



# IMPACT OF BROOTA RELAXATION TECHNIQUES ON PHYSIOLOGICAL MEASURES OF EMOTIONALLY DISTURBED STUDENTS

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**Abstract:** In the recent years, physiologists and psychologists tried to understand the influence of yogic practices on physiological functions of the individual. The present research paper aims to study the impact of broota relaxation techniques (contains four yogic postures) on physiological measures, i.e., Electro-Encepho Graph (EEG) and Galvanic Skin Response (GSR) of emotionally aroused college students. Only EEG and GSR channels of the 8-channel computerized polygraph test were used to measure the physiological reactions (brain waves activities and sweat gland activities) of the subjects. The pre and post-test design was used to compare the physiological data before and after the yogic posture sessions to determine the effectiveness of the Broota Relaxation Techniques. The results revealed that the GSR values comparatively decreased after the yogic posture sessions. The EEG pattern was also found to be more regular and synchronized alpha waves in subjects practicing Broota Relaxation Techniques.

**Keywords:** Electro-Encepho Graph (EEG), Galvanic Skin Response (GSR), Broota Relaxation Techniques

## CONCEPTUAL FRAMEWORK

Yoga can be understood as a practice to control and cultivate mental processes. It is an ancient orthodox system or cultural gift of Indian philosophy which can be a great remedy to the stressful life of modern people. In ancient literature, the term “yoga” is derived from the word ‘yuj’ which means ‘unite’. It has several meanings, such as to join or bind different bodily systems, attach body and mind, or soul and God. It also means to discipline the mind, the emotions and the will. It was collected and systematically organized by Patanjali in his classical work, termed as “Yoga Sutras” (Iyenger, 1966). Patanjali also explained it as the eradication of mental fluctuations with the help of variety of techniques that gradually give peace of the mind.

Thus, it can be assumed that yoga was an ancient Indian practice that can enhance the psychological and neuro-physiological functioning of its practitioners. Scientists and psychologists were trying to understand the effect of yogic practices on the various physiological functioning of the person by using various scientific methods and sophisticated bio-medical instruments. The measurement of brain activities was one of the main studied topics in yoga research. It has been reported that psycho-physiological changes due to yoga help in improvement of muscle strength, breathing, immunity. Scientific publications have reported that yoga improves immunity and helps to manage stress and anxiety.

Yoga can be practiced in many forms such as, Asana (Posture), Pranayama (breathing exercises), Meditation (concentration), Dhyana, etc. Each and every yoga style has its own positive and beneficial effects on psychological and physiological functioning of the individual. For instance, asana is the physical practice of yoga poses to target certain muscles or regulate specific brain area functioning. One of the techniques adapted from yoga postures is Broota Relaxation Techniques.

**Broota Relaxation Technique** is developed and standardized by Broota (1990) by publishing it as “Broota Relaxation Techniques” in National Research Journal. The technique combined four yogic postures with auto-suggestion in order to help the person to shift their attention from the emotional thoughts and worries to the more relaxed state. This technique can be administered in approximately 20-25 minutes. The four yogic postures or exercises are:

- Deep breathing
- Bow Posture (Dhanurasana)
- Raising the legs
- Cycling

Broota and Sanghvi (1994) investigated the effectiveness of Broota relaxation technique and Jacobson’s Progressive muscle relaxation technique on 30 test-anxious 18 – 23 years subjects. Spielberger’s Test Anxiety Scale and Anxiety Check List were administered on them before and after the treatment with doing self-rating on anxiety. Subjects were randomly divided into three treatment groups based on the technique they were given, i.e., Broota relaxation technique, Progressive muscle relaxation technique, and control group (which didn’t receive any treatment). The subjects from both the treatment group were received their respective relaxation treatment for 3 days/ week, while control group only engaged in conversation with the experimenter. The findings indicated that both the relaxation techniques were effective in reducing test anxiety. They also found Broota technique to be more effective in comparison to progressive muscle relaxation technique.

### ***PSYCHO-PHYSIOLOGICAL MEASURES OF EMOTIONS***

Emotions are important aspect of human’s life that govern and control one’s daily activities like learning, problem solving, decision making, etc. But the role of emotions in one’s life has been neglected by technology over the years which made a huge gap in research. So, in the recent years, numerous studies have been conducted to understand the role of emotions and how they affect physiological functioning of the individual. Researchers (Nummenmaa and Ratti, 2013) found that emotional arousal is one of the important factors that brought variations in physiological measures, such as, heart-rate, electro-dermal activity, brain functioning, temperature, etc.

