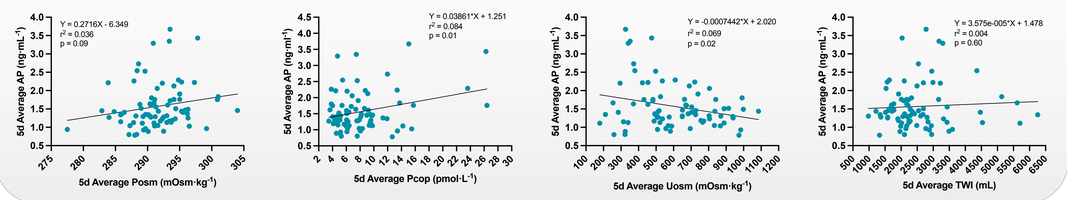



**AP did not change over the five days of observation (p=0.68), despite moderate daily variation in hydration practices and status.**




**As with Pcop, greater recorded concentrations of AP corresponded with greater intra-individual daily variation.**

**AP was significantly related to Pcop and Uosm, but not to Posm or TWI.**




## CONCLUSION

**Consistent with the role of AP as a potent diuretic, AP production has a corresponding mild consequent effect on next morning hydration profile as characterized by plasma copeptin (+) and urine osmolality (-) in young adults. Therefore, an increase in routine fluid consumption may be a viable strategy in mitigating sarcopenia via the mechanistic influence of an elevated level of AP. Further, many older adults are chronically hypohydrated, and it may be that increased fluid intake combined with physical activity, a potent AP stimulus in older adults, may be even more effective in this regard.**