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Effect of organized recreational games on executive function of procrastinating female students

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Abstract
Executive function is higher order cognitive function associated with self-regulation, self-control with a medium to the functions of plan, initiate, inhibit, organize and manage any task. Procrastination is a psychological behavior of delaying task that disturbs self-control and self-regulation. The aim of the study was to find out the effect of organized recreational games on executive function of female procrastinate students. Twenty female college students aged 21.9±2.15 years were selected out of two hundred female students based on the high score of Procrastination Scale Questionnaire. The subjects further divided into equal experimental and control group randomly. The experimental group performed organized recreational games for four-week with a frequency of three days per week. One-way ANCOVA indicated a significant improvement in executive function of experimental group than control group about 36.7% of effect size in partial eta square. The changes may be due to the anatomical changes in the brain that led to behavioral changes.

Keywords: Executive function, procrastination, recreational games, physical activity

Introduction
The need of understanding, predicting and developing Executive function is in exponential growth to ensure quality of life through developing physical, physiological and psychological aspects of human being (Gray-Burrows *et al*., 2019; Laureys *et al*., 2022) [12, 19]. It is very much essential to the students as it helps in attention and self-regulation (Arnaldi, 2014) [1]. There are several factors that influence Executive function are age, gender, academic achievement, sleep amount, drug use, mindfulness practice etc. of the students (Haenjohn, Supwirapakorn, & Sirithadakunlaphat, 2020). Physical activity, sports, and dance are important ways to improve self-efficacy, self-awareness, and social skills, all of which are positively correlated with the development of executive function (Navayuth & Yurayat, 2022) [22]. Physical Activity can be of any kind of physical movement by the skeletal muscles that exert energy and performed in various fields and various forms (Caspersen *et al*., 1985) [4]. There are two areas of brain controlling and regulating two specific forms of Executive function such as cold that is controlled and regulated by dorso-lateral prefrontal cortex which is associated with planning, reasoning and problem solving; whereas the other one is hot that is controlled and regulated by ventro-medial prefrontal cortex associated with social behaviour, experience of reinforcement and complex emotions (Grafman & Litvan, 1999) [11]. The deficit in this cognitive function make a large impact in the academic performance (Ramos-Galarza *et al*., 2019) [26]. It is found that reduced executive function is related to the increased risk of depressive disorders, anxiety disorders, ADHD, oppositional defiant disorder and conduct disorder in children and also these psychiatric disorders may increase the risk of reducing executive function of the brain (Halse *et al*., 2022) [14]. These forms of disorders are highly associated with the hypoactivism or failure to activate the brain regions such as left dorso-lateral prefrontal cortex, frontoparietal cortex and cerebellum (Shanmugan *et al*., 2016) [30]. Motivation in the form of reward trigger the activation of dorsolateral prefrontal cortex of the brain that may have the tendency to elicit neural efforts resulting in developing the state of cognitive health of youth (Taylor *et al*., 2004) [31]. The Executive function can strongly predict the academic procrastination by analysing the components of this cognitive function such as initiation, plan inhibit, self-monitor, working memory, task monitor and organization of materials (Rabin *et al*., 2011) [25]. It has reported that students showed higher procrastination found poorer in executive function with confining poor time

management, lack of planning and poor judgement (Rinaldi *et al*., 2021) [29]. The failure in self-regulation to prioritise short term mood repair probably increase the tendency of procrastination (S. Zhang *et al*., 2019) [38]. Procrastinators even face problems in attention and processing of executive function during any task related behaviour which may be due to the reduce in P300 amplitudes of event related potentials (Michałowski *et al*., 2020) [21]. Procrastination is well linked with anxiety as the Hippocampal prefrontal cortex (HPC)-Prefrontal cortex (PFC) pathway regulates poorly over negative thought (R. Zhang *et al*., 2022) [37]. It has found that limbic-prefrontal connection is well associated with working Memory and procrastination as well (Chen *et al*., 2021) [40] where limbic system of brain controls and regulates emotion, memory and motivation. The reason behind procrastination may be underlying triple brain anatomical network model that describes the psychological and neural dysfunction of self-control, emotion regulation and episodic prospection. Physical activity found to be effective and has negative impact on Academic Procrastination. It is also to be taken into consideration that type of exercise also plays an important role in improving or impairing cognitive function (Lambourne & Tomporowski, 2010) [18]. There are several scientific evidences that link the executive function and procrastination through neuro-physiological aspects and physical activity, exercise led to improve executive function. But there are very few studies that has establish the link between recreational games and executive function specially on procrastinators. There is urges to understand the effects of different forms of exercise on executive function of procrastinators to provide best application in general life to lead better life.

Aim of the study: The aim of the study was to find out the effect of four-week organized recreational games on executive function of procrastinating female students.

Subjects: Twenty (20) sedentary female college students aged 21.9±2.15 years were selected from two hundred females tested procrastination by the help of Procrastination Scale. The subjects scored high in this were selected for the study. The subjects divided into Experimental group (n=10) and Control group (n=10) randomly.

