Chapter 12

Effect of Odia and Tamil Music on the ANS and the Conduction Pathway of Heart of Odia Volunteers

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ABSTRACT

The current study delineates the effect of Odia and Tamil music on the Autonomic Nervous System (ANS) and cardiac conduction pathway of Odia volunteers. The analysis of the ECG signals using Analysis of Variance (ANOVA) showed that the features obtained from the HRV domain, time-domain and wavelet transform domain were statistically insignificant. But non-linear classifiers like Classification and Regression Tree (CART), Boosted Tree (BT) and Random Forest (RF) indicated the presence of important features. A classification efficiency of more than 85% was achieved when the important features, obtained from the non-linear classifiers, were used. The results suggested that there is an increase in the parasympathetic activity when music is heard in the mother tongue. If a person is made to listen to music in the language with which he is not conversant, an increase in the sympathetic activity is observed. It is also expected that there might be a difference in the cardiac conduction pathway.

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INTRODUCTION

Studies by various researchers have indicated that the emotional/mood states of a person may be altered by making them listen to music (Juslin & Sloboda, 2001). Music can also help in reducing the anxiety of the patients in the coronary care units (Haun, Mainous, & Looney, 2001). The change in the state of mind, as mentioned above, affects the functioning of the Autonomic Nervous System (ANS) (Yamashita, Iwai, Akimoto, Sugawara, & Kono, 2006). The ANS comprises of parasympathetic and sympathetic nervous systems (Martini, 2005). The parasympathetic nervous system increases the intensity of contraction of the heart muscles due to the release of acetylcholine (Kiernan & Rajakumar, 2013). This, in turn, results in the decrease in the heart rate. The sympathetic nervous system, on the other hand, releases noradrenaline, which results in the increase in the rate of the heart muscle contraction (Triposkiadis et al., 2009). Hence, there is an increase in the heart rate. The ANS tries to maintain a balance amongst the sympathetic and parasympathetic system (sympathovagal balance) (Goldberger, 1999). A stimulus (either internal or external) may either increase the parasympathetic or the sympathetic activity depending upon the nature of the stimulus. Subsequently, the ANS starts acting to bring both the activities to balance. This results in the cardiac beat-to-beat variation of the cardiac activity (Sztajzel, 2004). Hence, the activity of the ANS can be analyzed by analyzing the ECG signals. The branch of study which allows to understand the ANS by analyzing the ECG signal is known as Heart Rate Variability (HRV) (Sztajzel, 2004). In the present study, we have tried to understand the effect of Odia and Tamil music on the ANS activity of the Odia volunteers. A thorough literature survey suggested that, though researchers have studied the effect of music on the heart rate variability, very few reports were found, which studied the effect of music on the ECG signals (Umemura & Honda, 1998). Hence, the statistical features of the ECG signal and the wavelet processed ECG signal were calculated and analyzed using linear and non-linear statistical processing techniques for classification using Automated Neural Network (ANN).

BACKGROUND

Understanding the effect of music on the physiological parameters of the individuals started more than 125 years ago (Davis, Gfeller, & Thaut, 2008). Music therapy has received much attention in the last decade for treating various physiological disorders (Koelsch, 2009). In music therapy, the patients are subjected to auditory stimulus with music (Watkins, 1997). Various authors have reported the use of music therapy in conjunction with various treatment regimes using allopathic intervention (Metzger, 2004). The auditory stimulation using music has been reported to alter the cardiac autonomic nervous system modulation (Peng, Koo, & Yu, 2009). The music has also been reported to improve the neuro-physiological activity of the persons (Boso, Politi, Barale, & Enzo, 2006). This, in turn, has been reported to not only influence the physiological states of the patients but also drastically alter the hemodynamic parameters. In this regard, positive effects were observed on the cardiovascular system when the patients were stimulated with classical music (Scheufele, 2000). The effect of other types of music, namely, vocals, orchestra and progressive crescendos on the cardiac activity has also been explored (Bernardi, Porta, & Sleight, 2006). In all the studies, an improvement in the cardiovascular regularity was observed when the volunteers were stimulated with the auditory music (Trappe, 2010). Roque AL et al. (2013) reported that if the volunteers are subjected to relaxant music, there is every chance of the increased activity of the sympathetic nervous system (Roque et al., 2013). On the contrary, listening to heavy metal music...
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