

# Audio Visual EMG & GSR Biofeedback Analysis and Spiritual Methods for Understanding Human Behaviour and Psychosomatic Disorders

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## Abstract:

It is amazing that today's man, despite knowing so much about the world around him, knows so little about his own self. The more one tries to know subtle world, the more enigmatic and mysterious it becomes, the reach of human mind is indeed infinite but the mental complexities generated thereby have not only hindered and hampered the elevation of personality, but also have shaken and cracked its inner structure and stability. In professional youths between the age group of 20-24 years lots of psychological imbalances arise due to emotional immaturity and lack of knowledge of inner self. Spirituality with mindful meditation along with positive attitude is the only way through which one can get well soon from all types of problems by following some discipline. Stress due to headache (TTH) is the commonest primary headache. The objective of the present study was to compare the effects of EMG and GSR integrated Biofeedback's on stress due to headache and quality-of-life of the subjects under consideration. Electromyography (EMG) biofeedback (BF) and GSR (Galvanic Skin Resistance) is considered an effective therapy for headaches. There are no such comparative effects of visual and auditory EMG biofeedback for headache.

**Keywords:** Stress, EMG, GSR, Spirituality, Mental Health, Meditation, TTH, EMG and GSR Biofeedback, Audio, SF36.

## 1. Introduction

*Importance of Mental Health, Stress and Emotional Needs and Significance of study:*

Individuals experience the fundamental need to experience autonomy to feel competent and development relationships. When all of these needs are fulfilled, individuals experience improvements in well-being and satisfaction. They also become more resilient rather than sensitive problems. However, many common trends, such as the inclination to conceal personal problems or work extensive hours can impede the likelihood that such needs are fulfilled.

As all of us know, among the 4 main stages of human development i.e. Infancy, Childhood, Adolescence and Adulthood. Adolescence is the most transitory state and is the most important phase of life for every individual. It is the intermediate period between childhood and adulthood.

So, we selected to this work to observe the impact of affirmative ideas on mood states of personality for mental health (Anxiety, Stress, Depression, Aggression, Fatigue, Guilt, Extraversion and Arousal) on the students and technocrats of institute. [DSVV and ABES Engineering College Ghaziabad].

## 2. Previous Studies (Literature Review)

Tension type headache (TTH) is the most common type of primary headaches<sup>1</sup>. Biofeedback (BF), a process whereby information about usually unconscious biological activities is made available to consciousness is an established treatment modality for TTH<sup>2</sup>. BF treatments for pain emphasize the patients' active role in managing these conditions, thereby establishing improved coping with the psychological and psychosocial consequences of pain. BF is virtually free of untoward side effects and if effective for preventive and abortive treatment of headaches would obviously be preferable to the use of medication<sup>3</sup>. Though various forms of BF have been used in migraine, tension type headaches and combined headaches, electromyography (EMG) BF has shown maximum benefits.

## 3. Mental Health Introduction

Some form of medical help is usually need for recovery/management, this may take the form of counselling or psychotherapy, drug treatment and lifestyle changes [18,19].

Approximately 25 % of the people in UK have a mental health problem during their lives. The USA is said to have the highest incidence of people diagnosed with mental health. [21]

## 4. Four Independent Variable

*Emotional fulfilment:* Basic human needs for emotional fulfilment are universal and include: Love, Acceptance, Affection, and Feeling valued, Appreciated, Secure, Companionship, Admiration, Trust, Respect, Understanding, Conversation, and Communication.

Maslow in 1954 has given a hierarchy of human needs in his—Theory of Self Actualization! which are Psychological, safety, belonging, love, esteem needs and need of self-actualization.

