

Effects of abuse of bhang on autonomic nervous system and cardiac electrophysiology: a study of Indian farmers

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Cannabis sativa products are widely abused across the globe, just next to the abuse of alcohol because of their exultant impact. In India, the abuse of cannabis products is very much prevalent. This can be attributed to the fact that the price of making of the cannabis products is very low. The plant is cultivated comfortably in the Indian environment. Also, the cannabis products have been reported to be associated with a very low level of toxicity. Although the Government of India (GoI) has imposed restrictions on the abuse of the cannabis products, their abuse is widespread among the ordinary people. However, the restrictions imposed on the abuse of bhang (a product made from the leaves of cannabis plant) are not much strong. The people following Hindu religion also abuse bhang because of their religious perception. Bhang is employed by them to make drinks in some carnivals. Recently, several studies have reported that the abuse of cannabis products may lead to many cardiovascular as well as non-cardiovascular diseases and even death. An in-depth literature survey on the effect of cannabis products on human health suggested that only few studies have been performed to divulge information about the effect of cannabis products on physiology of the heart and the ANS. In the last few decades, the analysis of electrocardiogram (ECG) signal has received a special attention of the researchers. This is because it provides information about the cardiac electrophysiology. Heart rate variability (HRV) analysis provides a non-invasive method to analyze the physiology of the ANS. Taking a note of the afore-mentioned facts, a study was performed on Indian paddy field workers (volunteers) to understand the effect of bhang abuse on ANS and cardiac activity by acquiring their ECG signals for 5 min. The RR intervals (RRIs) were extracted from the ECG signals, and the time-domain, the frequency-domain, and the non-linear HRV features were computed from the RRIs. An in-depth analysis of the HRV features suggested that the abuse of bhang has increased the sympathetic activity in the volunteers abusing bhang regularly. Alteration in the cardiac electrophysiology was examined from the wavelet-based analysis of the ECG signals. The Daubechies (db06) wavelet was used to decompose the ECG signals into level 8, and the signal reconstruction was performed using D7+D8 sub-bands. 12 statistical features were extracted from the reconstructed signals and the statistical significance of the extracted features was examined using linear and non-linear statistical methods. Some of the features were found to be significantly different among the population abusing bhang and the population not abusing bhang, suggesting an alteration in the cardiac electrophysiology due to the abuse of bhang. Artificial neural network (ANN) was able to classify the HRV and the ECG data with an accuracy $\geq 90\%$.

Keywords: Artificial neural network, Autonomic nervous system, Cannabis, Electrocardiogram, Heart rate variability