Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Effect of Examination Stress on Memory and EEG

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Received: November 2019
Accepted: November 2019

ABSTRACT

Background: Prevelance of stress among the medical students is observed. Stress is associated with the cognitive performance and memory development. **Methods:** A total 336 male and female MBBS students were analysed when they are not facing with facing university examination with memory scale and electroencephalogram. **Results:** Results show in males increase in remote memory, delayed recall, immediate recall, retention of dissimilar pair, beta wave and decrease in recent memory, mental balance, alpha wave, delta wave. In females increase in remote memory, attention and concentration, visual retention and decreased delta wave. Positive correlation is between alpha wave and remote memory, recent memory, mental balance, attention and concentration, delayed recall, retention of similar pairs, recognition. Beta wave correlate with attention and concentration, delayed recall, immediate recall, retention of dissimilar pair, visual retention, recognition. Theta wave correlate with recent memory, mental balance, immediate recall. Delta wave correlate with delayed recall, retention of similar pair, retention of dissimilar pair, visual retention. **Conclusion:** In conclusion examination stress effect memory as observed in both memory scale and EEG.

Keywords: Examination stress, Memory, EEG.

INTRODUCTION

Stress is outcome observed among medical students.Normally, in our body and mind an alarm occurs which cannot able to justify the difference between what the individual has to do and what he has done.[1] Hans Selye by presenting a general adaptation syndrome introduced the term 'stress' in medical studies.[2] The stress response can be measured a)become aware of something through the sense b) behavioural and c)physical responses.[3] The three are threatening conditions for homeostatic imbalance such as injuries to individual.[4]

Several studies have reported that relatively greater right frontal activity is relation with negative reactions to emotional stimuli.[5] While relatively greater right frontal activity shows with a number of negative mood states or behaviors example depression, fear and withdrawal. One who perceived negative emotion or mood state that has received less attention and concentration due to stress.[6]

EEG shows a good correlation with the mental stress in terms of suppression of alpha waves add improvement of theta waves.[7] These results suggest that theta wave repet one after other may play an important role to organise the information network provided by working memory, and this network operates as an integrated unit by means of synchronization in the theta band, consistent with earlier studies.[10] Earlier findings suggest that alpha, associated with theta, in transit phase reflect the transition of information from manipulation to maintenance state of working memory tasks.[7] Alpha rhythm at 8-13Hz occurring during wakefulness over the occipital areas in the posterior regions of the head. Alpha wave with higher voltage seen with eyes closed and under conditiondition of relaxation and no relative mental inactivity.[9] Increased alpha activity (8-12Hz on the EEG frequency band) was shown to be an indication of brain inactivity, while decreased in alpha activity was an indication of greater brain activity.[7] EEG shows how one person feel stress when sensory stimuli received and other person may not feel dtress when received same stimuli.[8]

Power spectrum analysis showed an increase of 0.25–4.0 Hz in all experimental manipulations, whereas the 4.25–8.0 Hz increase occurred only in the situation of forced wakefulness plus stress.[10] This problem solving and picture recognition task reduces the alpha wave than a person at rest as high power alpha wave is being observed.[10]

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MATERIALS AND METHODS

Study: The present study is a cross-sectional study.

Sample size: 340, Prevelance=30%, Z=1.96 for 95% confidence interval.

Study design: The study is conducted Department of Physiology, Santosh Medical College, Ghaziabad in collaboration with Govt. Medical College, Kannauj. Ethical clearance was taken from both the institutions.

Upon young male and female first year students of age 20.03± 2.70 years. The PGI memory scale is used to assess the effect of examination stress on memory .The EEG is used to assess the effect of examination stress on brain. The baseline parameters were taken at the time of joining when they are not facing any examination and next, the parameters were taken one month before the university examination. The following inclusion and exclusion criteria are followed throughout the study period.

Inclusion criteria:

1 year medical students of either sex with good general, physical and mental health aged between 18 to 25 years.

Exclusion criteria:

Subjects with the history of any one of the following was excluded from the study: Anxiety and depression, smoking or alcohol intake or tobacco cheweres.

Methodology: Questionnaire and the task present in the PGI memory scale was used.

EEG was measured by neurocompact 32 and electrode placement was done by 10-20 medicaid system.

RESULTS

The paired two tailed t- test was done between two scores and0.05 value is considered statistically significant to draw any conclusion. Pearson correlation value 0.05 was considered as significant.