## 5. Stress: A-Models of Stress (Headache)

Three Models in practice:

1. General Adaptation Syndrome (Fig.2 and Fig.3)  
Stages: Alarm, Resistance, Exhaustion
2. Selye Eustress and Distress (Fig.4)
3. Lazarus: Cognitive appraisal Model (Fig.5 and Fig.6)

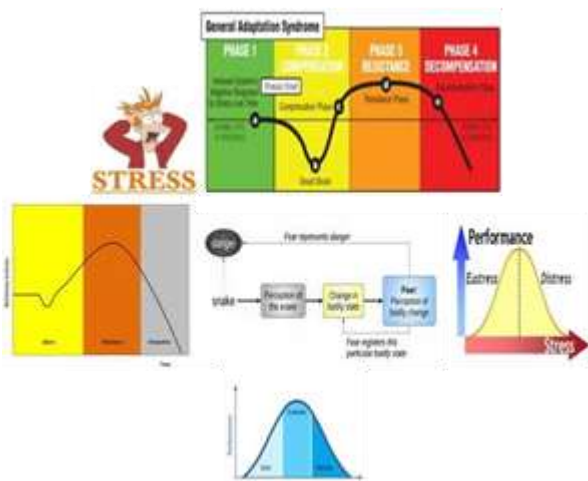


Fig. 1-6. Stress Models

### 6. Bio Feedback EEG Instrument (Earlier Experiments):

To understand biofeedback, one must first understand what biofeedback is. Biofeedback, also known as neurotherapy, is a progressive relaxation and self-regulation technique used to control one's own stress level (Wenk-Sormaz, 2005). It works by simply preventing illness through stress management techniques. This treatment promotes the quality of life and sharpens coping skills (Baum, Herberman, & Cohen, 1995). McDowell (2015) found that mindfulness meditation has positive impact on personality and self- concept. Chambers et al., (2008) in their research, practiced 20 novice meditations to participate in a 10-day intensive mindfulness meditation retreat. After the retreat the meditation group had significantly higher self-reported mindfulness and a decreased negative affect compared with a control group. They also experienced fewer depressive symptoms and less rumination. (Fig.7)

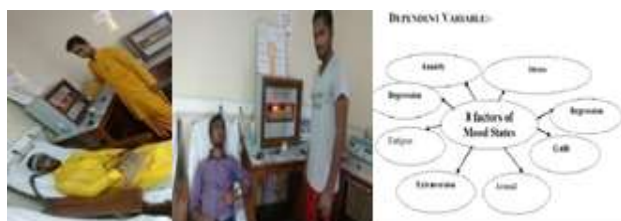


Fig. 7-9. Experienced fewer depressive symptoms and less rumination

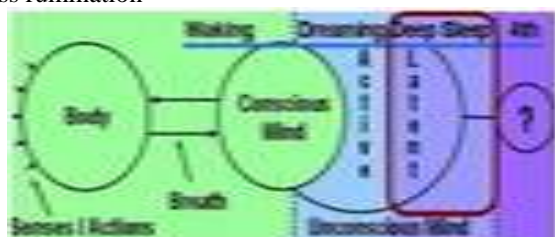


Fig 10. Experienced fewer depressive symptoms and less rumination

Table 1: Experienced fewer depressive symptoms and less rumination

Variable	Pre	Post	Control
Average frequency of headache per week	56	35.9	25.8
Average intensity of headache per week	58.2	56.3	46.5
Average duration of headache per week	73.7	63.6	49
SF-36 physical score	25	26	21
SF-36 mental score	25.1	39.5	21.7
SF-36 total score	28.5	30.5	21.7

### 7. Design of The Study: Procedure of Data Collection

**A. Method:** This study was a done in a controlled randomized trial in a single blind order prospectively. In totality 95 subjects gave their consent to be the part of the study and they were found eligible as per the experiment criteria. Out of them 13 subjects were cut-off due to various reasons like (declined to participate in future consequences, unsuitable timing due to office hours or house issues and treatment place or may not be fit for criteria of inclusion) and rest 82 subjects were allotted randomly using a lottery method to EMG-integrated audio-visual Biofeedback, GSR- integrated audio-visual Biofeedback, and Control groups (not undergone to the experiment). When sections with required sample structure were obtained, the enrolment was finished. All the objects under study were permitted to reconsume their medical treatments as their already running doctor suggested, but it was instructed to them not to take analgesics unless the stress (headache) pain was unbearable. The control group having no medicine did not observed any Biofeedback intervention, but they continued with their suggested medication. The Readings were recorded at starting point and after 30 days, 90 days 180 days and 365 days of therapy.

