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Glucose metabolic changes in the prefrontal cortex are associated with HPA axis response to a psychosocial stressor.

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Source

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Abstract

The prefrontal cortex (PFC) has been well known for its role in higher order cognition, affect regulation and social reasoning. Although the precise underpinnings have not been sufficiently described, increasing evidence also supports a prefrontal involvement in the regulation of the hypothalamus-pituitary-adrenal (HPA) axis. Here we investigate the PFC's role in HPA axis regulation during a psychosocial stress exposure in 14 healthy humans. Regional brain metabolism was assessed using positron emission tomography (PET) and injection of fluoro-18-deoxyglucose (FDG). Depending on the exact location within the PFC, increased glucose metabolic rate was associated with lower or higher salivary cortisol concentration in response to a psychosocial stress condition. Metabolic glucose rate in the rostral medial PFC (mPFC) (Brodman area (BA) 9 and BA 10) was negatively associated with stress-induced salivary cortisol increases. Furthermore, metabolic glucose rate in these regions was inversely coupled with changes in glucose metabolic rate in other areas, known to be involved in HPA axis regulation such as the amygdala/hippocampal region. In contrast, metabolic glucose rate in areas more lateral to the mPFC was positively associated with saliva cortisol. Subjective ratings on task stressfulness, task controllability and self-reported dispositional mood states also showed positive and negative associations with the glucose metabolic rate in prefrontal regions. These findings suggest that in humans, the PFC is activated in response to psychosocial stress and distinct prefrontal metabolic glucose patterns are linked to endocrine stress measures as well as subjective ratings on task stressfulness, controllability as well as dispositional mood states.

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