Do Cortisol Levels Affect Performance on SDMT in People With MS?

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Introduction

According to the Multiple Sclerosis Association of America, there are nearly one million people in the United States who are currently diagnosed with Multiple Sclerosis (MS). MS is a chronic autoimmune disease of the central nervous system that is most prevalent in females with the average age of onset between the ages of 25 and 35 years old (Yamout, 2018). Demyelination and subsequent degeneration of neurons caused by this immune dysfunction results in many debilitating symptoms, especially cognitive impairment. Previous studies have shown that cognitive processing speeds and memory are the most affected aspects of cognition affected in those with MS (Benedict, 2020).

Cortisol is a stress hormone that is a product of the hypothalamus—pituitary—adrenal axis (HPA axis). Studies have shown an association between dysfunction in the stress response and severity of MS symptoms (Pereira, 2019). In patients with MS, cortisol levels are elevated and indicate HPA axis dysfunction (Pereira, 2019). Higher levels of cortisol and HPA axis dysfunction lead to progression of MS symptoms and affect cognitive functioning (Pereira, 2019). Cortisol levels can be collected via hair sample and gives a representation of general stress levels for the previous 3 months.

The Symbol Digit Modalities Test (SDMT) is a commonly used to assesses psychomotor functioning and mental processing speed in people with MS. This test allows patients to reference a key where a symbol and number are paired. Accurate substitution of the number for the symbol shown on the page is timed and analyzed.

The aim of this study was to determine whether higher cortisol levels in people with MS is associated with worse performance on the SDMT.

SDMT
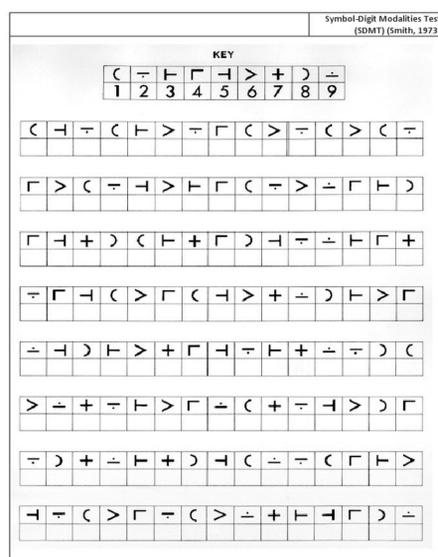
Methods

- A total of 58 patients with a MS diagnosis were enrolled in the study:
- 34 patients were designated as impaired (SDMT t-score < 41)
  - 29 female and 5 male participants
  - 13 white and 21 black participants
- 24 patients were designated as un-impaired (SDMT t-score≥ 41)
  - 20 female and 4 male participants
  - 16 white and 8 black participants
- Hair samples were taken from all 58 patients and cortisol levels measured
- ANOVA analysis for group comparison
- Pearson correlation of cortisol level and SDMT t-score via SPSS v26

ANOVA

ANOVA Analysis of Impaired vs Unimpaired

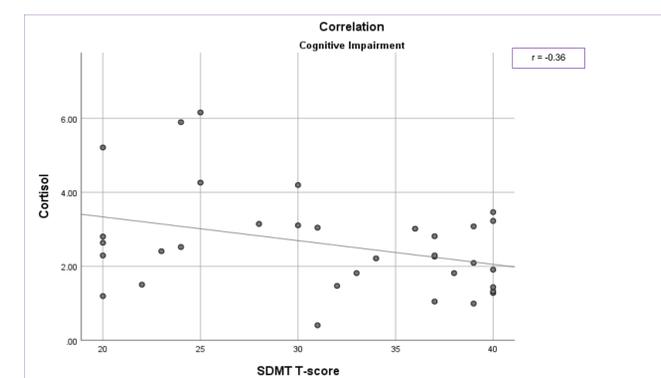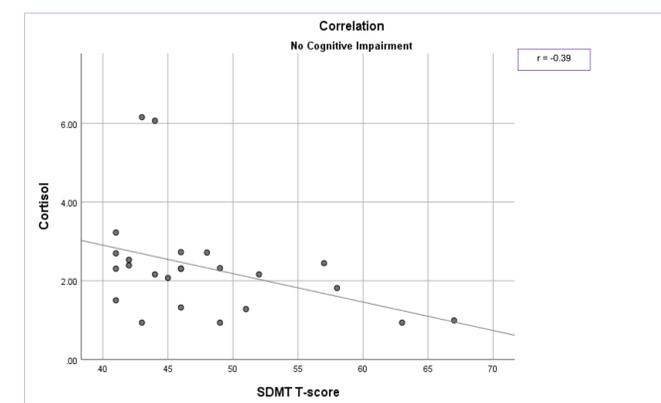|	Impaired	Unimpaired	F	p
Age (yr)	43.21 +/- 12.72	50.83 +/- 12.96	4.98	0.03
Education (yr)	13.55 +/- 2.24	15.88 +/- 2.71	12.61	0.01
Disease Duration (mo)	141.62 +/- 121.24	130.33 +/- 120.86	0.12	0.73
Cortisol	2.60 +/- 1.34	2.35 +/- 1.33	0.49	0.48

ANOVA analysis showed that the groups differed by age (f= 4.98 p=0.03) and education (f=12.61 p=0.01). The groups did not differ by disease duration or cortisol levels.

Results

SDMT T-Score– Cortisol Correlation

	Pearson Correlation	Significance
Impaired	-0.36	0.04
Unimpaired	-0.39	0.06

Correlations

Impaired group: r=-0.36 p=0.04
Unimpaired group: r=-0.39 p=0.06

Conclusion

The results show there is a negative correlation between cortisol levels and performance on the SDMT meaning as cortisol levels increase, performance on the SDMT decreases. The correlation between hair cortisol and SDMT performance in the non-impaired group was not statistically significant, but the r -0.39 is larger than the effect size in the impaired group. The non-significant result is likely the result of not having a large enough sample size in the unimpaired group. There appears to be a similar relationship between cortisol levels and SDMT performance regardless of whether the participants are performing in the average range or below.

References

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Pereira GM, Becker J, Soares NM, de Azeredo LA, Grassi-Oliveira R, Rysdyk A, de Almeida RMM. Hair cortisol concentration, cognitive, behavioral, and motor impairment in multiple sclerosis. J Neural Transm (Vienna). 2019 Sep;126(9):1145-1154. doi: 10.1007/s00702-019-02040-w. Epub 2019 Jun 27. PMID: 31250284.

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