#### B. Population for our study-

Those subjects who were lying under requirements of Inter- national Headache Society for stress (TTH) were accumulated in the experiment and their consent was taken accordingly for that.[15]. Clearance for ethical process was obtained from the Institute Ethical Committee. The candidates under study were considered to be part of study from different neurology clinics and those referred by their doctors to the physiotherapy department for any kind of Bio Feedback therapy. [16].

#### C. Intervention and Data Collection Procedure

On all the subject's bodies the Galvenic skin resistance instruments with electrodes were set up on the ring finger and middle phalanx of the index of one side.[18] EMG setup provided auditory feedback with earphones, and frequency and muscle activity were guiding the varying tone proportionately.

Similarly, the GSR-BF machine also provided audio-visual readings and observations. It was calculated by

colored glowing bars (Green indicating relaxation and Red indicating tension), skin resistance in Ohms along with numerical display of which increased on relaxation. Audio-visual feedbacks were similar to that of the EMG-Biofeedback machine. After skin preparation, the surface EMG electrodes were applied 2.5 cm above the centre of each eyebrow [17]. Subjects were given the following instructions by the instructor.

-Adopt any comfortable meditative posture like Padmasana, Siddhasan

-Try to follow the given instructions.

-Prepare yourself for the practice of meditation. (Fig.9)

-Keep the head neck and spine upright.

-Close the Eyes and relax the whole body.

-The EMG-BF machine displayed relative muscle EMG activity as glowing bars separately for the right and left frontalis along with numerical display corresponding to relative EMG activity. (Fig.8)

Along with their interest these sessions were being successful in completing this whole study with intervention. The study had the approval of department of Psychology of DSVV Haridwar as well as the Engineering fraternity of ABESEC, Ghaziabad.

#### D. Outcome Assessment:

Steps are as following:

- A- Different Pain type variables called as, duration of stress (headache) per week, average-frequency and intensity of stress on the analogue score were obtained for their Demographic data. As the primary outcome measure, average frequency of headache was considered.
- B- Secondary outcome measures included average duration and intensity of headache and SF-36 scores [19]. A diary record had to be maintained and all subjects were instructed to note on the given diaries about their pain variables at the end of each week.
- C- Average duration was mapped by dividing the total hours of all such hours/ duration of stress that week by the number of such cases for an individual in that week. The subjects under study were instructed to document frequency of stress/headaches as number of stress incidents per week.
- D- Average of the 10-point Visual Analog Score (VAS) per headache that week was used to calculate the intensity of stress/headache. The Average scores of the pain variables were recorded at start of experiment, 30 days, 90 days, 180 days and 365 days after receiving Biofeedback. (Graph4)
- E- From the pain diary, the baseline data were obtained in the week prior to the start of experiment study. The 30 days, 90 days, 180 days and 365 days scores were the scores of the last week of the corresponding months.

F- The licensed SF-36 (Short-form Health Survey) questionnaire was used in the regional language (Hindi) and English to record parameter of quality of life. SF-36 score table is a standard multi-purpose, short-form health survey with 36 questions, yielding psychometrically based physical and mental health summary measures. [20-23]

#### E. Sample Size

Total sample size was 91 out of which 3 groups \_A', \_B' and \_C' are formed of 27,28,27 quantity. Group \_C' is of control group people who didn't participated in the experiment and group \_A and B' are of people in stress to be experiencing EMG and GSR consequently.

The ages of the subjects are between 20 to 30 years, and they were not on medication, Shantikunj-Hardwar and ABESEC, Ghaziabad. Participant were divided randomly into three groups; one two group A and B-experimental group (n=27+28) and another was Group C-control group (n=27).

*The selection of participants was based on:*

*Inclusion criteria*-Healthy both male and female volunteers, ages around of 20 to 26 years, not on medication.

*Exclusion criteria*- Participants with any of following was excluded-History of smoking, intoxicants, or consumed caffeinated beverages. Chronic illness and chronic use of medication. The signed informed consent was obtained from all participants before they participated in the study.

