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Original Article

Effect of exercise on cognition in healthy males. A comparative study.

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Abstract

Cognition is an intellective action of understanding and gaining knowledge through speculation, acquaintance and practices that result in awareness, impression and perception. Cognition, Proprioception and balance all are aspects of ability of the brain to perform at high level at expense of endurance, speed and power. However, increasing age is linked with decrements in periodic memory. Thus, exercise positively impacts brain utility during middle age, particularly frontal lobe-mediated intellectual processes, like organization, programing, reticence and operational memory. The aim of the present study was to observe whether exercise improve cognitive skills or not. The study was conducted on 200 healthy male subjects equally divided in two groups: exercising males and non-exercising males. The subjects were asked to fill in a proforma consisting of visual test and a reading test, which aimed at comparative evaluation of the duration of short term memory between exercisers and non-exercisers. It was found that exercise impacts on frontal lobe to enhance intellectual processes and hippocampus memory processing.

Keywords

Exercise, cognition, hippocampus, memory.

Introduction

Cognition is an intellective action of understanding and gaining knowledge through speculation, acquaintance and practices that result in awareness, impression and perception. It describes intellective processes that are involved in gaining knowledge and apprehension, including knowing, thinking, judging, remembering and problem-solving. They all are brain's higher-level functions and beset intelligence, language, inventiveness, planning and perception (Clegg, 2015). Exercise positively impacts brain utility during middle age, particularly frontal lobe-mediated intellectual processes, like organization, programing, reticence, and operational memory. Exercise also has the advantage of improving cognitive enactment supports the imperious for interferences that are fruitful in enhancing physical performance, with the results of stimulating fitness and efficiency (Ratey and Loehr, 2011). Cognition in cognitive and psychology sciences is referred to a view of information processing of psychological functions of an individual. It is called social cognition in branch of social psychology to analyze mood, ascription and group fluctuations. Cognition, Proprioception and balance all are aspects of ability of the brain to perform at high level at expense of endurance, speed and power (Clegg, 2015). Gross motor control for stabilization or movement of the muscle fibers is the function of cerebral cortex while the fine motor control of the muscle fibre is the function of cerebellum. These fine motor controls are used for accurate movements which are skill based (Clegg, 2015).

Eight Habits that Improve Cognitive Function

- Physical Activity
- Openness to Experience
- Curiosity and Creativity
- Social Connections
- Mindfulness Meditation
- Brain-Training Games
- Enough Sleep
- Reduce Chronic Stress (Bergland, 2014).

Physical activity is somewhat an acute response stress that facilitates an individual to react to the alarm response. The rapid reaction system is the central nervous system along with sympathetic nervous system where perception and elucidation occurs. And the peripheral nervous system where coordination is made with effector muscles (Wilbourn and prosser, 2003). Physical activity is favourable for brain health and cognition while certain hormones that are elevated during exercise also help to improve memory, cognition and protects against neuro-degeneration as individuals engaged in physical activity had a lower risk of dementia (Bergland, 2014). Leisure-time

physical activity (LTPA) executed at least two times a week generated extreme neuroprotective effects for individuals transversely across sex, capricious grades of genetic vulnerability and ages (Tolppanen, et al., 2014). Eustress and a definite amount of neural provocation are necessary to ensure ideal performance (Wilbourn and prosser, 2003).

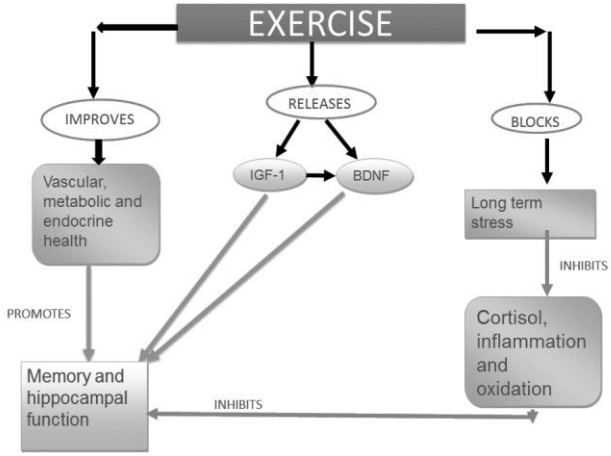


Fig: 1 Benefits of exercise (Laux, 2015)

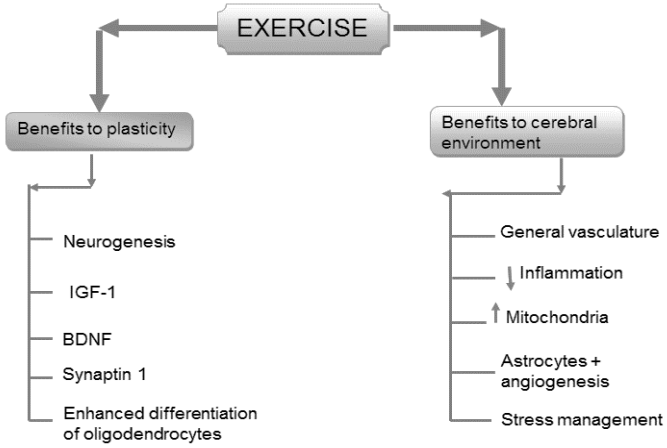


Fig: 2 Effects of exercise on brain (Laux, 2015)

