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Original Research Article

Effect of willingness of exercise on learning, memory and motor skills- An observational study

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ABSTRACT

Context: Cognition and motor skills both play a foundational role in the development of healthy perceptual, social life. Due to lack of exercise motor dysfunction and cognitive impairment is seen in young adults. Aerobic exercise has emerged as a lowcost treatment to improve neurocognitive function. Hence this study was undertaken to study the effects of willingness to exercise on cognition and motor skills.
Aims: To measure learning, memory and motor skills in medical students.
Settings and Design: Department of physiology. An observational study.
Materials and Methods: In this study the one hundred fifty students were given a self-prepared questionnaire which gives information about willingness to exercise. Among these students two groups were made based on inclusion and exclusion criteria each consisting 15 students. One group willing to exercise and other not willing to exercise. Every week a set of students were examined for learning, memory and motor skills by star mirror drawing apparatus, Recall and recognition test**,** Tweezer Dexterity testrespectively.
Statistical Analysis: The data obtained was entered in master chart and analysed using Student's paired t test for statistical significance.
Results: The mean scores for the willingness to exercise group in recall -recognition and tweezer dexterity were higher. In star mirror tracing test the number of errors made by both the groups were same but standard deviation was less in willingness to exercise group than in normal control group.
Conclusions: Willingness to exercise improves learning, memory and motor skills.
Key Messages: WHO defines exercise is a subset of physical activity that is planned, structured and repetitive improvement or maintenance of physical fitness. There is a positive relationship between physical activity and cognition in children aged 4-18 years. Hence it is responsibilities of parents and teachers to teach about importance of exercise.

1. Introduction

Cognition and motor skills both play a foundational role in the development of healthy perceptual, social life. Due to lack of exercise motor dysfunction and cognitive impairment is seen in young adults. Aging leads to functional changes in the hippocampus, a brain structure that is important for learning. The ability to learn new tasks decreases with age. On the cellular level, synaptic contacts, synaptic strength, and plasticity are reduced. In addition, hippocampal neurogenesis is diminished with aging. In elderly humans, imaging studies have shown hippocampal atrophy. These deleterious consequences of aging may be prevented or reversed by exercise.[1]

Health experts often remark that if exercise came in pill form it would be the most sought-after drug on the market. Exercise is the bodily activity that enhances overall health hence nowadays aerobic exercise has emerged as a promising low-cost treatment to improve neurocognitive function. For decades, research has frequently identified

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exercise as an important tool for enhancing a range of physical indices from balance, bone density, strength, and endurance to lipid profiles, blood pressure, and cardiovascular health. More recent studies have associated exercise with improved brain health and improved profiles for markers of cellular aging.[2]

Over the last several decades, numerous studies have tested both the effects of single, acute bouts of exercise and longer term (e.g., 3- or 6-month) interventions. In a review of 43 studies assessing performance on various cognitive tasks following single, acute bouts of exercise, exercise has been linked to improvements in cognitive performance in young adults.[3]

In medical students cognition and motor skills play a very important role in their career. But there is a very less studies done on the medical students to assess the effect of willingness of exercise on cognition and motor skills.

In our study we intend to evaluate the willingness of exercise and its effect on cognition and motor skills, so we can motivate the students to imbibe the lifestyle changes like exercise in day-to-day activity.

2. Materials and Methods

In this study first year medical students were recruited for the study. Institutional ethical clearance was obtained. The study was conducted in department of physiology. Here the 150 students were given a self-prepared questionnaire which gives information about willingness to exercise or not. Among these students two groups were made based on inclusion and exclusion criteria each consisting 15 students. One group willing to exercise and other not willing to exercise. Inclusion criteria includes Healthy adults in the age group of 18-20 years and Willing to exercise. Exclusion criteria includes Any physical/ mental illness, Substance abuse- alcohol/ tobacco/ drugs and those with no knowledge of English.

Every week a set of students were called for the study in the noon between 1-2pm when they had free time and written informed consent was taken from each participant. Later students were examined for learning, memory and motor skills by star mirror drawing apparatus, Recall and recognition test**,** Tweezer Dexterity testrespectively.