In the present study, a sample of 95 adolescents are selected from ABESEC, Gzb and DSVV Haridwar of graduation. Among these sample 55 are from urban area i.e. Lalquan and 50 are from rural area i.e. near to Pilkhua township in Ghaziabad.

## 8. EXPERIMENTS AND RESULTS

*Hypothesis:* There is a significant effect of Bio Feedback based self-Guided meditation on Mental Health, stress management (Headache). There is a significant increase in the level of Stress Management (TTH) and emotional Needs by meditation practices.

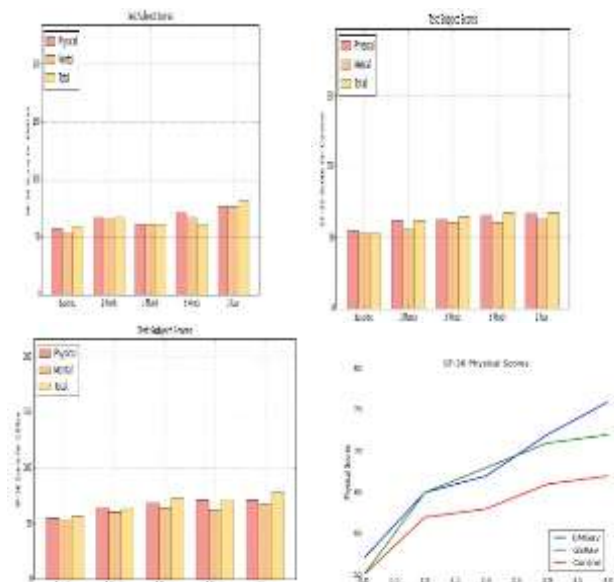
-There is no significance difference in the mental health of adolescents due to meditation and therapy by GSR and EMG integrated audio-visual Biofeedback.

-There is no significant relation between mental health and stress relief practices.

Variables in the Study:

Independent Variable- Audio-visual EMG and GSR Biofeedback therapy, Mindful Meditation, Spiritual Attitude. Dependent Variable - Stress Management, Tension Type Headache, Mental Health of Adolescents.

A. Experiment with Audio-Visual EMG & GSR—  
*Graphs were plotted in Anaconda Framework with the help of python programming.*



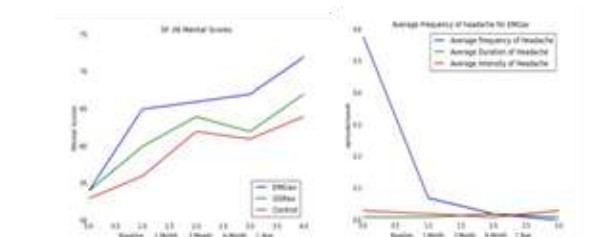
Graph 1-4. Anaconda Framework with the help of python programming

Analysis(Graph1):-SF-36 test was applied on different subjects who experienced the audio-visual EMG therapy and graph shows the SF-36 Scores of 27 patients over the period of starting point, 30 days, 90 days, 180 days and 365 days, from the bar graph it is observed that the relative scores of all the patients have been increased.

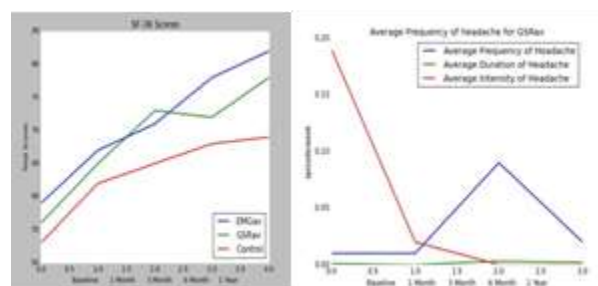
Analysis (Graph2): The above graph shows the SF-36 Scores of 28 patients which were give audio-visual GSR therapy for 10 sessions each of 15 mins. And records were taken over the period of starting point, 30 days, 90 days, 180 days and 365 days, from the graph we may conclude that the relative scores of all the patients have been increased, so it validates the utility of therapy.

