High Levels of Cortisol in Hair and Demyelination in African American Women with Multiple Sclerosis

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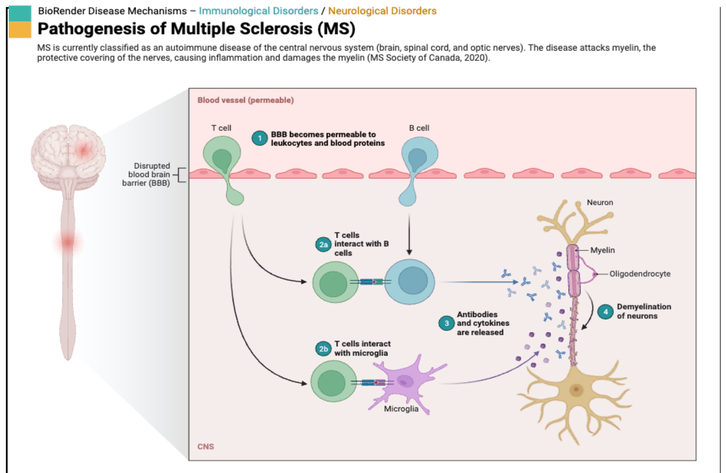
Introduction



- According to the National Multiple Sclerosis Society, nearly one million people have Multiple sclerosis in the United States (Nelson et al, 2019). Multiple sclerosis is a neurodegenerative disorder characterized by the breaking down of myelin cells (Ward & Goldman 2022) .This may result in both lesions and atrophy that can occur in the nervous system.

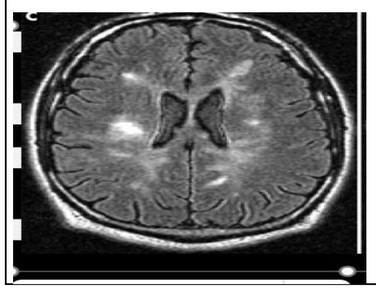
- Stress may impact cognitive decline in patients with Multiple Sclerosis. The adrenal glands release the hormone cortisol. Cortisol regulates glucose, decreases inflammation, controls sleep, and regulates blood pressure (Levine et al, 2007). Though a part of the Hypothalamic Pituitary Axis HPA-Axis system, cortisol is released to dampen the stress response, and occurs after the body's autonomic nervous system comes online (e.g. adrenaline, the fight or flight hormones), in response to stress.

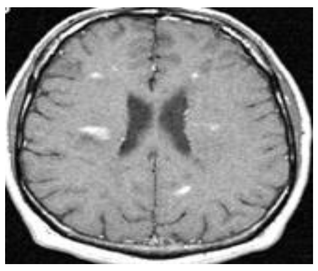
- MS Trust and the Multiple Sclerosis Association specify that African American women are diagnosed with the disease more than any other group (Nelson et al., 2019). According to MS Trust "Studies have also shown that Black people and people from ethnic minorities with Multiple sclerosis often reach disability levels sooner and may have a different disease course to White people with MS in the same country" (Kister et al. 2010). Data from the Multiple Sclerosis Association verify that Multiple sclerosis was highest for African American women (Multiple Sclerosis Association of America 2015)

- African American women are exposed to psychological, social, and biological stress and this consistent exposure to structural stressors may contribute to increases in neurodegeneration of African American women with Multiple sclerosis.

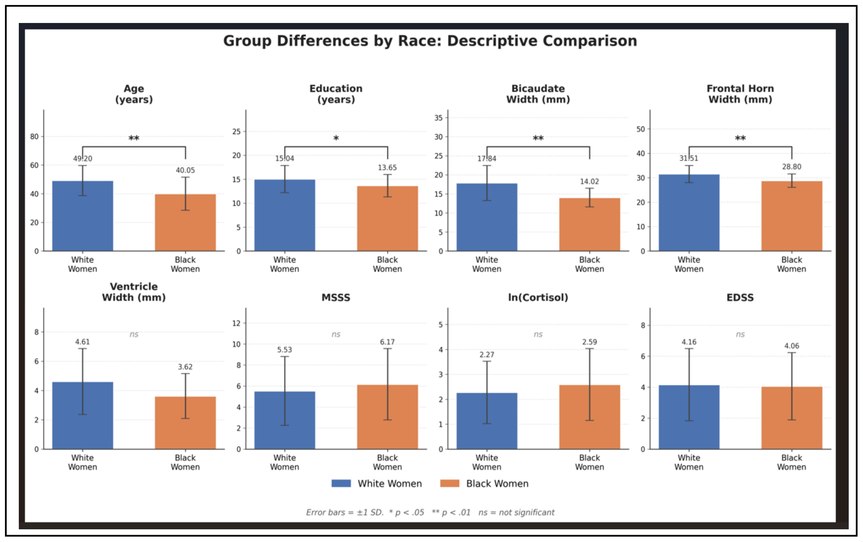
- This research investigates the correlation between cumulative cortisol in the hair and demyelination in the brain. This research investigates the association between hair cumulative cortisol (HCC) and measures atrophy in the brain in BW and WW women with MS to address how stress may impact brain atrophy differently in these groups.

