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ABSTRACT

Cognitive Variability Across the Menstrual Cycle: High Estrogen Enhances Learning and Bias Toward Negative Feedback in Healthy Women

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Background: During menstrual cycle, approximately 80% of all women of reproductive age experience physical and psychological changes. Cognitive alterations are among the most common complaints, with women reporting changes in attention and concentration, visuospatial and motor skills, working, verbal and visual memory. Although studies argue in favor of cognitive fluctuation across the different phases of menstrual cycle among healthy women, this has not been experimentally assessed.

Objectives: In this study, we investigate within-subject changes in reinforcement learning from positive and negative feedback across the follicular (low estrogen, low progesterone), ovulatory

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(high estrogen, low progesterone), and luteal (high estrogen, high progesterone) phases of menstrual cycle.

Methods: We recruited and tested twelve healthy women three times during each one of their menstrual phases (with counterbalancing). We evaluated reproductive hormonal levels at each testing session using plasma and saliva samples to confirm the menstrual phase. At each testing session, participants completed a reinforcement learning task that dissociates positive and negative feedback.

Results: Learning from negative feedback was significantly high during both the ovulatory and mid-luteal phases compared to the follicular phase. There was a significant reduction of learning from positive feedback during the ovulatory phase, followed by the mod-luteal phase. There was no significant difference between learning from positive or negative feedback in both the early-follicular phase.

Conclusions: Our preliminary results argue that hormonal changes seen in the menstrual cycle have significant cognitive consequences, especially for learning and bias toward negative feedback under high estrogen levels. Future studies will focus on linking hormonal and cognitive variability with pre-menstrual symptoms.

Keywords: Menstrual cycle, reinforcement learning, estrogen, progesterone, within-subject variability, learning bias.

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