

# The Pharma Innovation

ISSN: 2277- 7695  
TPI 2015; 4(8): 22-25  
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[www.thepharmajournal.com](http://www.thepharmajournal.com)  
Received: 12-08-2015  
Accepted: 13-09-2015

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## An effect of instrumental music on human body

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### Abstract

Now a day, music assumes a vital part in each human life. Because of overwhelming work weight, people listen music to relax. In this work, we show the impacts of instrumental music on the human body by utilizing Body Sensor Networks (BSNs). We picked instrumental music because this type of music only uses musical segments such as pitch, intensity, rhythm and timbre. It does not utilize any segment such as verbal language (lyric). So, the effects get generated exclusively from the musical segments. The reenactment consequences of our methodology are validated through sarode recitals.

**Keywords:** Body sensor networks (BSNs), Instrumental Music, Brain activity, Raga, HVE test.

### 1. Introduction

In public network applications, BSNs applications are in awesome interest in different fields, for example, medical care [1-3], games, amusement [4-6], military-industrial sector [7], and the social public field [8-10], and have continuously turned into an examination hotspot [10]. BSN is a sort of WSN which is shaped by physiological parameter sensors placed in the human body, on the body surface, or around the body [10]. BSNs comprise of smaller than expected remote sensors that are sent on a man's body to gather information identified with physiological parameters, for example, temperature, blood glucose level, or heart rate. This information is then transmitted to a central gateway device, for example a cellphone or PDA, which in turn can convey it to a healthcare provider or physician over the Internet. Music has an endless impact over the countries and people groups. It has been utilized as a part of each society, and is regularly associated with anxiolytic and pain relieving properties. Today it is utilized as a part of numerous healing centers to assist patients with relax and help relieve or ease pain, confusion and anxiety. Music treatments methods [20] may incorporate guided listening or improvisational playing and are utilized inside of the setting of numerous hypotheses, and for some sorts of mental issue, from wretchedness to schizophrenia. Large portions of the mending characteristics of music in directing are joined with its utilization as a nonverbal medium for correspondence. Music is perused diversely in the cerebrum than non-musical tones and is joined with a wide range of regions of the mind. Learning music consigns a bigger piece of the cerebrum to perceiving and deciphering music. Listening to music has additionally been found to have an impact on learning. The Effect of Music on the Human Body and Mind Throughout history, man has made and listened to music for some reasons. Music has served to express feelings, for example, bliss or distress, and has done as such successfully. Music has been an instrument of correspondence along these lines, assisting one with keeping an eye on to comprehend another and giving a medium of interconnection. Each known society all through history has had some type of music. People were at that point playing such complex instruments as bone woodwinds, jaw harps and percussive instruments long back in the soonest development [17]. Music has been seen to have supernatural qualities, and has in this manner been utilized pervasively inside of types of religious love [18]. Music is a special blessing to and from every individual who makes it. It uncovers incomprehensible amounts of data about the entertainer, from their emotional episodes to natural chemistry, internal rhythms of organs, and even the way they are physically fabricated [19]. Music is a perpetually evolving, always expanding blessing from God, free and accessible to all who look for it and numerous who don't. All things considered, it is normally invested with the capacity to influence the individuals who listen in fantastic ways. Music has been connected with physical and enthusiastic mending all through history.

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## A. Contribution

In this section, we present our major contributions. First we proposed a model where we show the effect of instrumental music on human body. Second, we proposed a High Body Effect Message Algorithm (HBEMA) to generate the message when the effect is exceeded or equal to the threshold value.

## B. Motivation

Recently instrumental music plays a vital role for our enjoyment as well as our treatment so there must be some algorithm to detect the effect of various instrumental music on our body.

## C. Pre-requisites

In this segment we portray about body sensor network that we have utilized as a part of our methodology. BSNs are a sort of WSN which is shaped by physiological parameter sensors set in the human body, on the body surface or around the body. The primary procedures it covers are sensors, information combination, and system correspondence. It is not only a new type of universal health care, disease monitoring, and prevention solution, additionally an imperative part of the alleged Internet of Things. Its fundamental reason for existing is to give a coordinated universal processing equipment, programming, and remote correspondence innovation stage, and a crucial condition for the future improvement of ubiquitous health care monitoring systems [11].