Variables

To fulfil the objective of the study the dependent variable was Executive Function (EF), the cognitive function of brain to plan, organize, initiate, manage any task; the independent variable was a four week recreational activity.

Tool and Technique

To measure procrastination first Procrastination Scale (Lay, 1986) [41] was used, the Executive Function was measured by the computerized neuro-cognitive test CNS Vital Sign-VS4. The Shifting Attention Test was used to assess Executive Function.

Procedure

The subjects were selected preliminarily on the basis of surveyed by the Procrastination Scale (Lay, 1986) [41] of two hundred female college students of Panskura Banamali College, West Bengal, India. Twenty subjects were selected from those who scored high in the scale and divided them equally into Experimental and Control group randomly. The subjects were assessed EF by Shifting Attention Test as Pre-test. Four weeks of recreational activity were given to the Experimental group about sixty minutes thrice in a week. The Control group were instructed to lead the normal life and avoid any kind of training. The Post-test was taken after four weeks. The recreational games were designed with general activities that provided fun and enjoyment in team work.

Data Analysis and Interpretation

To analyse the data descriptive statistics such as Mean, Standard Deviation (SD), Standard Error of Mean, Maximum, Minimum, Skewness, Kurtosis were used. Shapiro-Wilk test was used to analyse the assumption of normality of the data, for the assumption of difference of pre-test for both the groups, one way ANOVA was used, to assume the linearity F test was used to determine the interaction of Group and pre-test and to assume homogeneity leaven's test was used and finally ANCOVA was used to determine the difference in post-test between Experimental Group and Control Group with controlling pre-test. The level of significance set at 0.05.

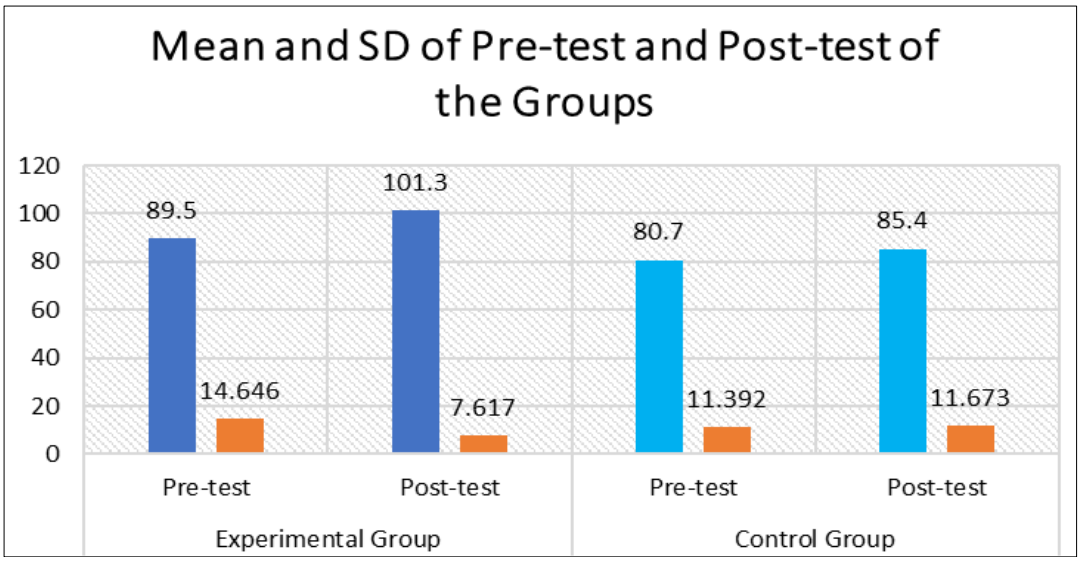

Fig 1: Mean and SD of pre-test and post-test of experimental group and control group of executive function

Table 1: Descriptive statistics of pre-test and post-test of experimental group and control group of executive function

Group	Condition	N	Mean	SD	SEM	Maximum	Minimum	Skewness	Kurtosis
Experimental Group	Pre-test	10	89.5	14.646	4.631	114	70	0.507	-0.794
	Post-test		101.3	7.617	2.409	114	87	-0.271	0.365
Control Group	Pre-test	10	80.7	11.392	3.603	97	62	-0.328	-0.929
	Post-test		85.4	11.673	3.091	96	66	-0.711	-1.418

Table No.1 showed that there was an increase in Executive function for both the groups in Post-test over Pre-test where the mean of Experimental group in Pre-test was 89.5±14.646 and 101.3±7.617. In case of Control group, the mean in Pre-test was 80.7±11.392 and in Post-test was 85.4±11.673.

