

Effects of Single Bout of Aerobic Exercise with Different Intensities on Cognitive Function in Young Adults

Divya¹, Sharma C.²

Abstract

Background: Several studies have suggested an inverted U-shaped relationship between aerobic exercise intensities, moderate levels of exercise increased physiological arousal and facilitated cognition however, when physiological arousal approached a maximal level, cognitive performance began to deteriorate. The majority of the studies reviewed report that exercise induced arousal influences cognitive performance, but it does not follow U-shaped function. There are very limited evidences in this field. Thus, this study is designed to evaluate the effects of a single bout of aerobic exercise with different intensities on cognition function in young adult. *Aim:* To compare the effect of single bout of aerobic exercise with different intensity on cognitive-function in young adults. *Methodology:* Ninety subjects were recruited based on inclusion and exclusion criteria, out of which 30 subjects were included in each group, Group A-(AEMI), Group B-(AEHI) & Group C- (control). Score of ST and d2 Test were recorded and compared respectively pre and post aerobic exercise with different intensity. *Result:* The study showed that all the groups regimes showed improvement in ST & d2 test score. On comparing the groups, results were significant in ST score but non-significant in d2 test score. ST & d2 score is better in Group A compare to Group B & Group C. *Conclusion:* AEMI show significant improvement in ST & d2 score compared with AEHI and Control-group.

Keywords: AEMI-Aerobic Exercise Moderate Intensity; AEHI-Aerobic Exercise High Intensity; Cognitive-Function; Attention; Stroop Test.

Introduction

Cognition is the process of knowing, including awareness, reasoning, judgment, intuition and memory.¹ Cognitive processes are important because they relate to daily function and span broad areas, including memory and executive control processes [2]. Attention acts as the mind's "gatekeeper" by regulating and prioritizing the stimuli processed by the central nervous system. It is essential for cognitive performance, memory, and behaviour [3]. Attention is playing a major role in the process of structural and functional maturation of the brain through adolescence to adulthood [4].

The transition to adulthood is an important period in life. Young adults move from ages 18 to 30 has potentially important implications for health, well being, and quality of life in later adulthood [5].

Aerobic exercise has positive effects on the brain as it improves cognitive function [6]. Intensity of aerobic exercise was operationalized in various ways: Moderate-intensity at 50-70% of HRR or High-intensity exercise at 71-90% of HRR [7].

Several studies and meta-analyses have suggested an inverted U-shaped relationship between aerobic exercise intensities, moderate levels of exercise increased physiological arousal and facilitated cognition, however, when physiological arousal approached a maximal level, cognitive performance began to deteriorate [8]. The majority of the studies reviewed report that exercise induced arousal influences cognitive performance, but it does not follow the U-shaped function [9]. Today people are less active than in previous generation which affect the attention in this age group. There are very limited evidences in this field. Thus, this study is designed to evaluate the effects of a single bout of aerobic

Author Affiliation: ¹2nd year Neurology ²Lecturer, Department of Physiotherapy, Swami Rama Himalayan University, Dehradun, Uttarakhand 248016, India.

Reprint Request: Divya, MPT 2nd year, Neurology, Department of Physiotherapy, Swami Rama Himalayan University, Dehradun, Uttarakhand 248016, India.
E-mail: divya.2012.12@gmail.com

Received on 21.10.2017, Accepted on 13.01.2018

exercise with the different intensities on cognition function in young adult.

Methodology

The current study was conducted in Himalayan Institute of Medical Science after taking approval from the ethical committee. It was an experimental study conducted in 6 months in 2016-17. Patient between the age of 18 to 30 years, with BMI score 18.5 - 22.9 were included in the study. Patient who had any musculoskeletal disorder, neurological disease, cardio-respiratory dysfunction were excluded from the study.

Ninety subjects were found eligible for the study & were included in this study, out of which 30 were included in Group A (AEMI), 30 were included in Group B (AEHI) & 30 were included in Group C (control-group). Pre and post score of ST & d2 test were recorded.

Procedure

After selecting the sample based on inclusion and exclusion they will be made to sign an informed consent form. A detailed explanation of the testing procedure and purpose of the test, and including the nature of the test was given to the subject. Then asked to the subjects not to eat or smoke for two hours prior to the study session, and to wear comfortable clothing and shoes to the session.

In all 3 groups, before protocol began the resting heart rate (HR_{Rest}) was measured and also took the Stroop test and d2 test.

The protocol began with a five minute warm-up period consisting of two minutes of walking at 3.0m/s followed by three minutes of running on treadmill. A warm-up phase was used to gradually increase

workload to raise each subject's heart rate according to the aerobic exercise intensity level.

Intensity was measured by using Heart Rate Reserve (HRR) method that is

$$HRR = HR_{Rest} + (HR_{max} - HR_{Rest}) \times \text{Level of Intensity of the exercise.}$$

In this HR_{max} was measured by age-predicted HR_{max} equation (220-age). Moderate intensity (MI) level 50-70 % and High-intensity (HI) level 71-90%.