## 2. Related Work

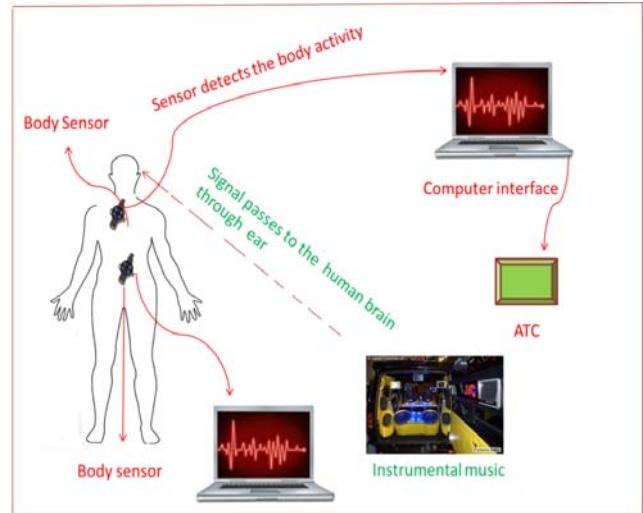
In [12] creator proposed a graphical hypothetical investigation of cortical thickness covariations (as roundabout pointer of availability) to analyze whether AP performers vary from relative contribute artists and non-artists little world system qualities. In [13] creator proposed a shorthand long haul impacts of listening to music and making music on utilitarian systems and auxiliary segments of the mind. The particular impact of music on the creating cerebrum is stressed and conceivable exchange consequences for passionate and psychological procedures. The information on the capability of music making backings and encourage neurorehabilitation. In [14] creator proposed a dark matter volume contrasts in engine, sound-related, and visual-spatial cerebrum districts when looking at expert performers (console players) with a coordinated gathering of beginner artists and non-artists. Albeit some of these multiregional contrasts could be inferable from inherent inclination and speaks to auxiliary adjustments in light of long haul ability obtaining and the monotonous practice of those aptitude.

In [15] creator explored the viability of music treatment strategies as a guide in enhancing mind-set and social connection after traumatic cerebrum damage or stroke where eighteen people with traumatic cerebrum harm or stroke were doled out either standard recovery alone or standard restoration alongside music treatment (3 medications for each week for up to 10 medicines). In [16] creator assessed the impact of a quality preparing system on uneasiness, influence, and state of mind in a gathering of more seasoned grown-ups ( $\geq 65$  years). Twenty men and ladies took an interest in a 12-week quality preparing project. Members were randomized to an intercession and a holding up rundown control bunch. Quality tension demonstrated a decrease in both gatherings. At the point when state of mind profiles of members' were investigated over the beginning 12-week of the study, a measurement of inclination called Vigor-Activity altogether

diminished in the control bunch while the intercession bunch's scores did not change. The influence information demonstrated that negative influence diminished essentially in the intercession gathering after the preparation convention.

## 3. Proposed Model

BSN plays an important role to detect the internal activity of the human body. The proposed model is shown in Fig.1. In Fig.1. When the instrumental music is generated, the signal is passed to the human brain through ear. We used body sensors to detect the internal activity of the human body. The computer interface is used to show the signal flow. Based on the different signal flow  $S = \{S_1, S_2, \dots, S_n\}$  different action can be taken. We used Action taking Center (ATC) where ATC takes an intelligent decision. ATC collects the data from the computer interface in a different time slot and checks the different status of the Heart, brain, pressure etc. ATC maintain a threshold value  $ATC_{threshold}$ . For the different signal the ratio of the variance is computed. If the ratio of the variance is equal or greater than the threshold value then ATC generates High Body Effect (HBE) message. We comparing the variance of the output patterns over one epoch to the variance of the input patterns over one epoch.



**Fig 1:** Proposed Model

The variance of the d-th dimension denoted as  $A^2_d$  in a set of N-D dimensional vectors,  $\Pi^n = [a_1^n, a_2^n, a_3^n, \dots, a_n^n]^T$  where  $n=1, 2, \dots, n$  is given by

$$A^2_d = \frac{1}{N-1} \sum_{n=1}^{N-1} (a_n^n - \mu_d)^2 \quad (1)$$

Where, the mean  $\mu_d$  is given by

$$\mu_d = \frac{\sum a_n^n}{N} \quad (2)$$

The total variance denoted as V for one epoch is given by

$$V = \sum_{d=1}^D A^2_d \quad (3)$$

The variance ratio is computed as follows:

$$V_{ratio} = V_{out}/V_{in} \quad (4)$$

Based on the value of  $V_{ratio}$  ATC generate the HBE message.