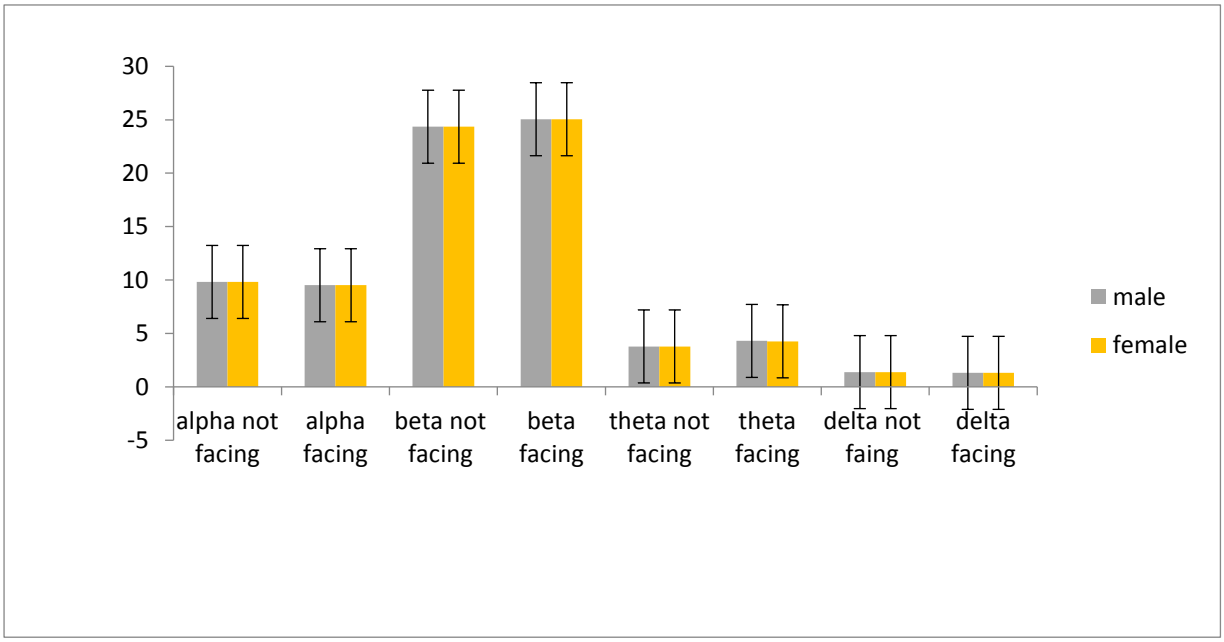

Figure 1: EEG frequency (Hz) distribution

Table 1: Memory performance value and EEG (Hz) of male and female medical students:

Variable	Male (168)			Female (168)		
	Mean	std	p-value	mean	std	p-value
remote memory not facing examination	5.129	±1.52		5.05	±1.43	
remote memory facing examination	5.323	±0.86	0.00037	5.24	±1.21	0.00018
recent memory not facing examination	4.635	±0.8		5.06	±1.13	
recent memory facing examination	4.45	±0.84	0.002	4.84	±1.14	
mental balance not facing examination	3.764	±0.49		4.36	±1.42	
mental balance facing examination	3.386	±0.43	0.027	2.18	±0.38	
att&conc not facing examination	3.55	±1.24		3.05	±1.23	
att&conc facing examination	3.481	±1.51		3.56	±1.48	0.001
delayed recall not facing examination	3.654	±0.97		3.93	±1.52	
delayed recall facing examination	4.28	±0.99	0.002	4.29	±1.6	
immediate recall not facing examination	4.45	±0.99		3.2	±1.05	
immediate recall facing examination	3.23	±1.38	0.002	3.33	±1.27	
retention for similar pair not facing examination	3.759	±0.56		3.47	±1.1	

retention for similar pair facing examination	2.423	±0.87		3.33	±1.08	
retention for dissimilar pair not facing examination	4.64	±0.56		3.58	±0.56	
retention for dissimilar pair facing examination	5.24	±1.88	0.0007	5.63	±1.47	
visual retention not facing examinatiom	8.79	±0.41		7.19	±2.11	
visual retention acing examinatiom	8.81	±0.88		7.77	±2.18	0.01
recognition not facing examination	8.71	±0.82		8.03	±2.12	
recognition facing examination	9.11	±0.84		8.26	±2.17	
EEG frequency in Hz	**Male**			**Female**		
	Mean	**std**	**p-value**	**Mean**	**std**	**p-value**
alpha wave hz not facing examination	9.82	±1.51		9.82	±1.185	
alpha wave hz facing examination	9.51	±1.27	0.011	9.51	±1.13	0.006
beta wave hz not facing examination	24.35	±2.51		24.35	±3.27	
beta wave hz facing examination	25.05	±3.48	0.028	25.05	±3.51	0.075
theta wave hz not facing examination	3.78	±0.77		3.78	±0.44	
theta wave hz facing examination	4.3	±1.2		4.26	±1.21	0.08
delta wave hz not facing examination	1.38	±0.49		1.38	±0.48	
delta wave hz facing examination	1.31	±0.46	0.03	1.31	±0.46	0.05