2.1. Methodology

Start mirror drawing apparatus. The task involved drawing a line between the two lines of a six-pointed star while looking in a mirror to observe the movements of the hand.[4] A shield prevented the subject from looking directly at the pattern which was placed on a board and was visible in the mirror (Anand Agencies, Pune, India). The subjects were asked to begin tracing with their dominant hand. Tracing with dominant hand began from the point of their choice and then proceeded either clockwise or anticlockwise. The participants traced the star using Pencil. The students were given three chances to draw the star by seeing the image on the mirror for learning. The next three chances were given to assess the learning. The number of errors that is line going out of the two outlines while tracing the star was recorded. The mean value of three assessment made were considered for the evaluation of learning. 2. Recall and recognition test. The short-term memory of students was assessed by recall and recognition test. Here the participants were given a fifty words to read and memorise. The students were given 3 minutes to recall the words and next 3 minutes to recognize the same words mixed with other new words. At the end of 6 minutes test scores was evaluated by counting the number of words they have recognized. 3. Tweezer dexterity- The assessment was modelled on the O'Connor tweezer dexterity test.[5] The apparatus was manufactured by Anand Agencies, Pune, India. Subjects were instructed to pick up cylindrical metal pins with a tweezer using the dominant hand and place them in holes in a metal plate, as quickly as possible. They were told to begin the test when the instructor signals them and start the stop watch and time taken to complete the task was recorded. It was noted that all subjects were right hand dominant (for writing, throwing a ball, combing their hair etc.).

2.2. Data analysis

The data obtained was entered in master chart and analysed using Microsoft XL Sheet by Student's paired t test for statistical significance.

3. Results

Total 30 students including 18male and 12 female students participated in this study. The student's paired t test was used to analyse the data between control group and willing to exercise group. The mean scores for the willingness to exercise group in recall -recognition and Tweezer dexterity were higher. In star mirror tracing test the number of errors made by both the groups were same but standard deviation was less in willingness to exercise group (4.92) than in normal control group (10.25).

Table 1: Assessment of learning in two study groups

Groups	n	No of errors (Mean±SD)
Normal control	15	13.78±10.25
Exercising	15	13.78±4.92

Table 2: Assessment of memory in two study groups

Groups	n	No of errors (Mean±SD)
Normal control	15	30.53±8.62
Exercising	15	32.93±7.61

Table 3: Assessment of motor skills in two study groups

Groups	n	No of errors (Mean±SD)
Normal control	15	8:25±1:51
Exercising	15	8:27±1:43

4. Discussion

In the present study willingness to exercise group showed improved learning, memory and motor skills and hence further research with larger sample to be done to know the effect of exercise on cognition and motor skills.

As per our knowledge there is no study on effect of exercise on cognition and memory in medical students. But a study conducted by Shirley tells et al. showed a month of yoga training and also the motivation brings about an improvement in a mirror tracing task.[6] The mirror tracing task is a visual and motor test that involves learning a new motor skill. The act of drawing is a learned skill that requires visual and proprioceptive feedback to control muscle movement. Here willing to exercise group learning was better than the normal control group.

In support to our study motivation to learn yoga influenced the performance of subjects in the dexterity task done by N. K. Manjunath And Shirley Telles.[7] Manual dexterity and the ability to perform rapid, fractionated movements depends on the presence of an opposable thumb[8] as well as on monosynaptic connections between the primary motor cortex and the ventral horn motor neurons in the cervical spinal cord.[9] Dexterous or skilled actions depend on the speed of gross movements of hand and arms, manual rhythm, and co-ordination of eye and finger control.[10] In our study motivation to exercise group finished the tweezer dexterity task faster than normal control group who do not want to exercise.

The hippocampus shrinks in late adulthood, leading to impaired memory and increased risk for dementia. Hippocampal and medial temporal lobe volumes are larger in higher-fit adults, and physical activity training increases hippocampal perfusion. But in a randomized controlled trial with 120 older adults they found out that aerobic exercise training increases the size of the anterior hippocampus, leading to improvements in spatial memory. Exercise training increased hippocampal volume by 2%, effectively reversing age-related loss in volume by 1 to 2 years. The study also demonstrated that increased hippocampal volume is associated with greater serum levels of BDNF, a mediator of neurogenesis in the dentate gyrus. Hippocampal volume declined in the control group, but higher preintervention fitness partially attenuated the decline, suggesting that fitness protects against volume loss. Caudate nucleus and thalamus volumes were unaffected by the intervention. These theoretically important findings indicate that aerobic exercise training is effective at reversing hippocampal volume loss in late adulthood, which is accompanied by improved memory function.[11] As this is a motivation for our study participants, willing to exercise group showed higher mean scores in recall and recognition test than the normal control group.

Limitations of our study is we have assessed the learning, memory and motor skills together wherein we can study each parameter separately with larger sample size. The participants need to be motivated to exercise regularly and evaluate the effect of exercise as a continuation of this study.

5. Conclusion

From this study I conclude that willingness to exercise improves learning, memory and motor skills hence, effect of exercise on the same need to be done with larger sample size for more better results.

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