Advances in biomedical devices helped the researchers to study the comparative variations in physiological parameters due to emotions by using the instruments such as Electro-Encephalo Graph, electrocardiogram, heart-rate variability, galvanic skin response, etc. (Hamdi and Philippe, 2012). They termed these studies as ‘Human Computer Interaction’ that gained a wide variety of attention from all over the world as these physiological measurements enable the researchers to study and identify various physiological changes in response to emotional stimuli. One of the most preferred and useful bio-medical device to study the changes in brain’s responses to emotional situations is Electro-Encephalo Graph (EEG).

Electro-Encephalo Graph is a bio-medical technique for recording and interpreting the electrical activities of one’s brain. The brain neurons produce electrical impulses in response to stimulus that fluctuate rhythmically in distinct patterns. The history of EEG in measuring electrical activities of human brain can be traced back to approximately 70 years ago. In 1929, German scientist Hans Berger developed an electroencephalograph, an instrument that

measures and records the brain-wave patterns. The recording generated by this instrument is known as electroencephalogram (EEG). In this, pairs of electrodes were placed to the scalp to record the electrical activities of the brain's neurons. Each pair of electrodes transmits a signal of the difference in the voltage between the pair. The rhythmic fluctuation of this potential difference is shown as peaks and troughs on a line graph by the recording channel.

Moreover, the development of EEG has important implications for not only in the study of brain activities but also for comparing the changes in brain responses to different emotions. In other words, with the help of EEG, it is possible to compare the electrical differences in brain activity between resting and aroused states, individual differences in brain activities during different cognitive and emotional processes and brain activities in depression or other psychopathology. Thus, EEG is fast, noninvasive, and relatively comfortable psycho-physiological technique which made it a useful method in studying the brain's responses to various emotional stimuli.

The Galvanic Skin Response (GSR) is also an important psycho-physiological technique to measure the skin conductance response to different emotional stimuli. The term 'Electro-dermal activity or response' are also used to refer to the measurement of skin conductance or sweat gland activities. The underlying principle of this technique is to measure the activities of sweat gland which are the indicator of Autonomic nervous system arousal. In other words, when the person aroused emotionally, changes in their bodily processes automatically takes place, like sweat gland activation. The secretion of sweat leads to the increment in skin conductance, which indicates stress in the person aroused by the emotional stimuli. These changes in skin conductance elicited by the emotional stimuli can be easily measured by GSR in which two electrodes are placed on the fingers facing palm.

Researchers have also compared the variations in these neuro-physiological measures between arousal state and relaxed state. They found beneficial alterations in physiological measures in yoga and meditation practitioners. Researches have huge probability to uncover many more discoveries regarding the effects of yoga on the physiological functioning because yogic practices help in maintaining the normal state of brain functioning without any side effects. Therefore, research focuses on how the yoga practices affect person's neurological functions have increased.

In the present research, the experimenter tries to find out the effect of Broota Relaxation Technique on the physiological measures (Electro-Encephalo Graph [EEG] and Galvanic Skin Response [GSR]) of the emotionally aroused subjects by comparing their pre-physiological recordings of EEG and GSR with their post-measures of the same.

### **Objectives:**

- To study the effect of Broota Relaxation Techniques on Electro-Encephalo Graph (EEG) of the emotionally aroused students
- To study the effect of Broota Relaxation Techniques on Galvanic Skin Response (GSR) of the emotionally aroused students.

### **Hypothesis**

- Broota Relaxation Techniques will be effective in improving EEG brain waves of the students.
- Broota Relaxation Technique will be effective in improving the GSR reactivity of the students.

### **Variables:**

*Independent Variable:* Broota Relaxation Technique

*Dependent Variable:* 1) Electro-Encephalo Graph (EEG)

## 2) Galvanic Skin Response (GSR)

**Sample Description:** 10 college students with age ranging between 20-25 years and showed disturbances in their physiological measures during the presentation of emotive stimulus were purposively selected for the experiment. It was ensured that the subjects have no past emotional trauma or physical problems.

### **Tools:**

**Physio-Pac:** The 8-channel computerized poly-graph test i.e., Physio-pac was used to measure the physiological functioning of subjects. Only EEG and GSR- channels of this instrument were used to record the brain waves and skin conductance responses of the subjects during the presentation of the emotive stimulus. EEG is measured by placing three electrodes on the scalp and GSR is measured by putting two electrodes on the subject's middle and index fingers respectively.

