Correlation of Anxiety& Eeg Pattern in Young Adults

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ABSTRACT *The present study was undertaken to find out the correlation between subjective and objective measure of anxiety with EEG pattern . A sample of 67 medical students, was drawn from the I MBBS batches and they were tested for subjective anxiety scores by using Rastogi' Self-evaluation scale for anxiety which measured three types of anxiety scores, state, trait and free-floating anxiety. These subjective anxiety scores were correlated with Alpha index(AI) and Alpha appearance time(AAT) in EEG. The correlation of anxiety scores with EEG pattern showed that there is a negative correlation of Alpha index with anxiety trait score(ATS) which is statistically significant . There is a positive correlation between Alpha appearance time and ATS which is statistically significant. There is no statistically significant correlation between Alpha index, Alpha appearance time and Anxiety state score (ASS) and Free-floating anxiety score(AFS). Hence Alpha index and Alpha appearance time in EEG are good objective measures of anxiety trait.*

Introduction:

The present age is an age of anxiety and stress. With advancement of knowledge, the need to learn more and retain more in a limited life-span has gained importance. This limitation of time has given rise to more anxiety. Therefore the need to study anxiety and all factors associated with it.

"Anxiety is the individual's reaction to the invasion of his conscious mind by irrational forces and images from the collective unconscious which serve as a threat to the orderly, stable existence of the individual", said Jung(1956)[1] in his definition of anxiety.

Giving importance to the stimulus of drive and considering its energizing function in their theory, some psychologists conducted studies relating anxiety with academic performance. They found that high anxiety groups are clearly superior in academic performance to the low anxiety groups.[2,3]

In today's cut-throat competition this theory holds great relevance for those individuals who strive for success. Anxiety for them acts as a driving force to better their performance.

Viewing both schools of thought the logical conclusion one can draw is that anxiety within reasonable limits inspires and drives the individual to reach the heights of excellence but once it exceeds these limits its unpleasant influence acts as a deterrent to the progress.

Since Freud's conceptualization of anxiety in 1894,clinical studies on anxiety have been conducted with increasing regularity[4]. There are two distinct aspects to the measurement of anxiety. Psychological tests are used with statements based on symptoms experienced during anxious states. These measure self-estimated subjective anxiety scores.

Anxiety being such an intense emotion is accompanied by a rise in arousal level and stimulation of the autonomic nervous system. As a result there is change in physiological parameters. These changes indicate the person's reactivity to stressful conditions. Examples of such parameters are changes in blood pressure, cardiac output, forearm blood flow, pulse volume and rate, heart rate, respiratory rate, Galvanic skin resistance, palmar sweat index, Electroecephalography, papillary reactivity, cold pressor test, stomach acid output and salivary secretion.[5]

The correlation of EEG with personality traits has been observed by some psychologists and physiologists. It was reported that subjects with higher anxiety proneness ratings had less developed alpha and more fast activity in the resting EEG. Those who are less anxiety prone tend to have more abundant alpha activity in EEG[6].

Medical students form a group that is required to perform at high levels of mental competence. They are required to take tough tests to gain admission to the course and are then subject to the unrelenting task of learning innumerable facts and to recall them at a moment's notice. Hence they are ideal to study the subjective anxiety scores and correlate them with an objective measure of anxiety like EEG pattern.

To measure the anxiety scores, anxiety state score (ASS), anxiety trait score (ATS) and free-floating anxiety score (AFS) and to correlate these anxiety scores with EEG pattern in young Medical students.

Materials and Methods

The present study was undertaken in the Department of Physiology, Government Medical College, Jabalpur. A sample of 67 medical students, 36 males and 31 females, between the ages of 17 and 20 years was drawn from the I MBBS batches. The students were subjected to Anxiety tests and EEG.

For Anxiety tests Rastogi's self-evealuation scale for anxiety state, anxiety trait and free floating anxiety levels was used[7]. This test had three sections - Anxiety state score (ASS) : This part of the test had 20 statements pertaining to the transitory emotional state of the individual at the time of performance of the test. Anxiety trait score (ATS) : There were 28 statements in this section which were based on relatively stable personality disposition of the individual. Free-floating anxiety score (AFS): This section had 24 items which presented symptoms encountered in anxious patients that were "objectless" or "free-floating".

Scoring of the test: All the sections had some statements that were positive for anxiety, showing the subject to be anxious. Some statements were negative for anxiety showing the subject to be devoid of anxiety and in a relaxed state of mind. There were five response categories against each statement and were numbered serially from 1 to 5. The subject chose only one response to each item. In case of items positive for anxiety the weights assigned were the same as the numerals of the responses whereas in case of statements negative for anxiety, the weights assigned were the reverse of the numerals.