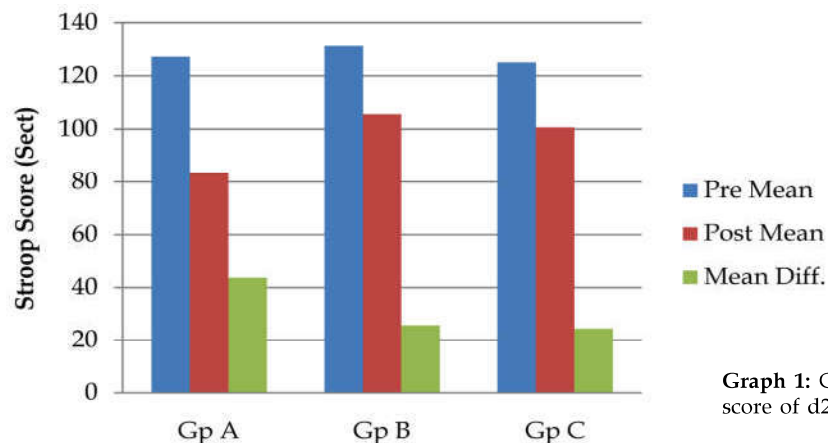
Subjects exercise at this level for 15 min before completing a 3-min cool-down during which the workload was removed. After the subject completing exercise protocol and 3 min cool-down session, then immediate took again stroop test and d2 test and the score was recorded.

Data Analysis

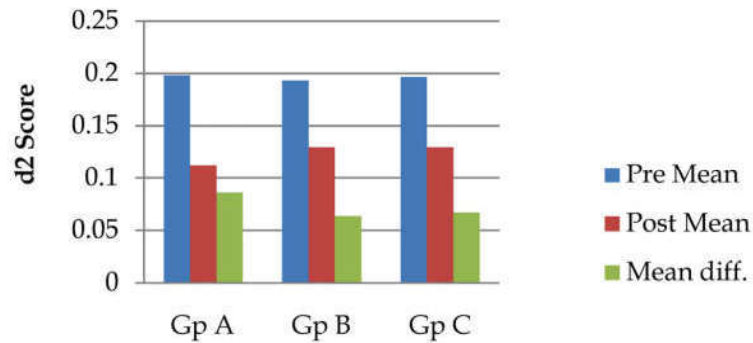
Statistically analysis were performed by using SPSS version 20. Data were reported as Mean \pm SD and statistical significance was assumed at $P \leq 0.05$. Paired t-test was used to analyze and compare the score within the group and One-way ANOVA was used to analyze and compare the score between the groups. The initial score of stroop and d2 test score compared with the immediate after exercise session. A significance level of $p \leq 0.05$ was set for data analysis.

Result

Two variables were included i.e. ST & d2 test. The result of the present study showed that all the groups A, B & C regimes showed improvement in the ST & d2 test score. On comparing the groups, the results were statistically significant in ST score but non-significant in d2 test score. ST & d2 score is better in group A compare to Group B & Group C.



Graph 1: Comparison of Mean diff. of Pre and Post score of d2 Test between the groups A, B & C.



Graph 1: Comparison of Mean diff. of Pre and Post score of d2 Test between the groups A, B & C.

Discussion

The current study measured the two variables i.e. ST & d2 test score before and after the protocol session. We found a significant improvement in all 3 groups. Aerobic exercise with moderate intensity show highly significant improvement in ST & d2 test. A Possible explanation is that increased oxygen consumption to the brain, it has been suggested to be responsible for improved cognitive function A.F karker [10]. Ayelet studied “The effects of a resistance vs. an aerobic single session on attention and executive functioning in adults” and suggested that adults should consider augmenting both modalities into their training routines, which may improve their cognition in addition to providing other physical benefits [11].

Mike studied with the aim of examines the effect of exercise intensity on cognitive performance, they indicate when physiological arousal and cognitive anxiety are at their highest, the effect on performance will be at its worst which is what was found in the present study at an exercise intensity of 90% [7].

Conclusion

Aerobic exercise with moderate intensity show statistically significant improvement in ST & d2 test score compared with aerobic exercise with high intensity and control group. A future study with It can be done with large area population, using different age group, using different Hand dominance and done with assess the subject exertion level during the exercise.

Limitation of Study

The present study was done in limited area

population, and also had the limitation to assess the subject exertion level during the exercise

References

1. O’ Sullivan. Physical Therapy 2014;6:1150.
2. Giorno, Miller et’ al. Cognitive Function During Acute Exercise: A Test of the Transient Hypofrontality Theory. Journal of Sport & Exercise Psychology, 2010;32:312-323.
3. Annette M. Starr. Attention performance in young adults with learning disabilities. Learning and Individual Differences 2004;14:125-133.
4. Richard J. Et’ al, (2015). Investing in the Health and Well-Being of Young Adults. Pp 37.
5. Arnett JJ. Emerging adulthood: A theory of development from the late teens through the twenties. American Psychologist 2000;55:469-480.
6. Colcombe S, Kramer AF. Fitness effects on the cognitive function of older adults: a meta-analytic study. Psychol Sci 2003;14:125-130.
7. Mike Smith et’ al, The Effect of Exercise Intensity on cognitive performance during short duration treadmill Running. Journal of Human kinetics 2016;51:27-35.
8. McMorris T, Graydon J. The effect of incremental exercise on cognitive performance. Int J Sport Psychol; 2000;31:66-81.
9. Yerkes, R. M., & Dodson, J. D. The relation of strength of stimulus to rapidity of habit formation. Journal of Comparative Neurology and Psychology, 1908;18:459-482.
10. Kramer AF, Hahn S, Cohen NJ, Banich MT, McAuley E, Harrison CR, et’ al. Ageing, fitness and neurocognitive function. Nature; 1999;400:418-419.
11. Ayelet Dunskey et’ al, The effects of a resistance vs. an aerobic single session on attention and executive functioning in adults. Journal of PLoS ONE 2017;12(4):1-13.