

Changes in body water distribution across the menstrual cycle

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PURPOSE

- To examine changes in body water distribution across the early follicular (EF), late follicular (LF), and mid-luteal (ML) phases of the menstrual cycle (MC).

METHODS

- Sixteen healthy women (62.5% White/Caucasian; age, 22±5 y; age of menarche, 12±2 y; body mass index, 23.7±4.1 kg·m⁻²) with a history of regular menstruation, abstinence from hormonal contraception use, and no current or past eating disorders participated in this study.
- Three lab visits per participant were scheduled to coincide with the EF (within 5 days of self-reported onset of menstruation), LF (within 48 hours of a positive at-home urinary ovulation test), and ML (7-9 days after the positive ovulation test) phases of the MC.
- Body water distribution was assessed at each visit with whole-body bioimpedance spectroscopy and quantified using total body water (TBW), intracellular fluid (ICF), and extracellular fluid (ECF) volumes. Urine specific gravity (USG) and hematocrit were measured as indices of hydration status.
- Statistical significance of the mean differences between MC phases for TBW, ICF, and ECF was determined using repeated measures ANOVA with an alpha level of significance of 5.0%. Magnitudes of the differences were expressed using the partial eta squared (η_p^2) effect size.

RESULTS

- Standardized residuals of all outcome variables were approximately normally distributed with equal variances between all within-subject conditions.
- Mean hematocrit ($\leq 41.4\%$) and USG (≤ 1.0187) values were similar (all $p > 0.05$) across MC phases and suggested that participants were euhydrated at each study visit.
- Differences in TBW volumes across MC phases were small ($\eta_p^2 = 0.06$) and non-significant ($p = 0.394$).
- ICF volumes were lower ($\eta_p^2 = 0.10$) during the EF phase compared to the LF and ML phases, although these differences were not significant ($p = 0.207$).
- ECF volumes were significantly ($p = 0.007$) higher ($\eta_p^2 = 0.28$) during the EF phase compared to the later phases.

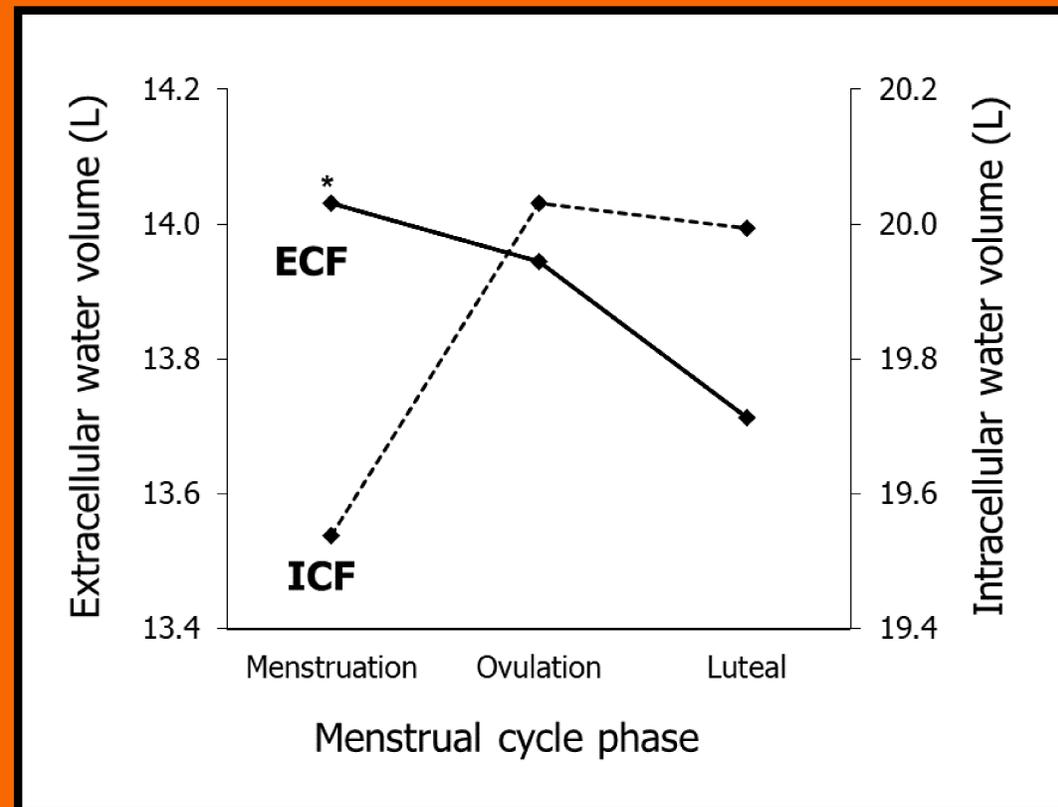
CONCLUSIONS

- Consistent TBW volumes across the three study visits with concomitant changes in ICF and ECF suggest that body water may shift from the intracellular fluid space to the extracellular fluid space during the EF phase.

PRACTICAL APPLICATIONS

- The observed shifts in body water from the intracellular space to the extracellular space during the EF phase of the MC suggest that athletes may be at greater risk of dehydration during menstruation.
- Strength and conditioning professionals and sport coaches who work with female athletes should be particularly cognizant of fluid intake during the early phase of the MC.

Body water shifts from the intracellular space to the extracellular space during menstruation.



Study protocol

Menstrual phase
• Visit with 5 days of period
• Body mass/hydration assessment
• BIS measurement for body water

Ovulation phase
• Visit within 48 hours of positive ovulation test
• Body mass/hydration assessment
• BIS measurement for body water

Luteal phase
• Visit 7-9 days after positive ovulation test
• Body mass/hydration assessment
• BIS measurement for body water

Participant characteristics (n = 16)

Age (y)	22 ± 5
Age of menarche (y)	12 ± 2
Height (cm)	166.6 ± 10.8
Body mass (kg)	66.2 ± 15.0
Body fat (%)	30.3 ± 5.8
Athlete (% yes)	25.0
Race/ethnicity (%)	
White/Caucasian	62.5
Asian/Pacific Islander	18.8
Black/African American	12.5
Mixed/Other	6.3

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