**Broota Relaxation Technique:** This technique consists of four yogic postures or exercises combined with auto-suggestions after each exercise in order to make the subject's mind more relaxed away from his emotional thoughts. This technique was administered to subjects in approx. 20-25 minutes on 3 consecutive days in a week for four weeks.

**Research Design:** Pre and post-test design was used to compare the EEG brain waves and GSR reactivity values of the subjects to determine the effectiveness of the Broota relaxation technique as a tool to stabilize physiological measures during the emotional arousal.

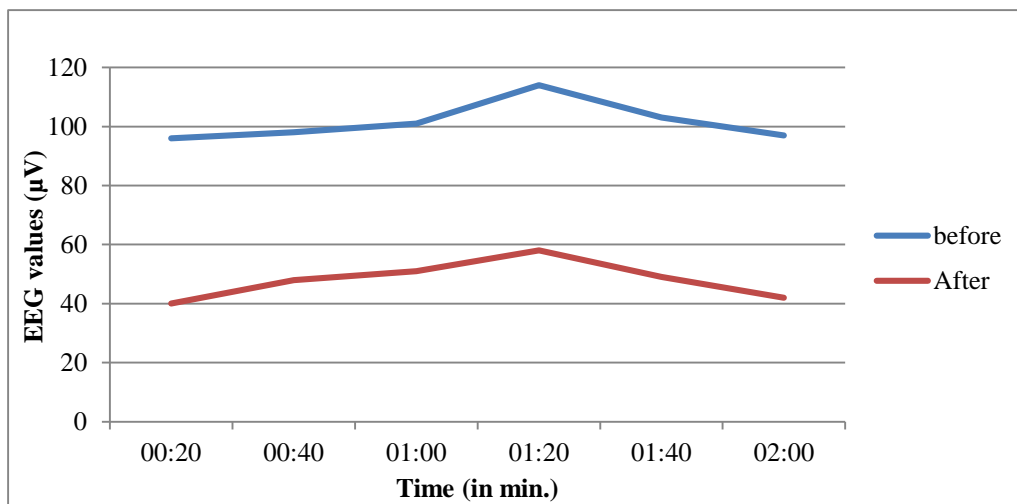
**Procedure:** The subjects were shown emotional video during the measurement of EEG and GSR which treated as pre-measures. Then, they were given Broota relaxation Technique for four weeks on 3 consecutive days per week in order to help them relaxed. After four weeks, they were again shown emotional video having similar intensity and time duration with the measurement of their physiological measures, i.e., EEG and GSR, and treated them as post measures. Then pre and post-test recordings of EEG brain waves and GSR values were analyzed and compared to find out the effectiveness of the relaxation technique.

### **Data Analysis**

The physiological data collected from the instrument i.e., Physio-Pac, was arranged into categories as pre and post-test measurements and analyzed the variations in values before and after the intervention was given to subjects.