Analysis (Graph3): 27 other subjects chosen for non-experiment group and their SF-36 scores were recorded but it has been observed that over the period of Baseline, 1 Month, 3 Month, 6 Month, 1 Year. From the graph it is observed that the above scores increased.

Analysis (Graph4): The above line graph shows the relation between Physical scores of audio-visual EMG, GSR, Control categories over the period of starting point, 30 days, 90 days, 180 days and 365 days,. From the graphs it is clear that the physical scores of EMG and GSR were better than have increased over the period of time. Initially the GSR superseded the EMG therapy up to around 6 months but in next half, EMG therapy showed significant increment over GSR and control groups.



Graph 4-5



Graph 7-8

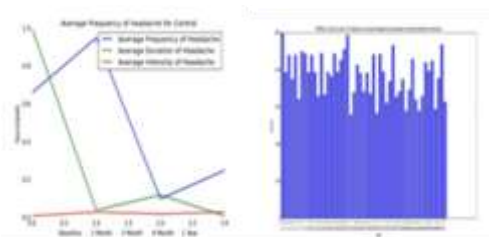
Analysis (Graph5):-The line graph showing the relation between mental scores of audio-visual EMG, GSR, Control categories over the time period of Baseline, 1 Month, 3 Month, 6 Month, 1 Year. From very starting point, the EMG therapy showed the drastic increment continuously over GSR and control groups in overall experiment period.

Analysis (Graph6): In overall score of EMG, GSR and control categories, we found that initially GSR and EMG were competing but in later half, EMG showed a clear win over GSR technique in period of time.

Analysis (Graph7):-The above line graph shows the relation between Average frequency of headache for audio visual EMG category over the period of starting point, 30 days, 90 days, 180 days and 365 days,. From the graphs it is clear that the frequency of EMG and GSR were decreased over the period of time.

Analysis (Graph8): The above line graph shows the relation between Average frequency of headache for audio-visual GSR category over the period of starting point, 30 days, 90 days, 180 days and 365 days,. From the graphs it is clear that any of the feedback used in separate arrangements. The study clearly reveals the fact that accurate learning and memory (retention) requires input from both visual along with auditory sources.

Another study similar to ours in terms of methodology, in which EMG and GSR BF were used for relaxation training. In this study the subjects were randomly assigned to four groups:1) group receiving EMG-GSR audio BF with eyes closed, 2) group receiving EMG-GSR audio BF with eyes open, 3) group receiving EMG-GSR visual BF and 4) control group which received no feedback. It was dealing with the stress issue of subjects. performance than reported that group which received EMG audio BF with eyes closed showed better decrease in frontalis muscle



Graph 9-10

Analysis (Graph9): The above line graph shows the relation between Average frequency of headache for control category over the period of starting point, 30 days, 90 days, 180 days and 365 days. From the graphs it is clear that the frequency of EMG and GSR were decreased over the period of time. On the other hand, their control groups do show such results.

Analysis (Graph10): The following graph shows the score of REMG & VAS of 51 patients. X axis shows the score of VAG and REMG score is shown on Y axis. The X axis is also shows the serial number of patients. Graph shows the Fluctuating records of different patients with respect to their relative EMG scores and Visual analogue Score of Headache intensity in scale of 10.

#### B. The Discussion on Quality of life

Since in the duration of 1 year, only 22 subjects participated fully so we are considering only them. Significant improvement was seen in the total scores of SF-36 in EMG, GSR and control groups at 1-year follow-up. Learning is facilitated when auditory and visual information is provided simultaneously, which explains why audio-visual aids an integral part of learning are. Likewise, BF too is a learning process which therefore can be assumed to be facilitated by providing audio and visual cues to the patients. In our study there was significant improvement of stress variables and SF-36 sum and sub-scores in audio-visual EMG group indicating that integrated feedback is effective than that of GSR.

Non-therapeutic study was conducted in a similar manner for integrated (auditory cum visual), separate audio and separate visual and feedback was provided to subjects under study. Task performance like assembly work of man electronic task and keeping peg in a hole were measured for study of subjective opinions, task completion time and performance errors. The analysis and output obtained showed that combined feedback offered better assembly task activity as compared to other groups. However, integrated feedback was not used in this study.

