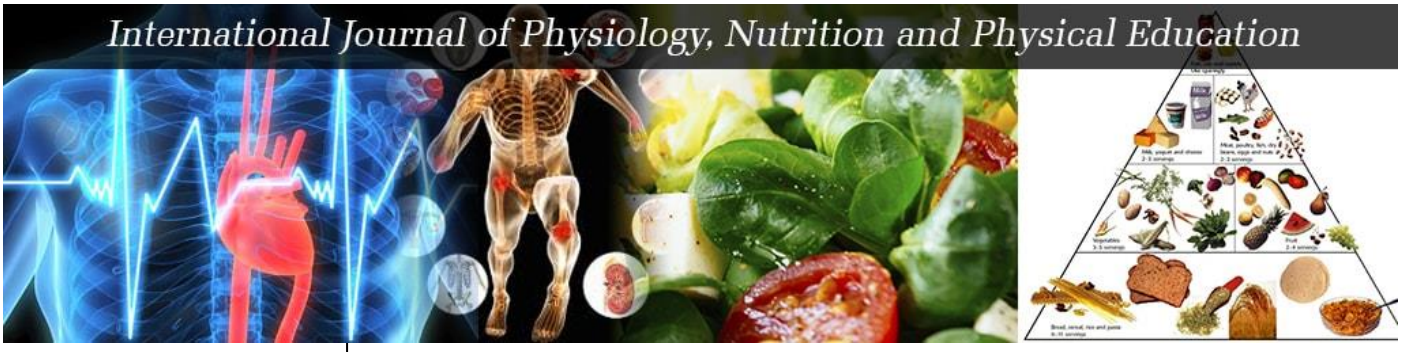

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Swimming: preferable aerobic exercise for younger population - enhances memory

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Abstract
Compared to other exercises, swimming does not cause too much pressure on the body and it can be enjoyed by anyone regardless of his/her gender. Animal models have shown that Regular physical exercise particularly swimming promotes enhancement of memory. But study on humans to study the effect of swimming on memory are lacking. And since Pre university education is the important stage of a student's life which demands good memory and cognitive abilities, this study was done to assess the effect of swimming on memory among Pre-university students. Pre-university students who regularly swim at least 30 min for 4 days a week from past 1 yr and students who are non swimmers were tested for Working (short term) and long term memory with Buschke Selective Reminding Test (SRT). Results indicated that subjects who used to swim regularly had better overall memory and long term memory storage than non swimmers, might be due to the effect on neuro-chemical processes, structure and function of hippocampus.

Keywords: Swimming, exercise, students, memory, hippocampus

1. Introduction
Memory refers to the complex processes by which the individual encodes, stores, and retrieves information [1].
The benefits of exercise and physical fitness on mental health and cognitive performance are well documented [2, 3]. Regular exercise has been shown to exert numerous beneficial effects on brawn as well as brain [4, 5, 6]. The most important favorable effects on the body include increased utilization of oxygen by muscles, increased blood flow to vital organs, improved short-term memory and decreased oxidative damage [7]. Moderate aerobic exercise is shown to improve cognitive performance but heavy bouts of physical activity interfered with information processing and memory [8].
Animal research has indicated that aerobic exercise is related to increased cell proliferation and survival in the hippocampus as well as enhanced hippocampal dependent learning and memory. Regular physical exercise particularly swimming promotes enhancement of memory which appears to be the result of enhanced neurogenesis [9]. And also evidences suggest that high aerobic fitness levels in older adults are associated with increased hippocampal volume and superior memory performance [10].
The present study aimed to further extend the link between fitness and memory to a sample of adolescent age group.
Since Pre-University, is the most important and critical phase in the system of education in India, because it is at this stage that the student has to decide on the specialization to pursue in future. And at this stage students are in need of good cognitive abilities and memory [11].
In the light of above, the present investigation was undertaken to assess the effect of swimming on memory among Pre-university students.

2. Materials and methods
2.1 Participants
Twenty four pre-university students from a college in Bengaluru with ages ranging from 16-18 years who regularly swim at least 30 min for 4 days a week from past 1 yr and twenty four pre-university students who are non swimmers were recruited for the study.

A routine clinical examination showed that they all had normal health. Sleep disorders, history of medical/surgical illness, and psychiatric disorders were pre-set conditions for exclusion from the study. And those who perform other regular physical activity, sports and yoga were also dropped from the study. Institutional ethical clearance was obtained prior to the study. The study protocol was explained to the subjects and the guardians and their signed consent was obtained. Later they were screened for their hearing. The participants were then tested for Working (short term) and long term memory with Buschke Selective Reminding Test (SRT) [1].