#### *Comparison of EEG brain waves*

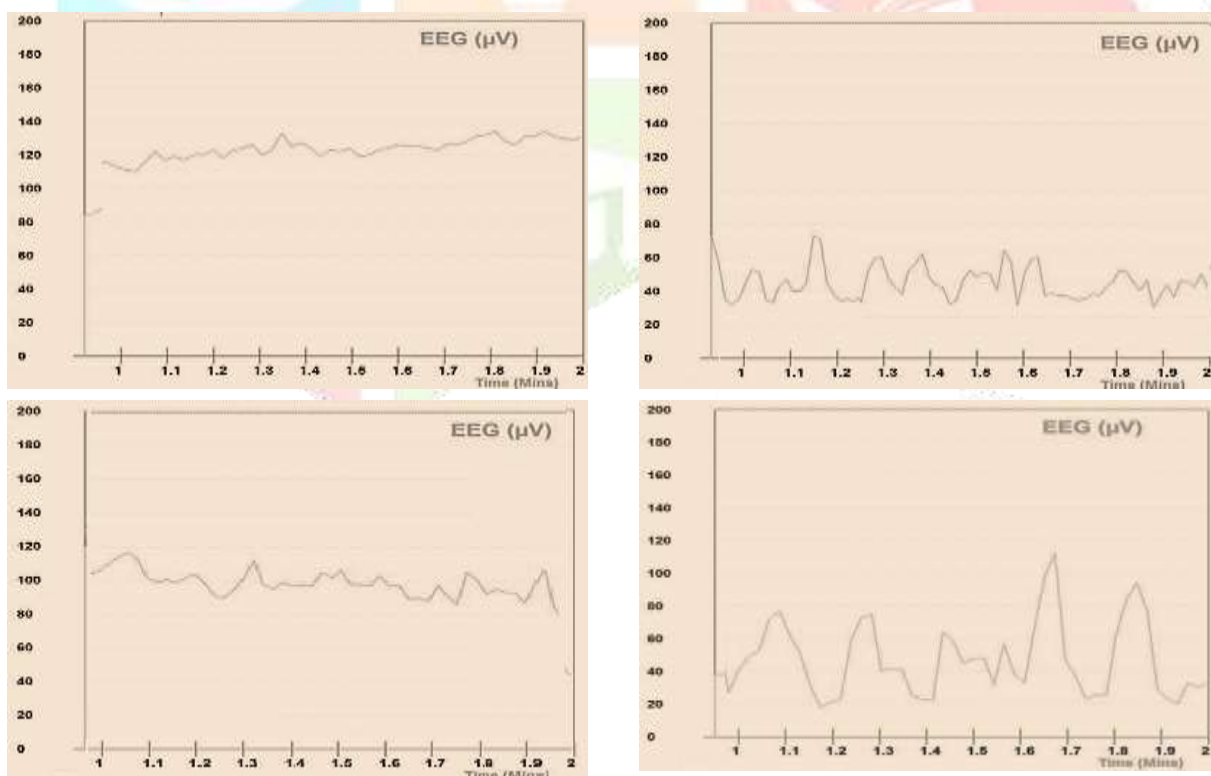
The EEG recordings of emotionally aroused subjects are compared for before and after giving the relaxation technique. The results are displayed with help of line graph (Fig. 1).



**Fig. 1 Comparative EEG values for before and after the relaxation technique (N= 10)**

The line graph (Fig. 1) displays the clear difference in EEG values of the subjects before and after the relaxation technique was given to them. The amplitude of EEG brain waves is higher in the pre-measurement of EEG denoting the heightened and arousal state of the subject. Whereas after practicing relaxation technique, the amplitude of EEG brain waves is relatively lower indicating the more relaxed and stable alpha waves.

The individual EEG recordings of the subjects also show disturbed, irregular, and high amplitude beta waves before the relaxation sessions were given to them [Fig. 2(a)]. In contrast, the individual EEG recordings of the subjects display more regular, low amplitude alpha waves with spikes after having relaxation sessions [Fig. 2(b)].



Individual EEG recordings before relaxation Sessions

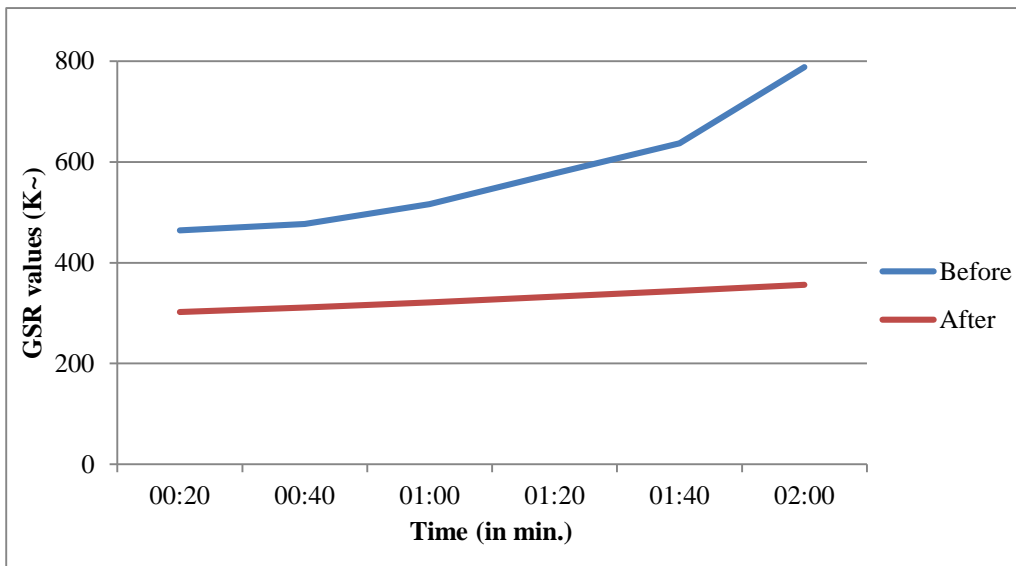
Fig. 2(b) Individual EEG recordings after relaxation Sessions

Fig. 2(a)

It is evident from the EEG graphs that the subjects shows irregular and unsynchronized beta waves during the presentation of emotional stimulus but after practicing Broota relaxation technique, the EEG pattern has found to be more synchronized and regular with alpha bands in between.

