



The Effect of Depression on The Autonomic Nervous System Activity

Background

Major depressive disorder is when a sad mood prolongs for a long period of time and interferes with everyday activities (CDC 2022). Symptoms of clinical depression can include loss of interest in activities/hobbies, weight loss or weight gain, insomnia or hypersomnia, decreased concentration, and low energy. Heart rate variability is the time between the slight fluctuations of the heartbeat. (Shaffer, Ginsberg 2017) The autonomic nervous system controls the variation between the fluctuations. The two main divisions of the autonomic nervous system includes the sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system has a role in stressful situation response. The parasympathetic nervous system has a role in the body's response at times of rest (McCorry 2007). Normal regulation of the heart is through the parasympathetic nervous system, but we tend to see elevated sympathetic nervous system activity with depression and chronic stress. Depression overall has been associated with abnormal regulation in the autonomic nervous system. Previous studies have shown that HRV is reduced with chronic exposure to stress and depression (Sarlou et al. 2021). Individuals with depression have been shown to have lower HRV levels which can predispose them to severe cardiovascular diseases. The objective of the study is to determine the effect of depression on the balance of the autonomic nervous system using heart rate variability. The hypothesis is that depressed individuals will have lower heart rate variability and higher sympathetic nervous system activity.

Materials and Methods

Participants

24 individuals participated of which 2 were excluded because of a previous health condition and an abnormal EKG recording. 22 participants were included in this study of which 3 were males and 19 females. All the participants were students/faculty/staff at Georgian Court University. The average age of the participants is 24. Of the 22 participants 3 were African American, 10 were White/Caucasian, 2 were Asian/Pacific Islander, and 7 were Hispanic.

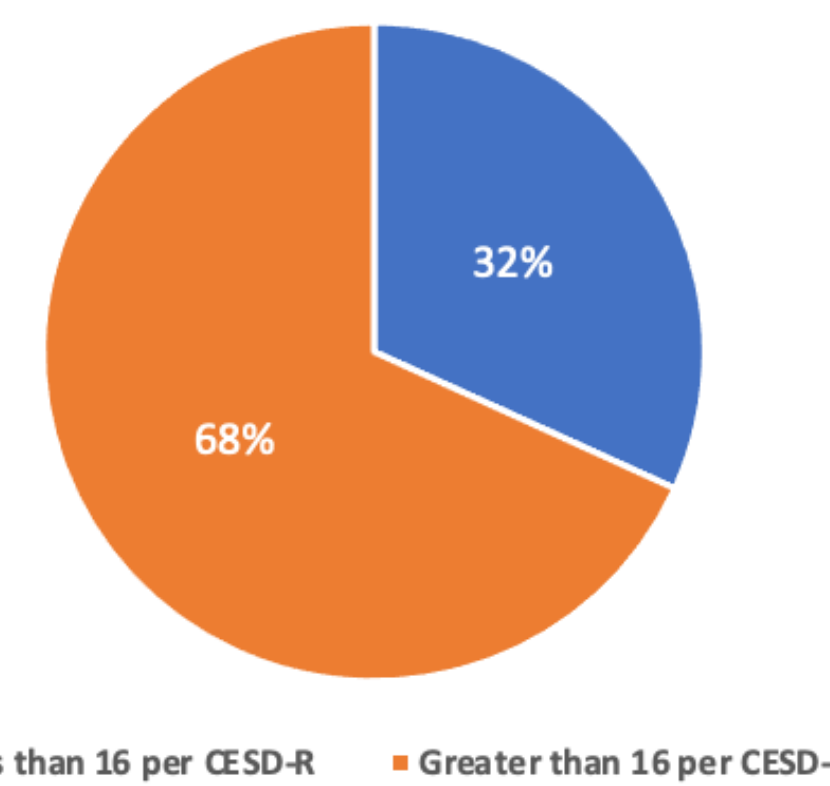
Study Design

The study consisted of three phases: completion of questionnaires, biometric assessment and HRV measurement using 10 minutes of continuous ECG. Participants completed a general assessment questionnaire which also had the International Physical Activity Questionnaire (IPAQ), Hamilton Anxiety Rating Scale (HAM-A), and the Center for Epidemiologic Studies Depression Scale (CESD-R). The CESD-R is a standardized test that screens for depressive symptoms and major depressive disorder. There are 20 questions in the questionnaire with a scoring that ranges from 0 to 60. A score of 16 or higher indicates a depressed state. HRV data was obtained using the BIOPAC equipment and acquisition software after 10 minutes of continuous EKG. Microsoft excel software was used for statistical analysis.

Results

The study included a total of 22 participants of which 68% had a CESD-R score of 16 or greater and 32% had a CESD-R score of less than 16. The average CESD-R score for those who met criteria for depression was 24, while the average for those who did not meet criteria was 10.