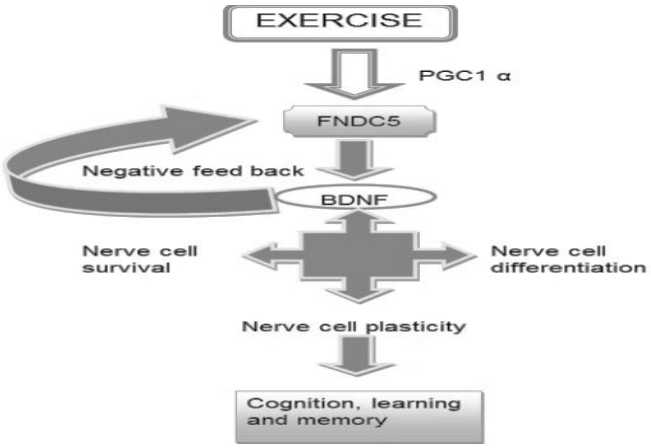


Fig: 3 Exercise Induces Hippocampal BDNF through a PGC-1α/FNDC5 Pathway (Wrann, et al., 2013).

Neurons are petulant; changes in their surrounding can change their rate of depolarization and results in changing behavior, feelings and ways of thinking. Normal cognitive functions can become reversibly compromised when physiological or biochemical fluctuations occur in the surrounding of nerve cells. Psychosomatic stress sources a series of neural and endocrine reactions that assist to preserve the individual in an active state of enthusiasm to deal with challenge (Wilbourn and prosser, 2003). Thickness of cortex of athletes is more in some areas and it is related to outstanding visual processing ability (Wei, et al., 2011) while thickness of superior temporal sulcus is involved in training experience of athletes (Lahnakoski, et al., 2012). Physical activity unswervingly progresses the blood flow to the brain and increases the functional ability of innumerable neurotransmitters that are involved in intellectual procedures. Mood enhancing properties of physical workout may ultimately employ an affirmative effect on cognitive working (Kashihara, et al., 2009).

During endurance exercise, brain produced specific molecule through chain reaction called irisin, which have a neuro-protective effect. Artificially increasing irisin levels in blood over expresses genes that are involved in learning and memory. Neurogenesis is also stimulated by the release of brain-derived neurotrophic factor (BDNF) during aerobic exercise (Bergland, 2014). BDNF controls irritation, recovers the communication of signals within cells, and also adjusts the functions of the synapses.
Physical activity aids both sexes, but there is some indication that it might be of better advantage to females (at older ages). This may be related to the presence of estrogen.

Brain regions affected by exercise
Nevertheless, the prominence located on the hippocampus, an important area for knowledge and remembrance. Specifically, it is found that decision-making functions were particularly improved by exercise that is primarily taken in the prefrontal cortex. It is also found that there is reduced grey and white matter in the frontal, temporal, and parietal cortexes of those who were less physically fit. The differences in the middle-frontal and superior parietal regions of the brain were also found due to aerobic fitness. Interestingly, it was also possibly found that higher cognitive function *during* sustained and moderate exercise reliant on the prefrontal cortex were weakened, but not those demanding little prefrontal activity (Dietrich and Sparling, 2004).

Methodology

The study was conducted on 200 male subjects, in the age group of 19-32, bearing weight in the range of 50 kg to 90 kg and height in the range of 5ft to 6ft. They were all the resident of Karachi, Pakistan and were not suffering from any pathological condition at the time of survey. Survey was done randomly in the campus of University of Karachi as well as from local gyms of Karachi city.

Standard Group:
It comprises of 100 subjects. The individuals of this group were used as a control. Questionnaire was filled by the individual consisting of visual and reading short term memory test and time was calculated. All the subjects in this group were healthy and were not engaged in any sort of physical activity or exercise.

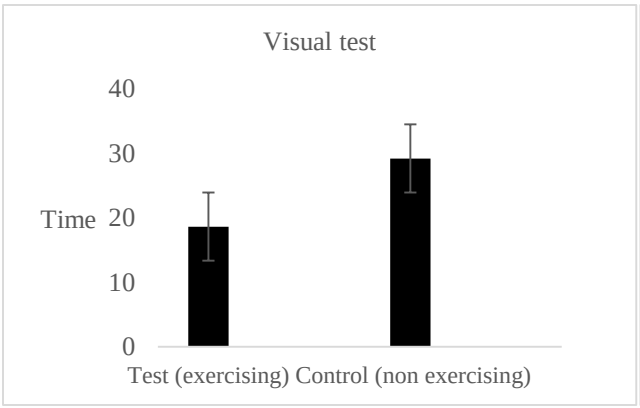
Experimental Group:
It comprises of 100 subjects. The individuals of this group were used as test. Questionnaire was filled by the individual consisting of visual and reading short term memory test and time was calculated. All the subjects in this group were healthy and were engaged in exercise from couple of years.