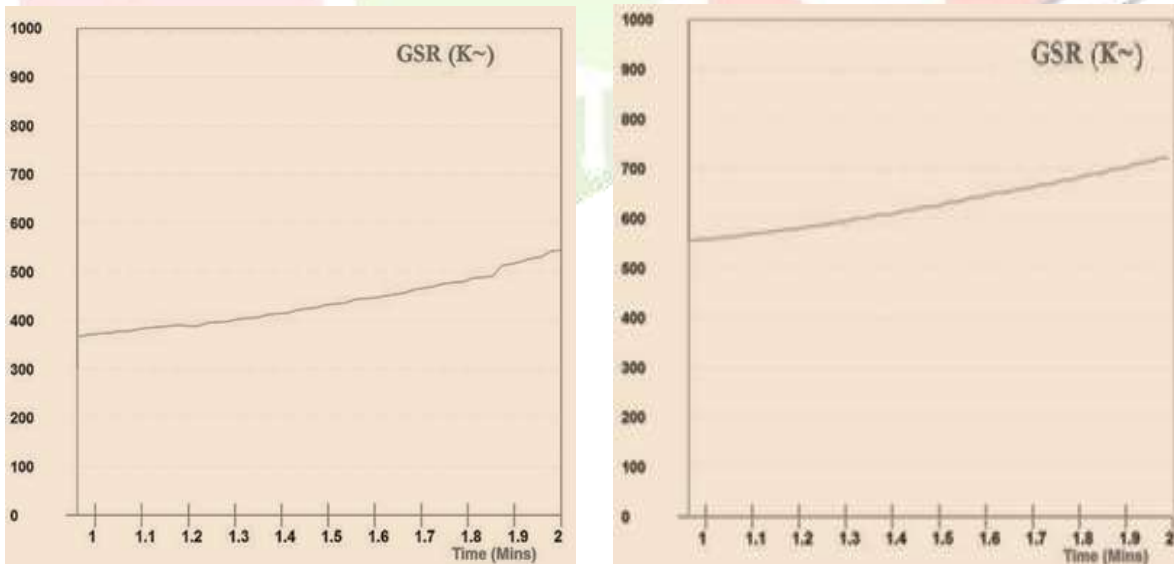
*Comparison of GSR Reactivity*

The GSR reactivity of the emotionally aroused subjects is compared for before and after the relaxation sessions were given to them. The comparative GSR values are displayed in Fig. 3.



**Fig. 3 Comparative GSR reactivity values for before and after the relaxation technique (N=10)**

The line graph (Fig. 3) comparing the GSR reactivity values of the subjects indicated that the average GSR value decreases after the subjects received relaxation sessions as compared to their pre-relaxation GSR values. The individual GSR recordings of the subjects also display the difference in GSR reactivity of the subjects towards the emotional stimulus before and after the relaxation sessions given to them (Fig. 4).