The final scores of each section were obtained by the sum of the weights given to each item. For a meaningful interpretation of the scores, the subjects were divided into five groups on the basis of the tables provided for each section of the test. The five groups were "average", "high", "very high", "low" and "very low". For the purpose of this study high and very high anxiety groups were grouped as "high" and low and very low anxiety groups were grouped as "low" thus forming three continuous groups of high, average and low anxiety levels.

Electroencephalography(EEG):

An eight channel Medicare EEG machine was used to record the EEG of the subject using 10-20 system of scalp electrode placement. Sitting comfortably the initial recording with the subject's eyes closed was made for more than one minute after the rhythm was stabilized. Then he was asked to open his eyes and then close them suddenly till an alpha rhythm lasting for 5 seconds was observed in the occipital leads. The following parameters were examined in the EEG:

(a) Alpha index (AI) : The percentage of total time that was made up by the alpha rhythm pattern in occipital leads was calculated as the alpha index in one minute of record after stabilization of the rhythm.[8]

Calculation of Alpha Index (AI):
Total time of record for calculation of Alpha Index
= 60 seconds
1 second = 25mm
Total distance of record = 60 x 25 = 1500
Let total of Alpha distance be = X mm
For total record distance of 1500mm, distance of Alpha waves = X mm
Percentage of Alpha = (X/1500) x 100

a) Alpha Appearance time (AAT)

This test was based on individual variability of reactivity of alpha rhythm to sensory stimulation, particularly visual. Reactivity to stimulation maybe measured as latent time before blocking (blocking time) or total duration of blocking phenomenon (time blocked). Blocking means replacement of Alpha rhythm by beta activity.

The second of these responses (blocked time) was used in this study and is named Alpha Appearance time (AAT). This blocked time or Alpha appearance time depends upon many factors like stimulus intensity, duration of stimulus and presentation of stimulus as solitary or a group of stimuli.[9-12] The effect of these factors was standardized by making the subject open his eyes and close them immediately, with standard illumination of the room in which EEG was recorded.

The time in milliseconds for Alpha type of wave pattern lasting 5 seconds to appear in the EEG after closure of the eyelids was the Alpha appearance time.

Calculation of Alpha appearance time:
Speed of movement of paper = 25 mm/second
Hence distance travelled during one second = 25mm
Distance from the mark for eye closure to the start of appearance of Alpha type of wave pattern was measured in mm.
Let distance be = X mm
For 25 mm distance, time = 1000 millisecond
                    1mm = 1000/25 = 40 ms
                    X mm   = 40 x X ms

Results:

Table no : 1 showing Correlation between Anxiety state scores and EEG pattern

Sr no	Observation	r value	t value	Sig
1.	Alpha index	-0.159	-0.128	NS
2.	Alpha appearance time	0.2302	1.907	NS

Table showed that Correlation between Anxiety state scores and EEG pattern

was not significant statistically.

Table no : 2 showing Correlation between Anxiety trait score and EEG pattern

Sr no	Observation	r value	t value	Sig
1.	Alpha index	-0.3288	-3.152	Highly sig**
2.	Alpha appearance time	0.3829	3.341	Highly sig**

Table showed that Correlation between Anxiety trait scores and EEG pattern

was significant statistically. There was a negative correlation between Anxiety trait score and Alpha index . There was a positive correlation between Anxiety trait score and Alpha appearance time in EEG. Both were highly significant statistically.

Table no : 3 showing Correlation between free-floating anxiety score and EEG pattern

Sr no	Observation	r value	t value	Sig
1.	Alpha index	-0.074	-0.598	NS
2.	Alpha appearance time	0.1485	1.210	NS

Table showed that Correlation between free-floating anxiety state scores and EEG pattern was not significant statistically.

Discussion

Results (Table 1,2,3)showed that correlation between Anxiety trait scores and Alpha index have a negative correlation which is significant statistically and Anxiety trait scores and Alpha appearance time have a positive correlation which is statistically significant. The other anxiety scores, anxiety state score and free-floating anxiety scores do not have a significant correlation with Alpha index and Alpha appearance time in EEG.

Anxiety of an individual has three facets to it. First is the anxiety state which denotes the existing anxiety level of the individual while he is undertaking a task in hand. This form of anxiety is likely to affect his performance while doing the task. Second is anxiety trait that is the habit of being anxious in general. This type of anxiety prepares the individual to undertake the given task with alertness and to avoid pitfalls while doing the task. Third is the free-floating anxiety which represents anxiety at a given moment but unrelated to the given task. A person maybe distracted because of the anxiety or may not be able to disregard the cause of anxiety while doing the given task. Of the three types of anxiety, the anxiety trait is likely to be the most important factor which will decide a person's overall performance.[8]

Many subjective and objective tests have been devised to measure all aspects of anxiety. This study was designed to correlate the psychological test with physiological measures of anxiety and to establish a firmer relation between the two types of tests. The correlation between subjective anxiety scores and EEG pattern was rewarding as a statistically significant negative correlation was found between alpha index in EEG and anxiety trait score.

