TITLE: Acute Stress Decreases Glutamate Transmission through Endocannabinoid-CB1 Receptors in the Female Rat Dorsomedial Hypothalamus

Stress was once a purely adaptive survival mechanism. But in our modern landscape of high social stress and high-calorie, palatable foods, it contributes to obesity, rates of which continue to rise, with New Brunswick having one of the highest obesity levels in Canada.

Women are particularly vulnerable to disordered eating behaviours when stressed, for which the neurophysiological basis is unclear. Yet, female research subjects remain underrepresented.

In the brain, the dorsomedial hypothalamus (DMH) is important in appetite regulation and neurons in this region express receptors that respond to stress hormones. The DMH is therefore an ideal site to study the effect of stress on appetite. Little is known, however, about how stress affects neuronal communication in the DMH.

Because DMH neurons stimulate appetite, and appetite is generally suppressed during an acute stressor, we hypothesized that acute stress would inhibit DMH neurons. We used whole-cell patch clamp electrophysiology to record from living DMH neurons from young, female Sparge-Dawley rats who experienced a single 30-minute restraint stressor. To determine if stress affects DMH neurons, we measured (1) transmission of the excitatory neurotransmitter, glutamate, onto DMH neurons by measuring current amplitude and (2) action potential (AP) parameters before, to assess initial stress-induced changes, and after high frequency stimulation (HFS), to assess long-lasting changes.

Acute stress decreased evoked current amplitudes, AP amplitude, and AP frequency at glutamate synapses after HFS. Recordings obtained in the presence of an endocannabinoid-CB1 receptor blocker (AM251; 5 µM) showed no change in evoked current amplitudes, AP amplitude, or AP frequency after HFS, suggesting the endocannabinoid systems is required for the change in communication and excitability seen.

Our study demonstrates a neuronal mechanism that links environmental factors to appetite regulation, providing a foundation for further obesity treatments. Future work aims to determine effects of chronic stress on the female DMH.