Tendency to Ruminate Predicts Higher Alpha Power During Resting State

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Background

- Rumination occurs when an individual experiences difficulty redirecting attention away from a thought (Nolen-Hoeksema et al. 2008)
- High trait rumination (tendency to ruminate) is associated with cognitive inflexibility (Davis et al. 2000)
- Brain oscillations in the alpha band (8-13 Hz) may enable cognitive flexibility to occur (Foxe et al. 2014)
- Alpha power dynamics are altered for individuals high in trait rumination while engaging in rumination (Ferdek et al. 2016)
- Resting state alpha power may index internal versus external engagement of attention (Bowman et al. 2017) and reflect resting state network dynamics (Mantini et al. 2007).
- The current study observed alpha power at rest in relation to trait rumination.

Methods

- Participants (n=43) rested quietly with eyes open for six minutes.
- EEGLAB (Delorme et al. 2004) was used to preprocess and analyze the data.
- EEG data was filtered from 1-100 Hz.
- The data was re-referenced to the average EEG signal.
- Data was epoched into 3000 ms segments.
- Epochs with changes in voltage greater than 75mv were removed from analysis.
- Independent Component Analysis (Bell & Sejnowski, 1995) was used to separate the data into independent components for analysis.
- ADJUST 1.1 (Mognon et al., 2010) was used to mark artifact components, which were then removed from analysis.
- Data was converted back in to sensor space and data from electrodes F7, F5, F3, AF7, and AF3 were used for final analysis for left frontal alpha power.
- Data from electrodes P5, P3, P1, Pz, P2, P4, P6, PO3, POz, and PO4 were used for final analyses for posterior alpha power.
- An average alpha power was calculated for each participant and each region of interest.
- Linear regressions with trait rumination, anxiety, and depression score as predictors of average alpha power at rest were used to determine whether trait rumination predicts higher alpha power at rest.

Regression Output

Left Frontal Alpha	B	SEb	Standardized Beta	Sr²	P
Beck Depression Inventory-II (BDI-II) score	-.053	.219	-.065	.001	.81
Beck Anxiety Inventory (BAI) Score	-.243	.215	-.376	.031	.27
Ruminative Responses Scale-Revised (RRS-R) Score	.300*	.150*	.348*	.097*	.05*
Interaction of RRS-R and BDI-II	.011	.050	.064	.001	.82
Interaction of RRS-R and BAI	-.029	.049	-.209	.008	.56
Interaction of BDI-II and BAI	.026	.023	.423	.031	.26

Posterior Alpha	B	SEb	Standardized Beta	Sr²	P
Beck Depression Inventory-II (BDI-II) score	-.333	.251	-.350	.041	.19
Beck Anxiety Inventory (BAI) Score	-.138	.247	-.184	.007	.58
Ruminative Responses Scale-Revised (RRS-R) Score	.341	.172	.339	.092	.06
Interaction of RRS-R and BDI-II	.013	.057	.061	.001	.82
Interaction of RRS-R and BAI	-.006	.056	-.111	.000	.91
Interaction of BDI-II and BAI	.030	.026	.417	.030	.26

## Descriptive Statistics

| Variables	Mean	SD
Beck Depression Inventory-II (BDI-II) score	5.53	4.31
Beck Anxiety Inventory (BAI) Score	5.51	5.43
Ruminative Responses Scale-Revised (RRS-R) Score	20.09	4.06
% Power Change From Baseline for Left Frontal Alpha	56.44	3.50
% Power Change From Baseline for Posterior Alpha	59.50	4.09

