ABSTRACT

Brain-derived neurotrophic factor (BDNF) is a protein that plays a role in growth, regulation, and plasticity of the nervous system. A single-nucleotide polymorphism (SNP) results in several isoforms of BDNF – Val/Val, Val/Met, and Met/Met. The valine wild-type allele is linked to positive health effects, such as increased heart-rate variability (HRV) and synapase maintenance, while the methionine polymorphism is associated with health and cognitive risks, including Alzheimer’s disease (AD). HRV has also been linked to AD. However, the mechanisms are not well understood.

In order to assess the impact of BDNF on HRV during stress, we hypothesized that methionine carriers would exhibit a poorer overall autonomic function or poorer task engagement by was exhibited by Val/Met carriers with cognitive stress. These findings were then correlated with the HRV data for interpretation using SPSS statistical software.

RESULTS

Figure 2. Histogram of the various isoforms of the BDNF gene. The fluorescent signals, VIC and VIC-AAC (determined the isoforms present: Met/Met (blue), Val/Met (green) and Val/Val (red)). The Val Allele, Amplicon plot of the samples (insert).

Table 1. Frequency of the BDNF isoforms in this study.

<table>
<thead>
<tr>
<th>BDNF Isoform</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Val/Val</td>
<td>44.1%</td>
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<tr>
<td>Val/Met</td>
<td>25.1%</td>
</tr>
<tr>
<td>Met/Met</td>
<td>30.8%</td>
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Figure 3. A normal representative HRV data set collected by the Nielsen lab.

Figure 4. Changes in HRV over time by BDNF Allele. The Val/Val allele is in purple and the Val/Met allele is in blue. Val/Met carriers of the BDNF Allele had a larger decrease in HRV when under cognitive stress. Val/Val Carriers had a less severe decrease in HRV under cognitive stress.

Figure 5A and 5B: Decrease in HRV between baseline and cognitive stress.

CONCLUSIONS

In order to assess the impact of BDNF on HRV during stress, a 2 (BDNF genotype: Val/Val or Val/Met) x 2 (time: baseline or cognitive stress) mixed factors ANOVA was conducted. This ANOVA revealed a significant main effect of time F(1,22) = 7.21, p < .05, n2 = .25, indicating that over time a decrease in HRV occurred irrespective of BDNF isoform group.

Post hoc paired-sample T-tests revealed statistically significant stress-induced decreases in HRV for carriers of the Val/Val allele. Importantly, decreased HRV measures during cognitive and psychosocial stressors have been repeatedly observed in otherwise healthy young adult samples (3).

The absence of an HRV response for Val/Met carriers of BDNF is interesting. The Met SNP’s linkage to symptoms of Alzheimer’s Disease and decreased BDNF production was expected to lead to a faster and more significant HRV decrease during times of cognitive stress.

Because this Val/Met SNP has been associated with cognitive impairment (4), it is possible that a lack of HRV response in Val/Met carriers could reflect a decreased ability to fully engage in the cognitive stress task.

To assess this explanation, we are currently examining baseline neuropsychological functioning and physiological measures of arousal (e.g., skin conductance) during the stressor.

REFERENCES