fMRI Analysis of Response to Visual Food Stimuli

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Introduction: Adolescence is an important period for brain development, with high sensitivity to the neurological effects of challenging conditions such as poor sleep or disease. Challenges that impact appetite or perception of food are of particular interest today. A neuroimaging paradigm in healthy adolescents which could capture the neuronal response to various food stimuli would help elucidate how disease or modified states, such as caloric restriction associated with eating disorders, might impact brain function and development.

Hypothesis: We hypothesized that healthy adolescents will display modulation of neuronal response in reward networks, as captured by fMRI, according to the type of food-related visual stimuli presented. In particular, we expect greater response from images of sweets compared to non-sweets.

Methods: Eleven healthy adolescents (7 female, mean age 15.5 ± 1.1 y, mean body mass index 20.3 ± 2.2 m/kg^2) were enrolled as of September 2016. Informed assent was obtained from all participants and consent from a parent or guardian. fMRI series were obtained with TR=2s at 3 Tesla during presentation of different types of food photos. Food categories included sweets, non-sweets, and neutral non-foods. Functional images were processed using SPM12 software under Matlab to model signal change in each image voxel by the time course of stimulus presentation and thereby compare neural activity stimulated by different types of food. Preliminary results report mean response at T-score > 1.5 and cluster size > 32 voxels.

Results: Comparison of sweets vs. non-sweets as visual food stimuli demonstrated clusters of voxels with greater activation during sweet stimuli in bilateral hippocampus, anterior cingulate, left amygdala, left caudate head, orbitofrontal cortex, fusiform gyri, and posterior cingulate. Images of sweets contrasted with neutral images revealed additional activation in the occipital areas.

Conclusions: In conclusion, the food image paradigm which we developed demonstrated increased activation of multiple brain regions known to support reward processing with presentation of reward-provoking (sweet) food images, suggesting that this paradigm will be useful for the study of the neuronal impact of eating disorders and for tracking changes related to treatment.

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