Table 2: Test of Normality

Conditions	Group	Shapiro-Wilk		
		Statistic	DF	Sig.
Pre-test	Experiment	0.945	10	0.613
	Control	0.955	10	0.726
Post-test	Experiment	0.977	10	0.947
	Control	0.815	10	0.022*

Table No.2 showed the Shapiro-Wilk test for the assumption of normality of the data where it revealed that there was no evidence of non-normality in the data but in case of Post-test of Control group violated the assumption.

Table 3: Test of between-subjects effects of pre-test

Dependent Variable	Pre-test				
Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Group	387.200	1	387.200	2.249	0.151
Error	3098.600	18	172.144		

Table No.3: revealed that there was no difference in Pre-test between Experimental group and Control group as F (1,18) =2.249, p=0.151. Therefore, the assumption of difference in Pre-test between group was not violated.

Table 4: Test of between-subject effects

Dependent Variable	Post-test				
Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Group	166.518	1	166.518	2.758	0.116
Pre-test	776.096	1	776.096	12.853	0.002
Group * Pre-test	86.248	1	86.248	1.428	0.249
Error	966.105	16	60.382		

Table No.4 revealed that the assumption of homogeneity of regression slope was not violated as the interaction of Group and Pre-test was not significant F (1,16) =1.428, p=0.249. Table 5 showed that there was homogeneity of the variances as Levene's test of equality of error variances showed no evidence of significance where F (1,18) =2.506, p=0.131.

Table 5: Test of Homogeneity

Levene's Test of Equality of Error Variances			
F	df1	df2	Sig.
2.506	1	18	0.131

Table 6: ANCOVA to determine difference in post-test between groups

Dependent Variable	Post-test					
Source	Type III Sum of Squares	DF	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1960.197[a]	2	980.098	15.833	0.000	0.651
Intercept	1177.302	1	1177.302	19.018	0.000	0.528
Pre-test	696.147	1	696.147	11.246	0.004	0.398
GROUP	611.432	1	611.432	9.877	0.006*	0.367
Error	1052.353	17	61.903			
A. R Squared = .651 (Adjusted R Squared = .610)						

Table 6 represented ANCOVA to determine the changes in Post-test between Experimental and Control group with controlling Pre-test after the assumption. The result showed that there was a significant difference in Post-test as F (1,17) =9.877, p=0.006 after controlling the Pre-test where partial eta square denotes a moderate treatment effect (ηp^2 =0.367) about 36.7%

Discussion of Findings

After meeting all the assumptions, one-way ANCOVA revealed that there were significant effect of recreational games on Executive Function of female procrastinate students. Executive Function is a goal directed cognition and behaviour (Best, 2010) [2] and it is the component that may help in construction of self-regulation. It is found that physical activity is well beneficial for the patients of

Alzheimer's disease (Zhu *et al*., 2020) [39] as physical activity may lead in increasing the size and volume of prefrontal and hippocampal areas of brain that may reduce the risk of memory impairment. It may be physical activity which has the natural capacity to develop better neural connections and improve cognition. Cardiovascular or coordinative forms of exercise were found to produce improvement in brain functioning (Voelcker-Rehage & Niemann, 2013) [34] as exercise facilitates neuroplasticity that helps in behavioural adaptations. Improving executive processing has found due to exercise as it increases the volume of those processing areas of brain of children with cerebral palsy (Ploughman, 2008). Exercise is also evidence to increase the volume of grey matter in the brain (Erickson *et al*., 2014) [9] and grey matter functions as to control movement, memory and emotions. Moderate intensity, moderate volume physical activity is well influential in grey matter volume of Dorsolateral prefrontal cortex and hippocampus region. Physical exercise has the tendency to improve working memory, a component of executive function has found in mild to moderate depressed adults. The probable mechanism underlying to reduce depression due to exercise may be the enhanced neurogenesis in the adult with increased synaptic plasticity and synaptic growth in the hippocampus of the brain. Acute bout of exercise can trigger exercise-induce arousal which activate cortical regions of brain that improve executive function.

Activities that demand cognitive approach promotes better in context of developing executive function. The changed and challenging situation in sports demand quick anticipation and adaptation that makes talented sportsperson more efficient in movement accuracy with possessing better quality of executive function. Working memory and cognitive flexibility-two subcomponents of executive function have found improves better after attending any sport activity program that consist with cognitive stimuli in children. Activities that increase difficulties experienced neural activation and cortical networking (Rietschel *et al*., 2012) [28]. The scientific literatures are well evidence that physical activity is beneficial for the improvement in executive function for the case of mental disabilities and disorders with the structural and functional changes in brain. Along with it activities where continuous approach of thinking and involving such as recreational games may also helpful in developing executive function.

Previous studies reported that irrespective of disorders, physical activity is well influential in developing of various factors of brain that are closely related with Executive function in terms of structure and functions. The microscopic changes in brain due to designed physical activities may improve the behavioural and social aspects.

Conclusion

From the finding of the study and reviewed scientific literatures, it may be concluded that there is positive effect of organized recreation games on executive function of procrastinating female students.

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