### 3.1 Algorithm to generate the HBE message

In this section, to validate our proposed model, we derived an algorithm named High Body Effect Message Algorithm (HBEMA) to make an intelligent decision of ATC. Where at first generate the instrumental music signal. Sensor detects the different status of the body after listening the music. We compute  $A^2_d, V$ , Vratio has given in Equation 1,2,3,4... Set the  $ATC_{threshold}$  value if  $V_{ratio} \geq ATC_{threshold}$  then generate HBE message.

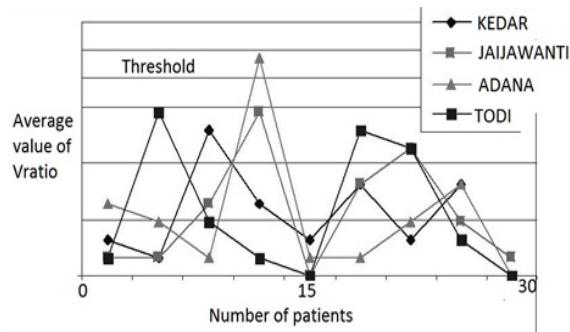
Generate the instrumental Signal  $S = \{S_1, S_2, \dots, S_n\}$ .

1. Set  $ATC_{threshold}$  value.
2. Sensor detects the internal activity of the body and pass to the computer interface.
3. For every signal  $\{S_1, S_2, \dots, S_n\}$  do
4. Calculate  $A^2_d$
5. Calculate  $V$
6. Calculate  $Vratio$
7. End for
8. Compare  $ATC_{threshold}$  and  $V ratio$
9. If  $V_{ratio} \geq ATC_{threshold}$
10. Generate HBE message

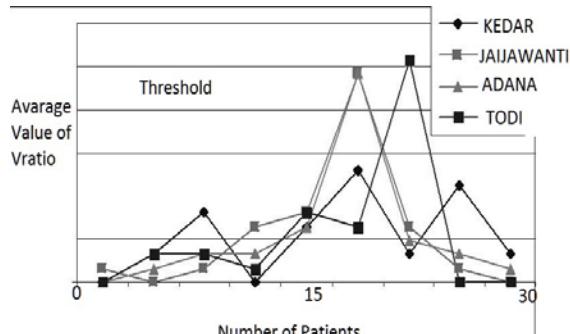
#### Algorithm 1. The HBEMA algorithm

#### 4. Results and analysis

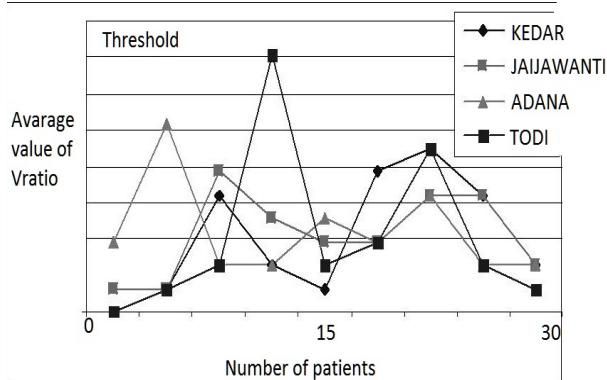
We used 30 patients and for each patient we use same raga for 30 minutes and take the Heart Rate Variability (HRV) test [21]. We take the average value of  $V_{ratio}$  for each patient and the age limit of each patient's is  $15 \leq \text{age} \leq 35$ . Before start our experiment we record the initial condition (pulse rate, pressure, sugar level etc.) of every patient. We set the  $ATC_{threshold}$  value 0.35. If  $V_{ratio} \geq ATC_{threshold}$  then ATC generate the HBE message. Fig.1 shows the first day's results of average  $V_{ratio}$  for 30 patient and we use Raga Kedar, Raga Jaijawanti, Raga Adana and Raga Todi for different experiments. Fig.2. and Fig.3. for day- 2 and day- 3 respectively



**Fig 1:** The results of  $V_{ratio}$  with respect to different patients for day-1



**Fig 2:** The results of  $V_{ratio}$  with respect to different patients for day-2



**Fig 3:** The results of  $V_{ratio}$  with respect to different patients for day-3

#### 5. Conclusion and future work

In this work, we analyzed the effect of Instrumental music on human body using BSNs. We used Raga Kedar, Raga Jaijawanti, Raga Adana and Raga Todi and we have taken 20 patients in our experimentation and for each patient we took the HRV test and analyze the effect of different Raga for different patients. In our future work, we try to improve the health of autistics patients by using this approach.

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