Other studies have shown a significant correlation between Alpha index in EEG and anxiety. Ullet et al[13] in 1953 reported a significant relationship between "anxiety proneness" and the amount of Alpha activity in the resting EEG. Subjects with higher anxiety proneness ratings had less developed alpha and more   fast activity whereas those who were less anxiety prone tended to have more abundant alpha activity . Ullet's "anxiety proneness" appears to describe anxiety trait score

of our study and so it seems to be in agreement with our study.

The anxiety levels measured by Rastogi's Self-evaluation scale for anxiety state, trait and free-floating anxiety in male and female subjects are similar hence these two populations can be regarded as one with respect to anxiety. Females showed a lower alpha index in EEG as compared to males and it is statistically significant. There is no study which shows a similar finding.

The results of Lindsey[14] in 1951 and Roubicek[15] in 1970 were also similar. Lindsey showed that anxiety patients have evidence of absence of alpha waves and more fast activity in EEG. Roubicek found that anxious patients tend to show low voltage, fast records and had significantly higher ratio of beta to alpha type of wave pattern in their EEG. Our study is in agreement with these studies too.

The other measure of cerebral cortical arousal used in this study, Alpha appearance time in EEG showed a statistically significant positive correlation with anxiety trait score. This is in agreement with other studies. Mundy Castle et al [16] reported in their study that the alpha rhythm appeared earlier in less anxious patients after closure of eyelids, other conditions of illumination of the room etc being constant, than in high anxiety subjects where the alpha rhythm appeared late or did not appear at all after closure of eyelids. Hence it is found in this study that Alpha index and Alpha appearance time in EEG are good measures of Anxiety trait.

REFERENCE 1. Jung, C. J., Psychology of the Collective Unconscious, Regan Paul and Co. Ltd, First Edition, 1968; 78-79. | 2. Spence, K. W. and Haggard, quoted by Upadhyay, Sripathy, Anxiety a multidimensional study, Rupa Psychology Centre, First Edition, 1978; 65-66. | 3. Spence, K. W. and Taylor, J. Psychology of Learning and Motivation, Mc Graw Hill, First Edition, 1971; 13. | 4. Euler quoted by Upadhyay, Sripathy, Anxiety, a multidimensional study, Rupa Psychology Centre, First Edition, 1978; 128. | 5. Malmo and Amsel, quoted by Upadhyay, Sripathy, a multidimensional study, Rupa Psychology Centre, First Edition, 1978 ; 125. | 6. Ulett, G. A., Gleser, G., Winokur, G. and Lawler, A., The EEG and reaction to photic stimulation as an index of anxiety proneness, Electroencephal. Clin. Neurophysiol., 1953c; | 22-23. | 7. Tripathi, R. R., Rastogi Ambar, Manual for Self-evaluation scale of A-state, A-trait and A- free-floating, | Oct 1986; 7-10. | 8. Storm van Leeuwen, W., Bickford, R., Brazier, M., Cobb, W. A., Dondey, M., Gastaut, H., Gloor, P., Henry, C. E., Hess, R., Knott, J. R., Kugles, J., Larry, G. C., Loeb, C., Magnus, O., Oller, Daurella, L., Petsche, H., Schwabb, R., Walter, W. G., and Wider, L., for an EEG Terminology Committee of the International Federation for Electroencephalography and Clinical Neurophysiology, Electroenceph., Clin., Neurophysiol. 1966; 20, 306-310. | 9. Saul, L. J., Davis, H., Davis, P. A., Correlation between electroencephalograms and then psychological organization of individuals, Trans Amer, Neurol. Ass. , 1937; 63, 167-169. | 10. Berlyne, D. E., and Mc Donnell, P., Effect of stimulus complexity and incongruity on duration of EEG desynchronization, Electroenceph. Clin. Neurophysiol., 1965; 18, 156-161. | 11. Jasper, H. H., Cortical excitatory state and synchronism in the control of bioelectric autonomous rhythm, Cold spr. Harb. Symp. Quant. Biol. 1936; 4, 320-328. | 12. Well's, C. E., Alpha wave responsiveness, Ing. Glaser (Ed.), EEG and Behaviour, Basic Books, New York, 1966; 27-39. | 13. Ulett, G. A., Gleser, G., Winokur, G. and Lawler, A., The EEG and reaction to photic stimulation as an index of anxiety proneness, Electroenceph. Clin. Neurophysiol., 1953c; 91-92. | 14. Lindsey, quoted by Upadhyay, Sripathy, Anxiety, a multidimensional study, Rupa Psychology Centre, First Edition, 1978; 132. | 15. Roubicek, quoted by Upadhyay, Sripathy, Anxiety, a multidimensional study, Rupa Psychology Centre, First Edition, 1978; 133. | 16. Mundy-Castle, A. C., The relationship between primary- secondary function and the alpha rhythm of the electroencephalogram, J. Nat. Inst. Personnel Res, 1978; 6, 95-102. |