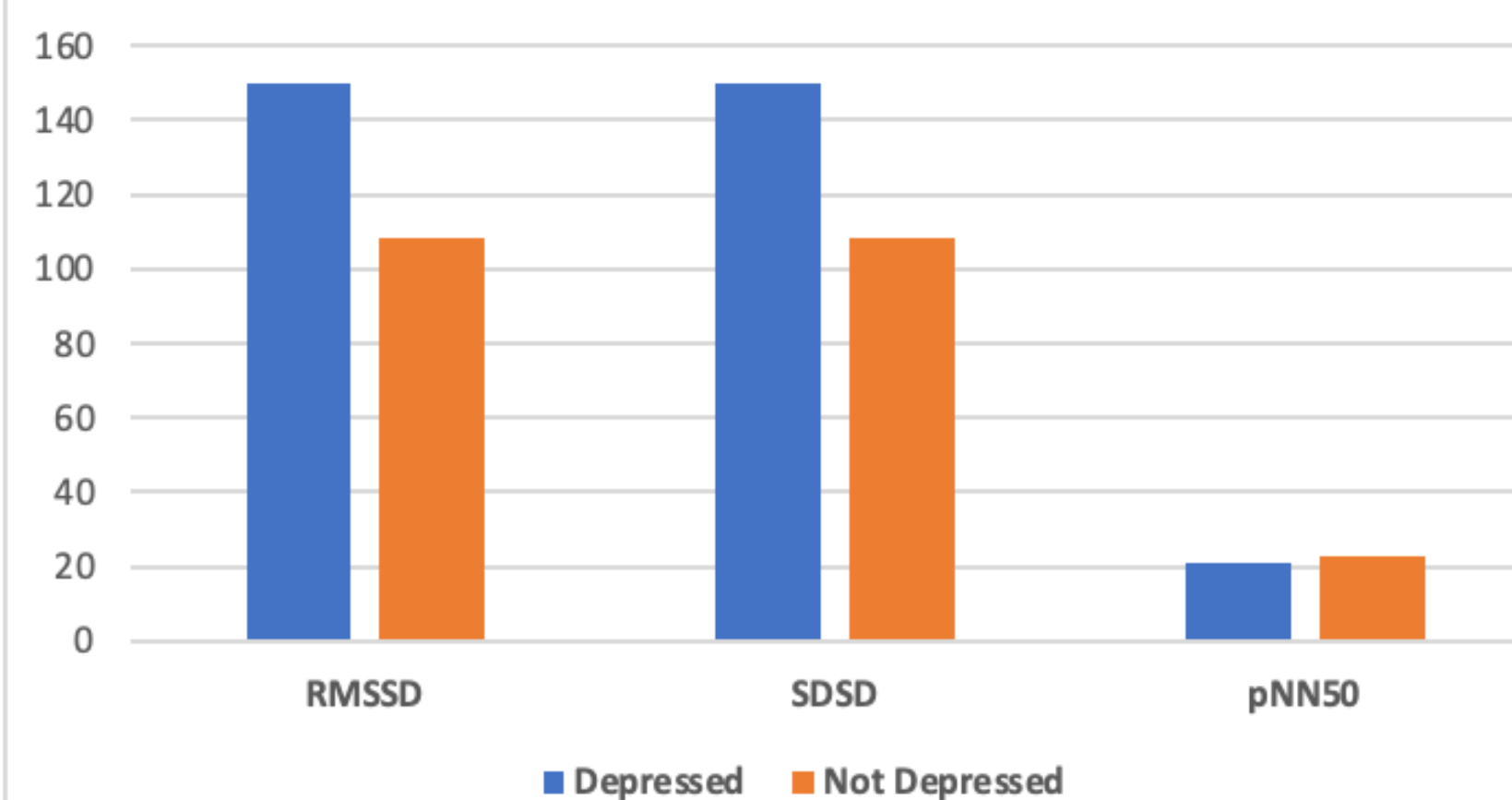
Depression Criteria based on CESD-R



The Effect of Depression on HRV

The average RMSSD and SDSD for the non-depressed group is 108.43, while that of the depressed group was 149.97 (p=0.729). The average pNN50 for the non-depressed group is 23.06, while that of the depressed group is 20.81 (p=0.793).