Correlation of the memory scores with EEG frequency of male and female students n=336:					
variable	alpha	beta	theta	delta	p-value
remote memory facing examination	0.002	-0.08	-0.004	-0.065	p>0.05
recent memory facing examination	0.017	-0.087	0.059	-0.11	p>0.05
mental balance facing examination	0.018	-0.079	0.11	-0.04	p>0.05
att&conc facing examination	0.003	0.077	-0.11	-0.0049	p>0.05
delayed recall facing examination	0.01	0.098	-0.02	0.05	p>0.05
immediate recall facing examination	-0.001	0.139	0.004	-0.0025	p>0.05
retention for similar pair facing examination	0.036	-0.005	-0.166	0.088	p>0.05
retention for dissimilar pair facing examination	-0.04	0.078	-0.695	0.08	p>0.05
visual retention acing examinatiom	-0.018	0.02	-0.0165	0.071	p>0.05
recognition facing examination	0.006	0.008	-0.14	-0.014	p>0.05

Significant increased in remote memory (p-0.00037), delayed recall (p-0.002), immediate recall (p-0.002), retention for dissimilar pairs (0.0007) increased and decrease in recent memory (p-0.02), mental balance (p-0.027) in male. Significant increased in remote memory (p-0.00018), attention &concentration (p-0.001), visual retention (p-0.01) in female. Significant decreased in alpha wave (p-0.011), delta wave (0.03). Increase in beta wave (p-0.028) in male volunteers. Significant decreased in alpha wave (p-0.006) and delta wave (0.05) in female volunteers.

After finding the results correlation of each component of memory scale with alpha, beta, theta and delta frequency separately upon 336 medical students to see the effect of examination stress on memory performance. Positive correlation in alpha wave with remote memory (r=0.002), recent memory (r=0.017), mental balance (r=0.018), attention &concentration (r=0.003), delayed recall (r=0.01), retention of similar pairs (r=0.036), recognition (0.006).The author find positive correlation in beta wave vs attention & concentration (r=0.077), delayed recall (r=0.098), immediate recall (r=0.0139), retention of dissimilar pairs(r=0.078), visual retention (r=0.02), recognition (r=0.008). Positive correlation in theta wave vs recent memory (r=0.059), mental balance (r=0.11), immediate recall (r=0.004). Positive correlation in delta wave vs delayed recall (r= 0.05), retention of similar pairs (0.088), retention of dissimilar pair (r=0.08), visual retention (r=0.071).

DISCUSSION

Individual are divided into five groups depend upon their reactivity to face stress. Delayed recall and remote memory task increase of memory because these tasks are used in laboratories. Questionnaire is the best for the self- evaluation. Decreased mental balance due to cognitive overload. Attention & concentration are the cognitive mood representor regulated by exogenous and endogenous environment support,[1] Facilitation increases the task of dissimilar pair and visual retention, delayed recall and retention for dissimilar pair develop memory synapse due to reward and punishment activity, in lateral frontal cortex support,[6] Decrease in recent memory the anxious young male cannot solve arithmetical and mathematical task. Fear response does not correlate with recent memory development in young adult as observed beta wave in EEG .Event related tasks increase old memory but decreases new memory in males. Time bound decrease mental balance, recent memory task and increases anxiety in young males observed decreased alpha wave in EEG and decrease in mental balance due to work overload to a certain extent in young adults. Overload task decreases mental balance support.[6]

Training increase attention and concentration in young females. Attention and concentratration improves training at any adverse condition to overcome stress in young adult. New questionnaire decreases recent memory to an extent that the individual can adjust but memory cannot be developed. System task overload decrease in mental

balance in male adult. By increasing immediate recall and visual recognition task the trainee of a particular field learns more quickly than other individual support.[4]

Due to anxiety and depression, activity right frontal cortex decreases observed desynchronized alpha wave in EEG.in right prefrontal cortex low power alpha wave observed in EEG. Alpha wave desynchronizes in recent memory development process. Alpha wave power is increased to develop smooth and repetitive process. Alpha wave is decreased as working memory is processing to encode the synaptic neuronal development support.[7]

The relation between positive emotion like facilitation and greater left frontal activity observed theta wave in EEG. The theta wave synchronise as recent memory is ongoing process of encoding to develop new memory synapses. Alpha wave desynchronizes and theta wave is synchroniz when recent memory is developed support.[9]

The correlation between beta wave and attention concentration type of behaviour. The difference in BAS and BIS score. Aggressive behaviour with shyness than sociability is seen in right fronta cortex as observed beta wave in EEG. Agressive behaviour with more sociability than shyness seen in left frontal cortex observed. Visual retention of picture show arousal behaviour which the individual recognizes, observed beta wave in EEG stored as remote memory in the prefrontal cortex observed alpha wave in EEG support.[10]

CONCLUSION

In conclusion examination stress causes environmental cues, mood cues, facilitated behavior increase theta frequency in left frontal cortex and decrease alpha frequency enhance memory development during examination period effect memory as observed in both memory scale and EEG.

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How to cite this article: Kalita BC, Tripathi Y, Garg R. Effect of Examination Stress on Memory and EEG. Ann. Int. Med. Den. Res. 2020; 6(1):PH06-PH09.

Source of Support: Nil, **Conflict of Interest:** None declared