Multi-Domain Short Term Heart Rate Variability Analysis to Detect Single Night Sleep Deprivation on Drivers

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Introduction: Sleep deprivation is associated with road accidents.

Autonomic nervous system (ANS) activity presents alterations during stress, extreme fatigue and drowsiness episodes. The ANS activity can be estimated non invasively from the heart rate variability (HRV) signal calculated from the ECG.

The aim of this work is to find useful parameters to detect sleep deprivation on drivers. These parameters can be obtained from several multi-domain representation of the HRV, such as the Poincaré graph.

Materials and Methods: we utilized two groups of non professional healthy drivers aging from 21 to 25 years old. The subjects were experimentally divided in two groups: non-deprived (ND, sleep >= 4 hours) (N=10) and deprived (D, sleep < 4 hours) (N=13). The ECG signal was obtained on rest for five minutes by a D1-lead holter The ECG signal was preprocessed and the RR interval series calculated. The RR series was analyzed time-domain, through statistic calculation, frequency-domain, the power spectral density (PSD) was obtained through Lomb periodogram, and nonlinear parameters through Poincaré plot. To analyze possible differences of the HRV parameters between the groups of drivers Mann-Whitney was used and a p value of < 0.05 was considered as significant.

Results: Both the parameters of the time-domain and those of the frequency-domain resulted with non-significant p values. The nonlinear analysis, the parameter **SD12**, ratio of SD1/SD2, of Poincaré plot, resulted with a p value of 0.0438.

Conclusion: This work show that only the nonlinear analysis of short-term HRV, allowed the detection of a single night deprivation through **SD12**, a parameter of the Poincaré graph.

In future works it will be analyzed HRV of ultra short term RR series, equal or less than one minute of duration in both groups, through multi-domain analysis to find new parameters capable of detection sleep deprivation on drivers.