2.2 Buschke Selective Reminding Test (SRT) Procedure

It involves reading to the subject a list of words and then having the subject recall as many of these words as possible. Each subsequent learning trial involves the selective presentation of only those items that were not recalled on the immediately preceding trial.

A series of 12 unrelated words (e.g., Garden, Doctor, Metal, City, Money, Cattle, Prison, Clothing, Water, Cabin, Tower, Bottle) were presented over 12 selective reminding (SR) trials, or until the subject was able to recall the entire list on three consecutive trials. A cued-recall trial was supposed to be presented after the 12th or last selective reminding trial, where first two or three letters of each word will be presented on an index card, and the subject will be asked to recall the corresponding list word. But since all subjects were able to recall entire list on 3 consecutive trials before 12 trials, cued-recall trial was not given to any subjects.

2.3 Buschke Selective Reminding Test (SRT) Abbreviations and definitions of scores

LTS - If a word is recalled on two consecutive trials, it was assumed to have entered long-term storage (LTS) on the first of these trials.

LTR - When a subject recalled a word that has entered LTS, it was scored as long-term retrieval (LTR).

STR - Short-term recall referred to recall of a word that has not entered LTS.

Total Recall - Number recalled over 12 trials – maximum 144.

2.4 Statistical analysis

The Descriptive statistics were used, i.e. mean and standard deviation (SD) for describing the parameters. The data was analyzed using paired t-test to compare between the groups. The difference was considered statistically significant when P0.05. SPSS V.16.0 was used for analysis of data.

3. Results

Socio-demographic profiles of swimmers and non-swimmers group were comparable. Age of participants in swimmers group was 17.2±1.32 years whereas that of non- swimmers group participants was 17.4±1.22 years. Swimmers group participants were regularly swimming for a period of 1.3±0.4 years. Swimmers group comprised 24 participants out of which male and female were 13 and 11 respectively, whereas in case of non- swimmers group, male and female were 12 each.

Comparison of Scores of SRT between Swimmers and non Swimmers group is represented in Table 1. On comparing the total number of words recalled over 12 trials by the swimmers and non-swimmers, there was a significant difference found (p value – 0.022). Numbers of words recalled were significantly more in swimmers (130.8±2.69) compared to non-swimmers (127.4±2.98). Number of words which entered long-term storage (LTS) was also significantly (p value – 0.0012) more among swimmers (126.3±3.09) than non-swimmers (121.2±1.93).

Number of words recalled which had entered long term storage was also more among among swimmers (125.7±2.75) than non- swimmers (124.9±1.791). But there was no significant difference (p value – 0.104) found.

Table 1: Comparison of Scores of SRT between Swimmers and non Swimmers group

SRT	Swimmers group (n=24)	Non Swimmers group (n=24)	P-value
	Mean±SD	Mean±SD	
Total score	130.8±2.69	127.4±2.98	0.022*
LTS	126.3±3.09	121.2±1.93	0.0012***
STR	5.8±1.398	7.5±1.581	0.003***
LTR	125.7±2.75	124.9±1.791	0.104

*P<0.05 significant, ***P<0.005 highly significant difference

4. Discussion

The present study was intended to study the effect of regular swimming on memory of Pre University students. Results indicate that subjects who used to swim regularly at least 30 min for 4 days a week from past 1.3±0.4 years had better overall memory and long term memory storage than non swimmers.

To treat both physical and mental problems, aerobic exercise is generally recommended, with swimming as the main type suggested [12]. Compared to other exercises, swimming does not cause too much pressure on the body and it can be enjoyed by anyone regardless of his/her gender [13]. In one more study, the four factors in swimming, including water, buoyancy, water pressure, resistance, and water temperature, were used to show that the effects and stability of this type of exercise can be maximized more than the effects of doing ground exercises [14].

Present study showed beneficial effects of preferable aerobic exercise for all age groups – swimming, on memory performance among the Pre University students.

The results are consistent with animal models that indicate aerobic activity positively impacts hippocampal structure and function and thus memory performance [15]. Given that the neuro-chemical processes involved in hippocampal changes with exercise in rodents are also involved in human brain development and organization, it seems possible that aerobic fitness may impact the brain during childhood and adolescence, a period of significant cognitive and neural development [16, 17]. For example, changes in gray and white matter during brain development are said to reflect the interplay among changes in cell proliferation / apoptosis, dendritic branching / pruning, synaptic formation / elimination, growth factors (e.g., BDNF, IGF), and myelination [18]. These cellular underpinnings parallel exercise induced neural effects including changes in cell number, dendritic complexity, synaptic plasticity, and growth factors

[15]. The current study provides initial evidence for the impact of exercise on the childhood brain by revealing that greater aerobic fitness level in preadolescents is related to greater hippocampal volume.

