Introduction

The Power of Food Scale (PFS) is a self-administered measure of the drive to consume food in an obesogenic food environment. Here we performed brain network analyses in order to determine whether brain functional connectivity changes as a result of food craving and how this may be moderated by scores on the PFS. Because liquid meal replacements have been shown to satiate short-term hunger, we choose to image participants both with and without Boost® on board following food restriction.

Methods

• 19 older adults (age 64.65 ± 6.84 years), divided by median split of PFS score
• “Low PFS” = 1.89 ± 0.52, n=9; “High PFS” = 3.63 ± 0.61, n=10

On scan days:
• Participants consumed a prepared, calorically controlled (350 or 450 calorie) breakfast, then completed 2.5 hour fast
• Received Boost® on one of the scan days, randomized for supplement/no supplement scan order
• Scanned on 1.5T GE scanner using an 8-channel head coil (GE Med Systems, Milwaukee, WI)
• During scan, exposed to a food cue manipulation followed by a resting session

Network Generation

Time series
Correlation matrix
Threshold
Adjacency matrix
Brain network

Results

Figure 1a. Figure represents connections between nodes in a network, but does not indicate community structure.

Figure 1b. Performing modularity analyses reveals communities, or, nodes that are more interconnected with each other than they are to nodes in other communities.

Figure 2. Neighborhood connectivity maps by PFS category showing consistency of connections between the cerebellum, basal ganglia, visual cortex, and thalamus.

Figure 3. Neighborhood connectivity maps by PFS category showing the consistency of the sensorimotor and premotor cortices.

Figure 4. Second degree connections to sensorimotor cortex. Red circles highlight precuneus, yellow arrows indicate PFC, green arrows show insula.

Conclusions

• In the no Boost® condition, both groups show high interconnectivity between the cerebellum, basal ganglia, and thalamus (figure 2), areas related to craving and motor function. Following Boost®, this relationship remains strong in the high PFS group, but is reorganized in the low PFS group.
• Those with high PFS also show high interconnectivity between the basal ganglia and visual cortex, even following consumption of Boost®, indicating better visualization and, potentially, stronger food seeking behavior.
• The sensorimotor and premotor cortices are highly interconnected regardless of condition (Figure 3). In the low PFS group following Boost®, there is a decrease in the consistency of this neighborhood and reorganization of the network, suggestive of a decrease in the drive to seek food.
• Following Boost® only in the low PFS group, the motor and premotor cortices reestablish connections with the default-mode network (figure 4).
• These data suggest that those with high PFS scores are hypersensitive to food cues that are prominent in obesogenic environments.

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