**Fig. 4(a) The individual GSR recordings before relaxation sessions**

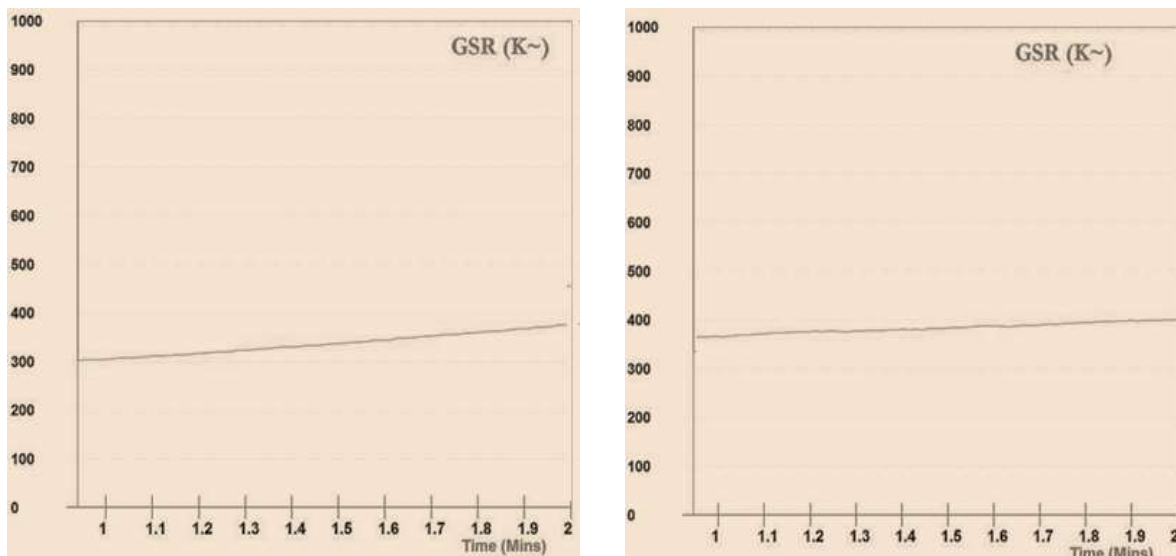


Fig. 4(b) The individual GSR recordings after relaxation sessions

It is evident from the graphs that the GSR reactivity of the subjects for the emotional stimulus decreases after practicing Broota Relaxation Technique. These results indicate that the subjects' skin conductance decreases after practicing relaxation technique.

### Discussion

The results of the present research paper showed the variations in pre and post treatment recordings of EEG and GSR which suggests the effectiveness of Broota Relaxation Technique in improving the EEG brain waves and GSR reactivity of the subjects. These results are in accordance with the previous studies conducted by neuropsychologists and yoga practitioners in the field of different yoga practices and their effect on psycho-physiological measures. A study conducted by Kumar and Joshi (2009) to investigate the effects of yogic practices (eg., yog-nidra and Pranakarshan pranayama) on students' EEG and GSR measures. They compare the EEG and GSR measures of the students for pre and post yogic practices and found significant improvement in the alpha waves and skin conductance of the students. They concluded that the yoga practices aid in the improvement of physiological functioning of the students.

Jacobs and Friedman (2004) conducted a controlled experiment on the CNS effects of relaxation techniques (RT) with the help of spectral analysis of EEG activity. They randomly assigned the subjects into two conditions, i.e., listening to Relaxation technique audiotape and music audiotape, to compare their alpha and theta EEG activity in all the cortical regions. They found significant increment in the theta EEG activity in many cortical regions during Relaxation technique condition in comparison to music condition. Their findings indicated that the CNS was in hypoactive state during the RT condition which was similar to Stage 1 sleep of the person.

Another study conducted by Kakar and Tiwary (2012) on the effect of 'Bhootashuddhi kriya' on alpha EEG of college students. They selected 10 male students (age between 18-25 years) to practice 'Bhootashuddhi kriya' for 30 minutes daily for the time period of 20 days. The pre and post measurement of EEG was taken to compare the changes in EEG due to the yogic practices. The results indicated a significant change in the EEG brain waves in post-measurement as compared to pre-measurement. They concluded that there was positive increment in the Alpha EEG waves of the male students after practicing Bhootashuddhi kriya.

The above mentioned researches provide evidence to support the findings of the present research indicating that the yogic practices are helpful in improving the psycho-physiological functioning of the subjects. It is also evident from the results that the Broota Relaxation Techniques have positive effect on the EEG brain waves as the alpha are found

to be more regular in post measures. It also increases the conductivity of the skin, in turn, decreases the skin resistance.

### **Conclusion**

Thus, on the basis of the above findings and discussion, it can be concluded that the Broota Relaxation Technique improves the physiological measures (EEG and GSR) of the emotionally aroused subjects.

### **Limitations and Recommendations**

Some *limitations* and *recommendations* for the future researchers are:

- The study was conducted on small sample of 10 subjects. Future researches can be conducted on a larger sample.
- The study was conducted on the age group of 20-25 years. Further studies can be conducted on lower and higher age groups also.
- In Physiological measures, only EEG and GSR were used in this research. Other physiological measures like, ECG, fMRI, ERP, etc., can also be used in future endeavours.

### **Implications**

The present research has many *implications* for the college students as well as academicians as in this modern stressful world, it is quite difficult for an individual to deal with numerous life stressors and emotional situations and maintain their physiological and cognitive balance. The present study provides help to these students to normalize their physiological reactions and remain calm even at times of emotional arousal. It also aid the academicians and policy makers in understanding the importance of yoga activities in determining psycho-physiological conditions of the students.

### **Declaration of Conflicting Interests**

The authors have no conflicts of interests with respect to the authorship and/or publication of this article.

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