References

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Results
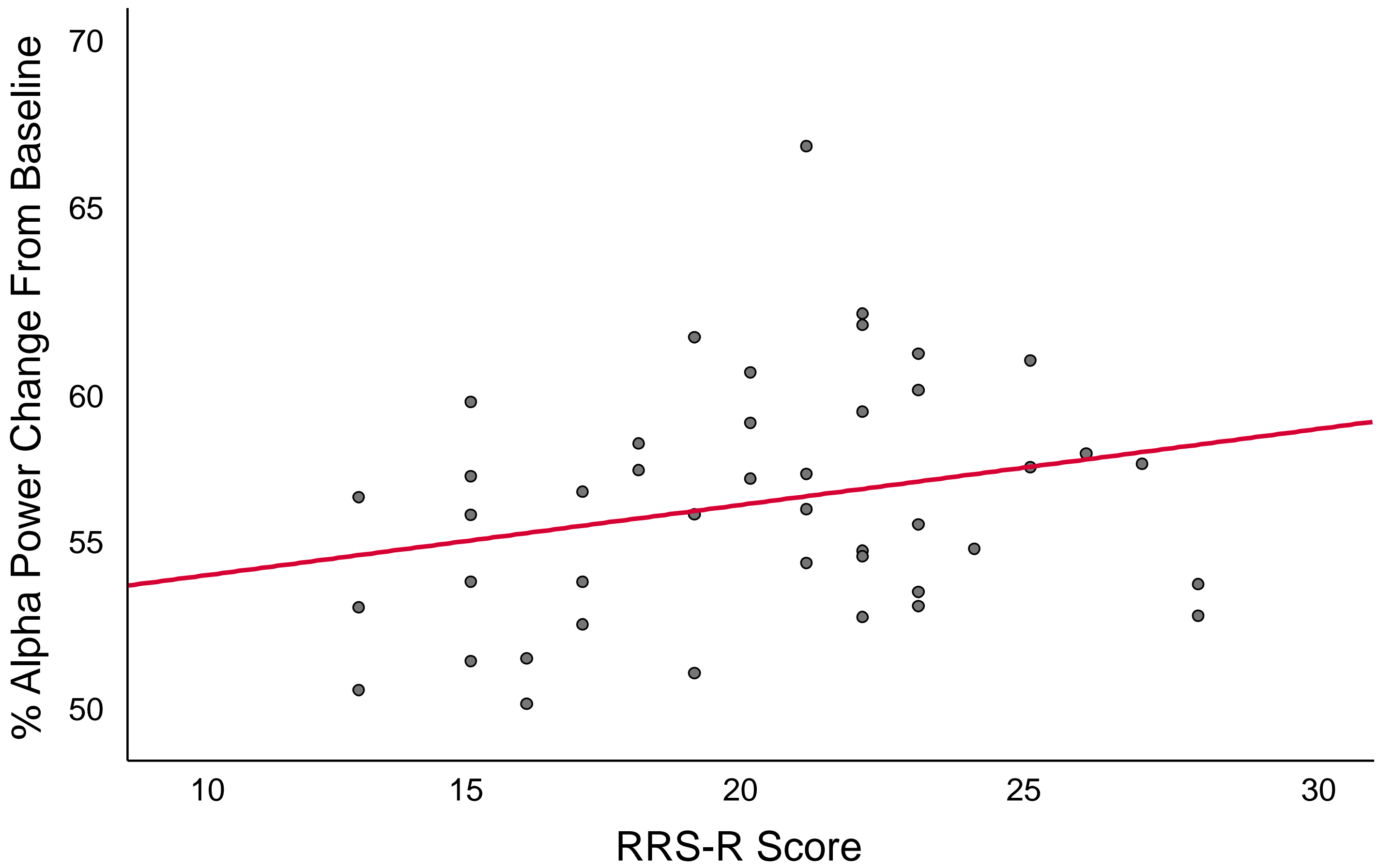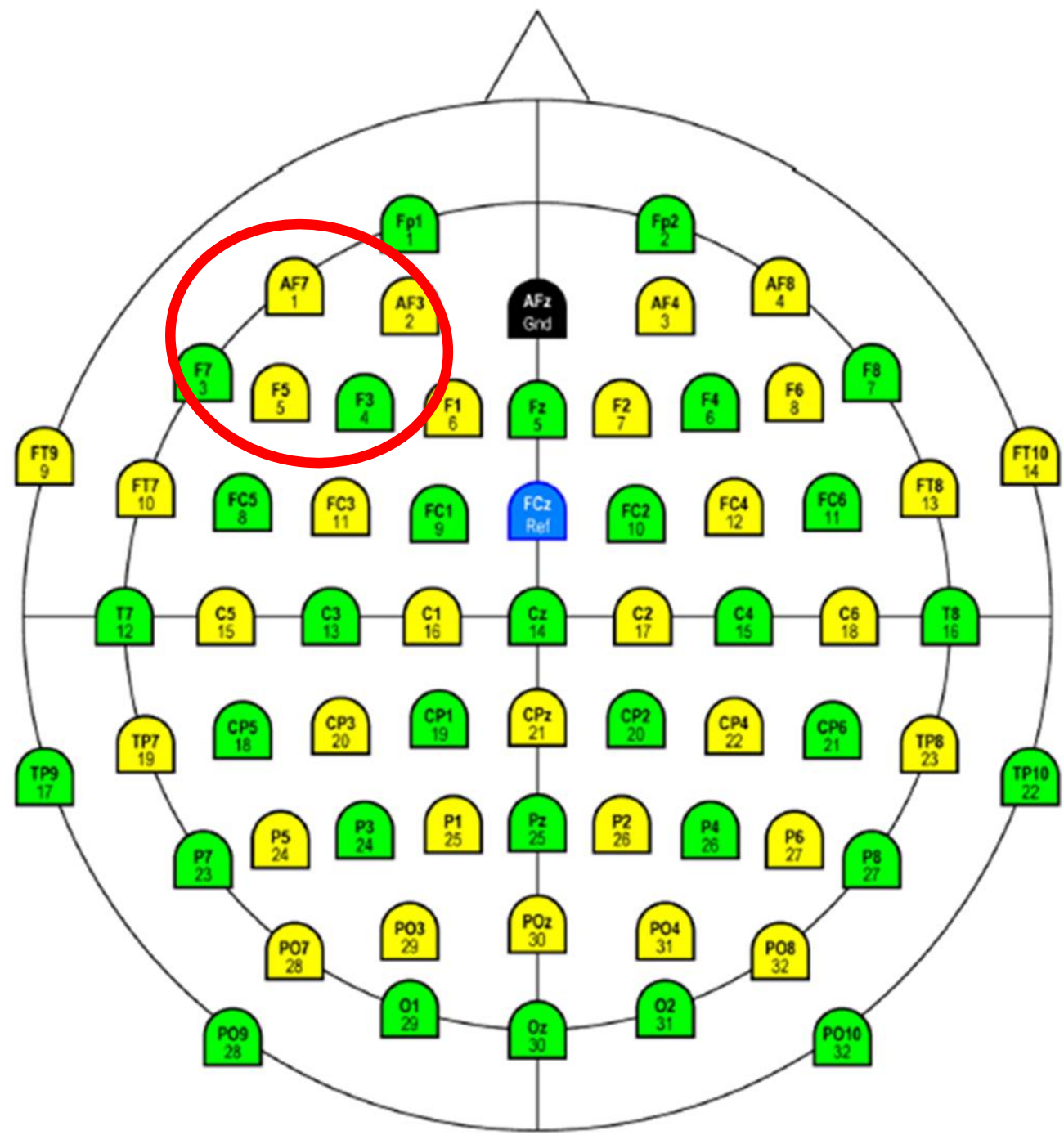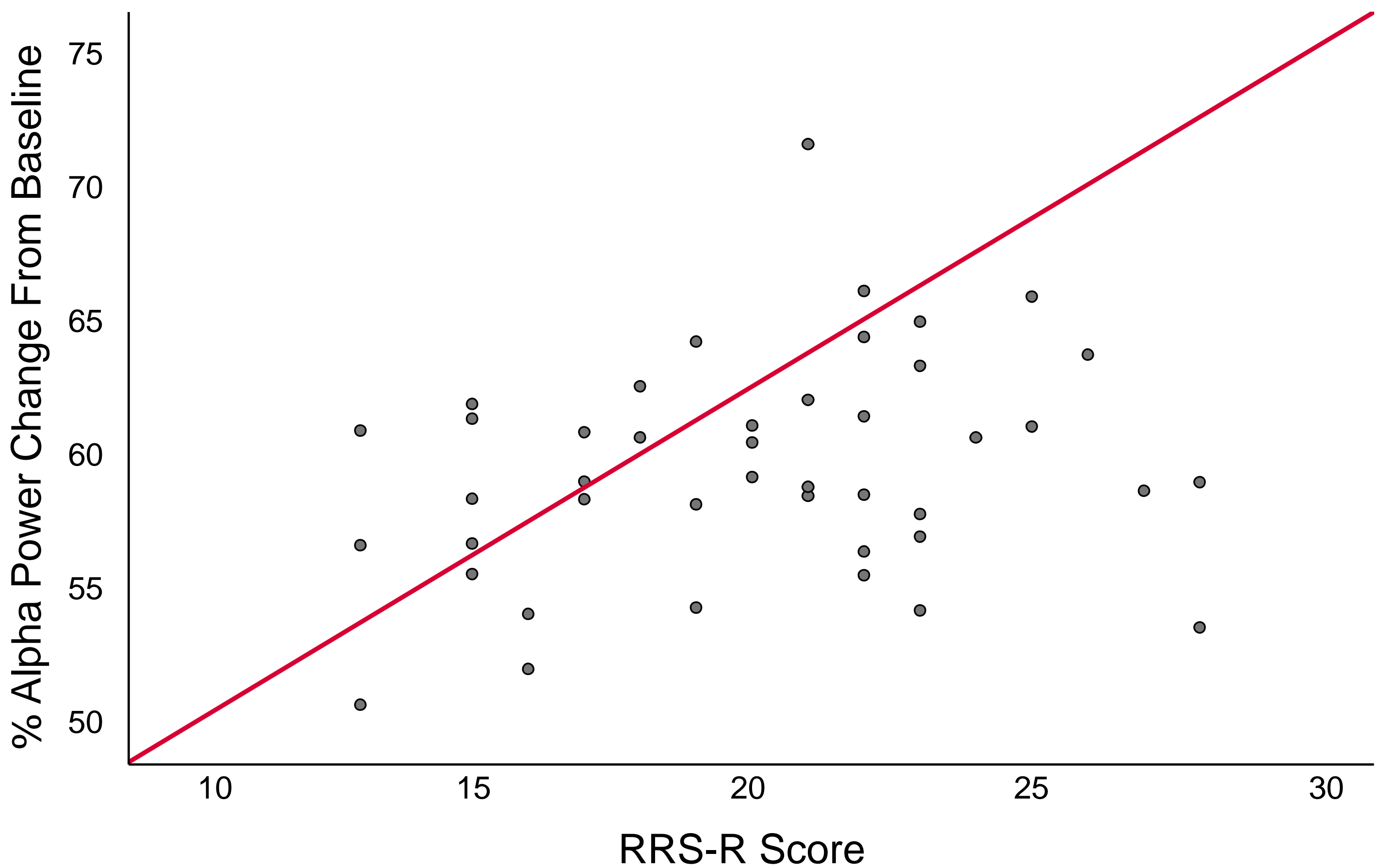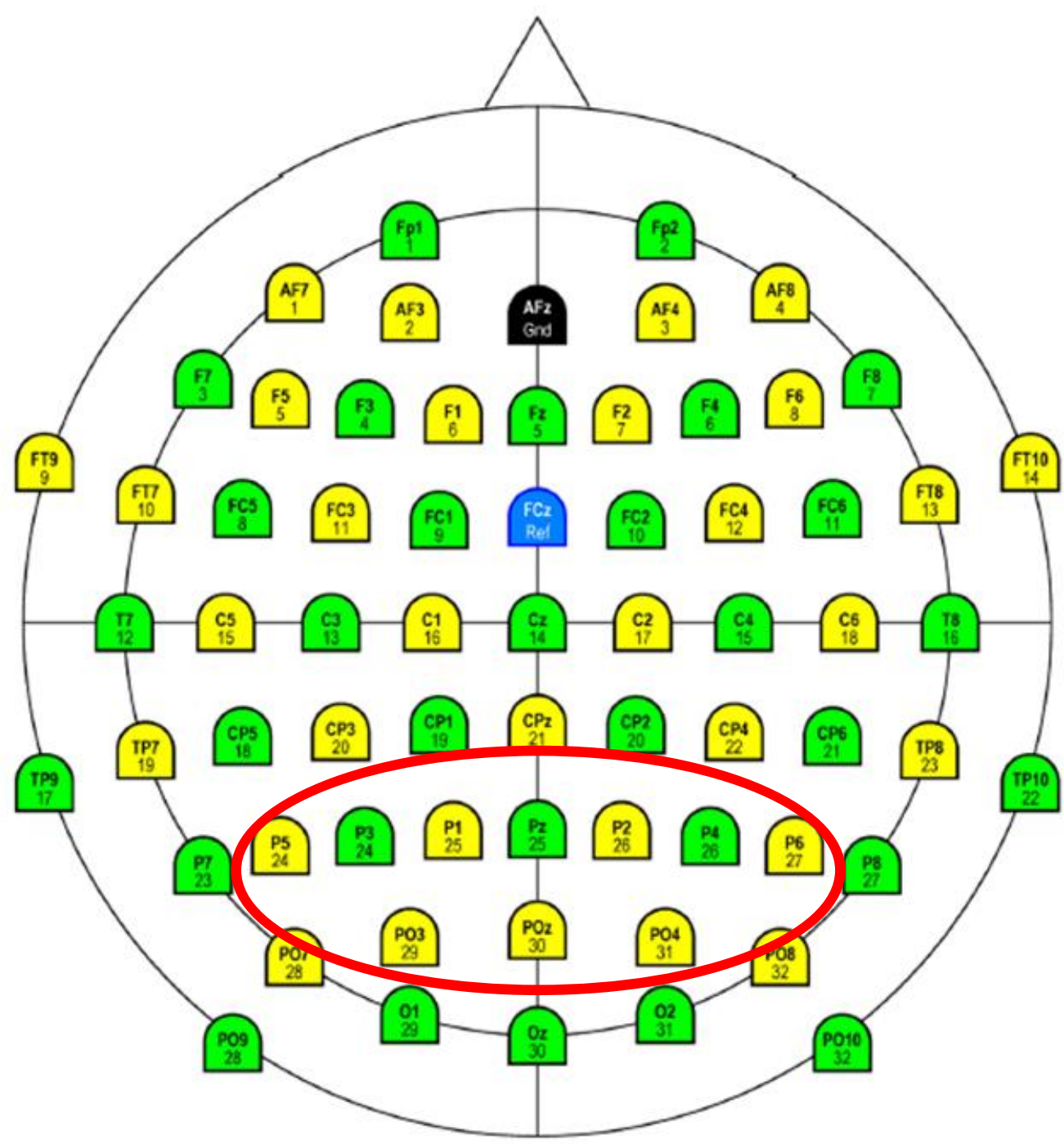
A) Left frontal alpha power increases as trait rumination increases during resting state while controlling for state anxiety and depression.

B) Posterior alpha power increases as trait rumination increases during resting state while controlling for state anxiety and depression.

Conclusions

- Higher trait rumination is associated with higher alpha power at rest in left frontal and posterior parietal regions.
- Higher alpha power in left frontal regions for individuals high in trait rumination may reflect an engagement in state rumination during resting state (Ferdek et al. 2016).
- Left frontal and posterior parietal regions include areas associated with the default mode network. Higher alpha power in these regions is associated with greater recruitment of the default mode network (Mantini et al., 2007) and a more internal focus of attention (Bowman et al. 2017).
- Individuals higher in trait rumination may be utilizing the default mode network more so than individuals low in trait rumination. This may have implications for task performance that is sensitive to switching between different modes of thinking (such as those that require cognitive flexibility).