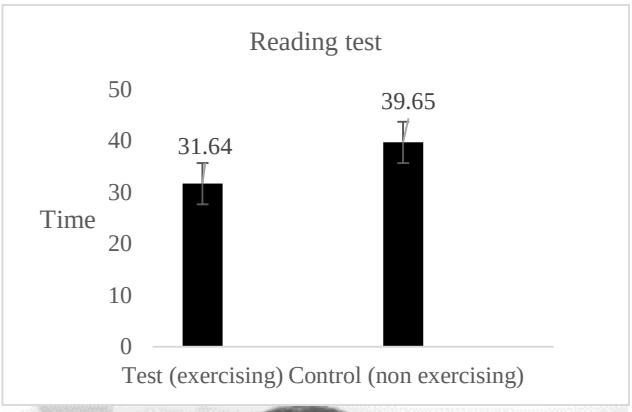
Result
All the individuals show increase in their cognitive skills after exercise as took less time during reading and visual test while testing short term memory.

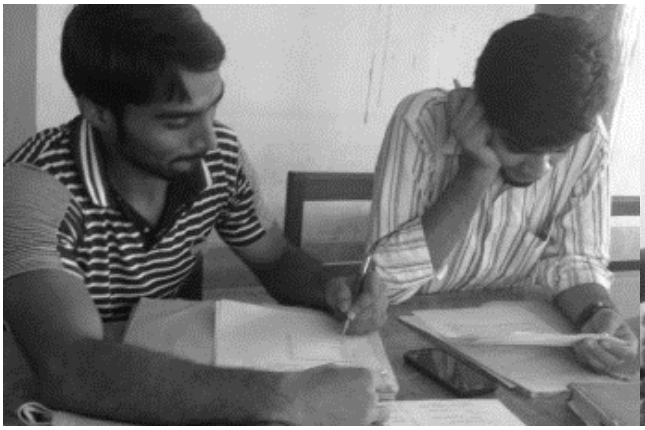
Reading test:
Subjects took about 8% (10.57 ± 5.285) less time to complete reading test than control group indicating increased short term memory after exercise.

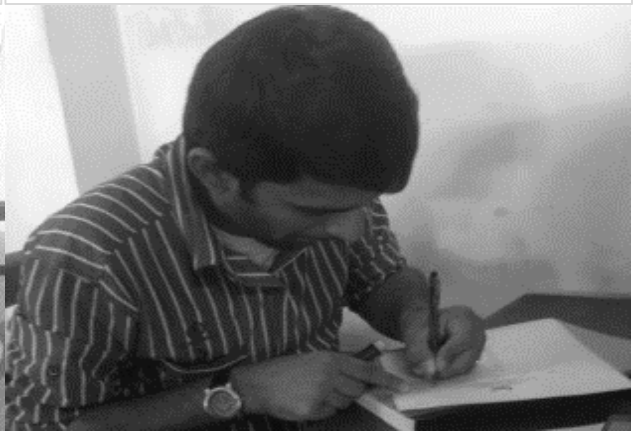
Visual test:
Subjects took about 11% (8.01 ± 4.005) less time to complete visual test than control group indicating enhanced cognitive skills after exercise.

Parameter	Non Exercising Males	Exercising Males
Visual test (time in seconds)	29.21 ± 2.4893	18.64 ± 1.4365
Reading test (time in seconds)	39.65 ± 1.7691	31.64 ± 1.5995









Discussion

Time taken by exercising males is far less than non-exercising group in visual test. P value was found to be 0.001 in visual test, which is less than 0.05, so difference between exercising group and non-exercising group is significant. Exercise positively impacts frontal lobe-mediated intellectual processes during middle age (Ratey and Loehr, 2011).
Thickness of cortex of athletes is more in some areas that are related to outstanding visual processing ability (Wei, et al, 2011). Psychosomatic stress sources a series of neural and endocrine reactions that assist to preserve the individual in an active state of enthusiasm to deal with challenge (Wilbourn and prosser, 2003).

Time taken by exercising males is less than non-exercising group in reading test. P value was found to be 0.000 in reading test, which is less than 0.05, so difference between exercising group and non-exercising group is significant indicating increased exercise induced cognitive skills. Physical activity is favourable for brain health and cognition while certain hormones that are elevated during exercise also help to improve memory and cognition (Bergland, 2014). It was found that exercise impacts on frontal lobe to enhance intellectual processes. Exercise also impact hippocampus memory processing as observed by reading test. Specifically, it is found that decision-making functions were particularly improved by exercise that is primarily taken in the prefrontal cortex (Dietrich and Sparling, 2004).

Conclusion

Exercise do increase memory along with cognitive skills and also improve hippocampal function by elevating level of hormones like irisin and elevating levels of brain derived neurotropic factor that ultimately improves synaptic plasticity. Further investigations could also be done in this field by doing animal studies on mice using Morris water maze that is widely used to study spatial learning and memory.

Competing Interests

No competing Interests found.

Acknowledgment

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