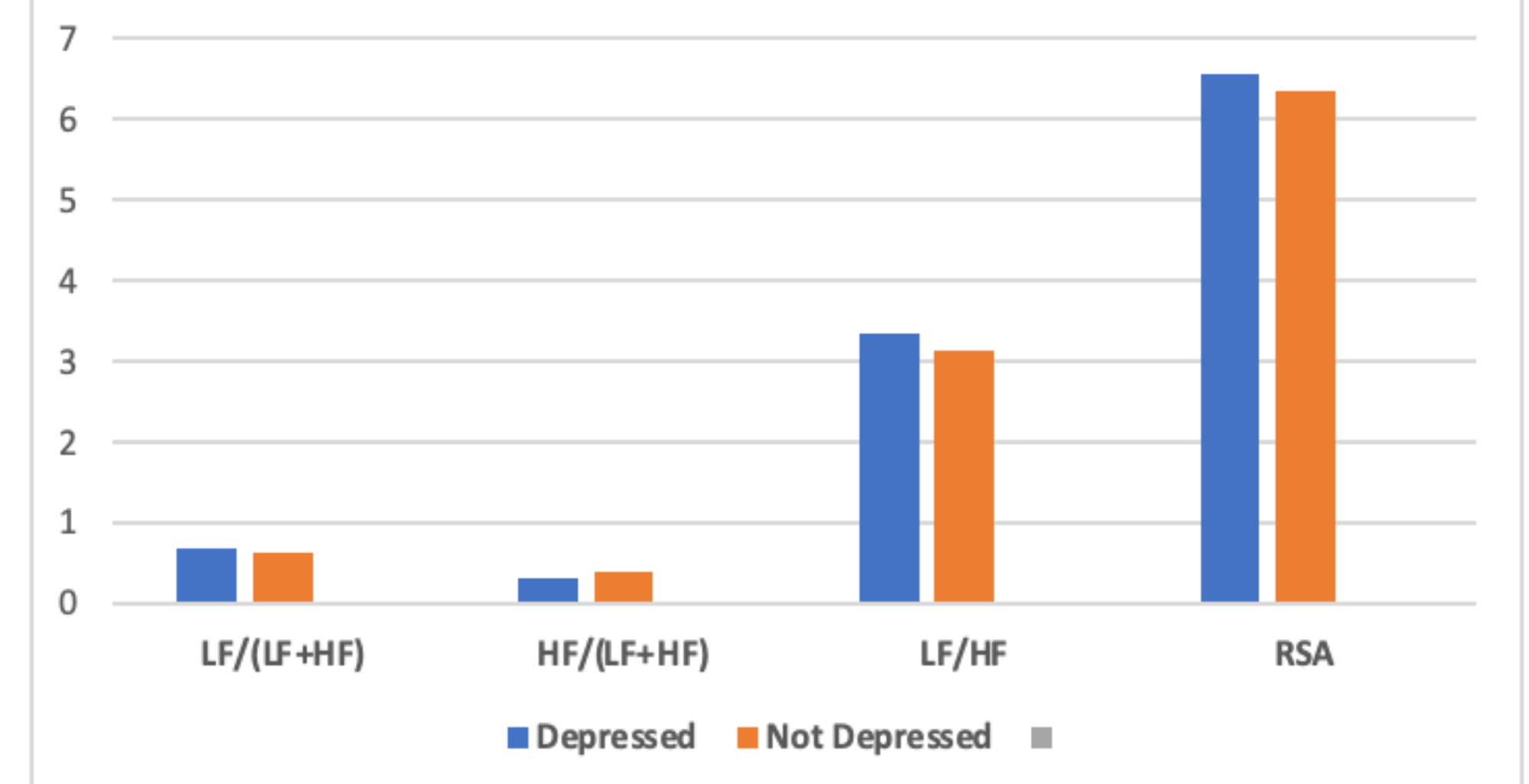
Effect of Depression on HRV



The average of the very low frequency power for the non-depressed group is 1107.45, while that of the depressed group is 1783.70 (p=0.389). The average of the low frequency power is 1592.82 for the non-depressed group, while that of the depressed group is 4339.22 (p=0.243).

The average HF frequency power is 1113.08 for the non-depressed group, and 4261.148 for the depressed group (p=0.321). The average very high frequency power for the non-depressed group is 264.64, while that of the depressed group is 2719.104 (p=0.353). The average of the respiratory sinus arrhythmia (RSA) was 6.34 for the non-depressed group and 6.55 for the depressed group (p=0.77). The average LF/(LF+HF) is 0.62 for the non-depressed group and 0.67 for the depressed group (p=0.513). The average HF/(LF+HF) is 0.39 for the non-depressed group and 0.33 for the depressed group (p=0.513). The average LF/HF for the non-depressed group is 3.14, while it is 3.35 for the depressed group (p=0.916). The average RSA is 6.34 for the non-depressed group and 6.56 for the depressed group (p=0.77).

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Discussion

The objective of the study is to determine the effect of depression on the balance of the autonomic nervous system using heart rate variability. The percentage of participants that met criteria for depression was 68%, while 32% did not meet depression criteria. A recent study has shown that 1 in 3 college students have experienced anxiety and depression (Druckenmiller 2022). The RMSSD and SDSD averages are higher in the depressed group compared to the non-depressed group. This was not expected and although the values are not significant, this could be due to the small sample size. The pNN50 averages are higher in the non-depressed group than the depressed group which is expected based on previous studies. The frequency measurements showed increased parasympathetic activity in the non-depressed individuals and increased sympathetic activity in the depressed counterparts albeit not statistically significant. The LF/(LF+HF) average is higher in the depressed group. The HF/(LF+HF) is lower in the depressed group. The LF/HF is higher in the depressed group. The sympathetic nervous system activity increases with chronic stress so elevated levels are expected to be observed in depressed individuals. Colleges and universities should implement programs to identify and decrease the level of depression rate amongst college students. A study with a larger sample size is recommended to increase the power of the study.

References

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