In one more study done on elderly, it was shown that 1 year of aerobic exercise was sufficient for enhancing hippocampal volume. Increased hippocampal volume translates to improved memory function and higher serum BDNF. They also demonstrated that higher fitness levels are protective against loss of hippocampal volume. These results clearly indicate that aerobic exercise is neuro-protective [10].

All the evidences underline the importance of aerobic exercise and few studies highlighting the effect of swimming in particular on enhancement of memory performance by positively impacting the neuro-chemical processes, structure and size of hippocampus.

The results of present study provide a foundation for future developmental research by suggesting that swimming may relate to the brain and memory performance of younger population. And suggest that physical fitness programs especially swimming should be integrated into educational curriculums not only for public health purposes but also because swimming may benefit brain structure and function. Hopefully, the present findings will encourage modifications of educational and health care policies which emphasize the importance of swimming on physical and cognitive health.

5. Limitations

While the present cross-sectional study provides a first step in understanding the relationship between swimming and memory, a cross-sectional design raises the possibility that the observed differences might have caused by another factor (e.g., genes, motivation, personality characteristics, nutrition, intellectual stimulation, etc.). Thus, randomized, controlled trials are necessary in future to account for potential selection bias and to establish a direct relationship between swimming and memory among adolescents.

6. Conclusion

Regular swimming has a beneficial effect on memory among Pre-university students. Including swimming in the curriculum of high school and Pre University education might help the students have better memory and thus brighter future.

7. References

1. Esther STRAUSS, Elisabeth MS. Shermann, Otfried Spreen. A compendium of neuropsychological tests.3rd ed. New York: Oxford university press, 2006
2. Chaddock L, Erickson KI, Prakash RS *et al*. A neuroimaging investigation of the association between aerobic fitness, hippocampal volume, and memory performance in preadolescent children. Brain Res. 2010; 1358:172-183.
3. Colcombe S, Kramer AF. Fitness effects on the cognitive function of older adults: a meta-analytic study. Psychol Sci. 2003;14:125-130
4. Vijay Kumar K, Naidu MUR. Effect of oralmelatonin on exercise-induced oxidant stress in healthy subjects. Indian Journal of Pharmacology. 2002; 34:256-259.
5. Tong L, Shen H, Perreau VM, Balazs R, Cotman CW. Effects of exercise on Geneexpression profile in the rat hippocampus. Neurobiology of Disease. 2001; 8:1046-1056.
6. Ahmadiasl N, Alaei H, Hanninen O. Effect of exercise on learning, memory and levels of Epinephrine in rats Hippocampus. Journal of Sports Science and Medicine. 2003; 2:106-109.
7. Radak Z, Kaneko T, Tahara S, Nakamoto H, Pucsok J, Sasvari M *et al*. Regular exercise improves cognitive function and decreases oxidative damage in rat brain. Neurochemistry International. 2001; 38:17-23.
8. Tomporowski PD. Effects of acute bouts of exercise on cognition. Acta Psychologica. 2003; 112:297-324.
9. Milind Parle, Mani Vasudevan, Nirmal Singh. Swim every day to keep dementia away. Journal of Sports Science and Medicine. 2005; 4:37-46.
10. Kirk Ericksona I, Michelle Vossb WC *et al*. Exercise training increases size of hippocampus and improves memory. PNAS. 2011; 108(7):3017-3022.
11. Available from. http://www.onlinebangalore.com/educ/puc/puc.html
12. Banz WJ, Maher MA, Thompson WG, Bassett DR, Moore W, Ashraf M *et al*. Effects of resistance versus aerobic training on coronary artery disease risk factors. Exp Biol Med. 2003; 228:434-440.
13. Ussher M, West R, McEwen A, Taylor A, Steptoe A. Efficacy of exercise counselling as an aid for smoking cessation: a randomized controlled trial. Addiction 2003; 98:523-532.
14. McNeal RL. Aquatic therapy for patient with rheumatic disease. Rheum Dis Clin North Am. 1990; 16:915-929.
15. Cotman CW, Berchtold NC. Exercise: a behavioral intervention to enhance brain health and plasticity. Trends Neurosci. 2002; 25:295-301.
16. Caviness VS, Kennedy DN, Richelme C, Rademacher J, Filipek PA. The human brain age 7–11 years: a volumetric analysis based on magnetic resonance images. Cereb. Cortex. 1996; 6:726-736.
17. Casey BJ, Getz S, Galvan A. The adolescent brain. Dev Rev. 2008; 28:62-77.
18. Gogtay N, Giedd JN, Lusk L, Hayashi KM, Greenstein D, Vaituzid AC *et al*. Dynamic mapping of human cortical development during childhood through early adulthood. PNAS. 2004; 101:8147-8179.