

BMI Correlates with Brain Activity during the Stroop Task in Individuals with Overweight and Obesity



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Background

- Obesity is associated with:
 - Slower response times (RT) on inhibitory control paradigms, e.g., Stroop task^{1,2}
 - Reduced activity in brain regions important for inhibitory control during those tasks^{3,4}
- There is limited research examining associations between body mass index (BMI) and brain activity *within* an overweight and obese sample
- Aim:** To determine if BMI is related to Stroop task performance and brain activity in individuals with overweight or obesity.

Methods: Participants

- 124 adults with overweight or obesity
- Baseline session of a weight loss intervention

Demographic Information

Age	44.36 ± 8.61
BMI	32.46 ± 3.96
Education	16.36 ± 2.67

Note: BMI in kg/m²; education in years

Methods: fMRI

- Siemens Verio 3T MR scanner, 32-channel coil
- Whole-brain analytical approach
 - Corrected for voxel wise multiple comparisons ($p < .01$)
 - Cluster thresholding at $p < .05$
- Image processing in FSL
 - Pre-processing: BET, high-pass temporal filter, motion correction, registration
 - Blood oxygen level dependent (BOLD) activation patterns
- Contrast of interest: **INC > CON**
- Covariates: Sex

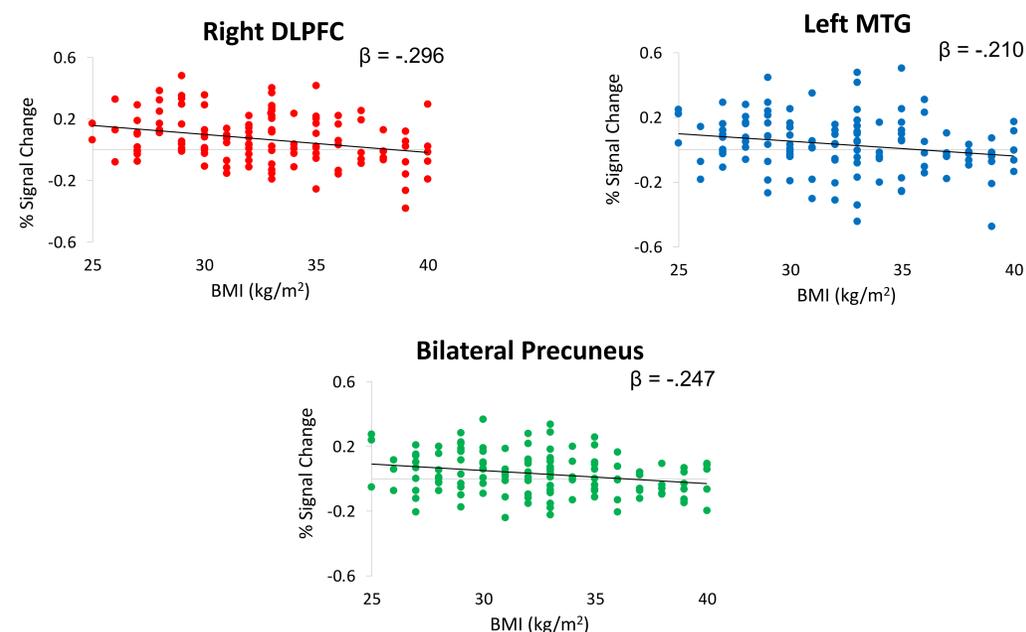
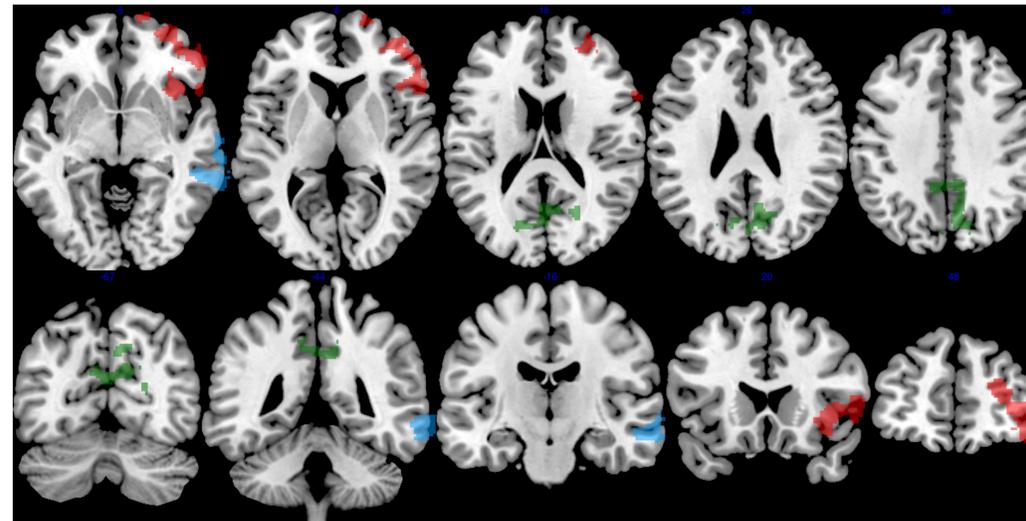
Methods: Stroop Task

- Task to measure inhibitory control
- Completed in a 3T MR scanner
- Congruent, Incongruent, and Neutral conditions.
- 182 total trials, computerized
- Variable of Interest: Stroop Effect (RT) = $\frac{INC - CON}{CON}$

RED
Congruent Condition
GREEN
Incongruent Condition

Results: BMI & Brain Activity

- Higher BMI is associated with reduced differences in BOLD activation in the **right dorsolateral prefrontal cortex (DLPFC)**, **left medial temporal gyrus (MTG)**, and **bilateral precuneus**



Results: BMI, Brain Activity & Task Performance

- Activity in the right DLPFC and bilateral precuneus is associated with behavioral Stroop Effect
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- Right DLPFC** $p = .029$, $\beta = .196$
- Left MTG** $p = .393$, $\beta = .077$
- Bilateral Precuneus** $p = .034$, $\beta = .190$
- BMI is not related to behavioral Stroop Effect, controlled for sex, $\beta = -.102$, $p = .298$

Conclusions

- Reduced differences in BOLD activation between task conditions due to increased activity during the congruent condition
 - Suggesting those with higher BMI expend more neural resources during easier task condition
- Relationship between BOLD activation in identified regions and Stroop effect show that brain activity is likely a mechanism for better performance
- BMI was not directly associated with task performance
- Future studies should investigate pathways at play between BMI and the brain to better understand clinical implications

References

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