Frontal Horn and Bicaudate





Group Differences by Race



Descriptive Statistics

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	Age	Education	BW	VW	Horn	MSSS	Incort	MSInYears	EDSS
Valid	86	85	61	61	61	82	49	86	83
Missing	1	2	26	26	26	5	38	1	4
Mean	44.84	14.39	16.40	4.23	30.49	5.83	2.44	9.83	4.11
Std. Deviation	11.90	2.69	4.34	2.05	3.50	3.33	1.35	8.86	2.24
Minimum	19.00	10.00	7.87	1.68	22.65	0.09	0.41	0.42	0.00
Maximum	71.00	20.00	30.77	12.67	39.39	9.97	6.16	38.83	8.00

Linear Regression

Linear Regression

Model Summary - Horn

Model	R	R^2	Adjusted R^2	RMSE
M_0	0.00	0.00	0.00	3.78
M_1	0.61	0.37	0.24	3.28

Note. M_1 includes Age, Education, MSSS, Incort, Black

Results

- There was a positive relationship between and front horn width $r(31) = .45$, $p < .01$, 95% CI [.12, .69]. Independent samples *t*-tests showed a significant difference between BW and WW in frontal horn width, $t(59) = 3.14$, $p < .01$ (BW $M = 28.80$, $SD = 2.77$; WW $M = 31.51$, $SD = 3.53$), and bicaudate width, $t(59) = 3.65$, $p < .01$ (BW $M = 14.02$, $SD = 2.45$; WW $M = 17.84$, $SD = 4.62$).

- BW also differed significantly from WW in age, $t(84) = 3.84$, $p < .01$ (BW $M = 40.05$, $SD = 11.55$; WW $M = 49.20$, $SD = 10.55$), and years of education, $t(83) = 2.46$, $p = .02$ (BW $M = 13.65$, $SD = 2.34$; WW $M = 15.04$, $SD = 2.84$).

- Linear regression showed that the overall model predicting frontal horn width from age, education, MSSS, cortisol, and race was significant, $R = .61$, $R^2 = .37$, adjusted $R^2 = .24$, $F(5, 25) = 2.95$, $p = .03$. HCC was significantly associated frontal horn width, $B = 1.35$, $SE = 0.45$, $\beta = .49$, $t = 3.00$, $p < .01$, such that higher HCC was associated with greater frontal horn width. Race was also significantly associated frontal horn width, $B = -3.16$, $SE = 1.48$, $t = -2.13$, $p = .04$, such that BW had smaller frontal horn width than WW even after controlling for age, education, MSSS, HCC.

Conclusion

This research was driven by an exploration of the relationship between elevated cortisol levels and atrophy associated with Multiple Sclerosis (MS). Evidence indicates that African American women experience a higher diagnosis rate of this disease compared to other demographic groups. This leads to the inquiry of whether structural stressors resulting in increased cortisol levels unique to African American women may influence both their diagnosis and the extent of atrophy caused by the disease. Elevated cortisol, a hormone linked to chronic stress, is known to play a role in the atrophy in the brains of individuals with MS. To investigate this, MRI scans were utilized to measure the frontal horn width, bicaudate width, and ventricle width in assessing atrophy. Additionally, hair samples collected from the parietal region of the scalp were analyzed to quantify cortisol levels. The findings revealed a direct correlation between HCC and brain atrophy as measured by the front horn and bicaudate width. While BW had less atrophy, across all women higher level of HCC were associated with more brain atrophy in the frontal horn. This showed that race, and HCC play meaningful roles in brain atrophy for our sample.

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