#### 9. Novelty in this Paper

Till date the field of tension type Headache (stress) was less covered area, this time, a systematic study has been Conducted to show the effect of other than medication therapies like BFB therapy and comparing the results of EMG

And GSR techniques for the effect of positive thinking to manage daily life stress and increase the capacity of Problem solving. The study also shows the benefits of Biofeedback mechanism in a long duration of 1 year, subsequently recorded the SF-36 scores in 4 quarters and ignites the path of alternative medication techniques to overcome stress, anxiety and depression like psycho challenges. That means we can use this term commonly, but stress is not so easy to explain. Stress as a word means —to draw tightl and has been used to describe

hardship, affliction, force, pressures, strain or strong effort.

There are two higher mental processes. Problem solving has been conceived by psychologists as discovery of correct response to a problem or situation that is new and difficult to the individual. But decision-making refers to selection of a correct response, out of several correct responses already brought out and had been found that as people are getting older and older their problem-solving ability is reducing. The paper has shown a clear path to find the relation of stress (headache), problem solving, decision making and physical and mental well-being of individual. This higher level of intelligence is the best indicator. Student characteristics like intelligence level are significant predictors for student's performance at school besides the other school factors, peer factors and family factors. Higher intelligence levels lead to higher performance of students in studies, and low intelligence levels lead to lower performance (Hanes, 2008). That the low intelligence level has negative on the academic performance of students because the mental capacities to learn and understand the things and logical power they need is remain lacked and hence they do not perform better academically.

#### 10. Future Scope, Limitations and Possible Applications

This is an endeavour of authors to study the effect of stress management and spiritual health of individual and groups. The study was done under several challenges, threats and limitations like possibility of dropout, time constraints, resources limitations and supportive spirit of participants. Due to these limitations this study was conducted in the university premises with small size of sample, similar studies can be done in different parts of the country on large samples for better scope of generalization. For the further researches it should kept in mind that environment also play a vital role in increment and decrement of mental health so, it should also include, it can be done on the sample of different age groups, gender differences, socio economic status, parents education, academic environment.

This research is done in a very short time period due to limitation of some aspect left by the researcher. They should also build in further studies.

a- Study of the physiological, psychological and therapeutic effect of positive thinking and mindful meditation on tension type headache (stress). b- Control group and long duration study suggested. c- Study of its effect on exclusion and inclusion criteria. d- Effect of this practice can be studied on other dependent variables i.e. BP (Blood pressure), HR (Heart rate), Hb (Haemoglobin), ESR, TLC (Total lymphocyte count), DLC (Differential Leucocytes count), Sugar Level, Lipid profile and different lung functions. e- Study the effect of meditation at microscopic level. F- Study its effect not only on mental and physical but at consciousness level too. The research should be conducted on larger sample. Another tool of measure should be used to measure the variables.

A large sample size should be selected. The further research should be conducted between adolescents of two different states, socio economic status, and different gender.

### 11. Conclusion

From above experimentation, we may conclude that audio visual EMG-BF and GSR-BF are effective in the treatment of stress (TTH), with facts of EMG-BF being more effective than GSR-BF. In this study, the experimental group showed significant reduction in the level of stress. Hence it can be proved by EMG and GSR biofeedback therapy concluded that continuous positive thinking has the capacity to reduce stress among students and increase their working performance.

This study also concluded that the effect of positive thinking enhancing also helps in stress management and increase the level of Creative Problem solving among youths/ students. Because we also know that the students who allow positive ideas also perform good in their work and other students who did have negative thought process, tensions and useless reasons for living life aimlessly have no difference before their work. And we know that, Stress is physical response to a situation. Some level of stress is essential for response, but continuous and high level of stress is harmful for the human, manifest as physical and mental. A person's response towards stress depends on whether an event is appraised as a challenge or a threat (Lazarus and Folkman, 1984). So it's play an important role in our life. Students had now a good coping capacity to manage stress and also done their work very well, i.e. had a good problem capacity.

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