

Article

Exercise and its impact on memory/cognition

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Abstract: This paper discusses a topic that is not well known by many people in today's society. The majority of the human population is well aware that regular exercise will produce extreme physical fitness benefits such as weight loss, increased muscle mass, and an overall improved cardiovascular function; however, they are not aware of the effects exercise has on the brain itself. Exercising regularly is crucial for preventing memory loss and maintaining cognitive function. It may also play a role in slowing the negative effects of those already suffering from diseases such as Alzheimer's. According to the Texas Department of State Health Services, as of 2018, it was estimated that nearly 5.7 million Americans suffered from this disease, and 200,000 of them were under the age of 65 [7]. This paper will discuss the effects of exercise, what exactly occurs in the brain when we perform moderately intense activity, and the truth regarding impacted cognitive abilities for those with memory loss.

Keywords: EXERCISE, COGNITIVE FUNCTION, ALZHEIMERS, MEMORY, BRAIN

1. Introduction

When the average person thinks about exercise and the impacts it has on the human body, the effects they resort to are typically cardiovascular, muscular, or weight loss. What most people do not realize is that not only can exercise prevent us from cardiovascular disease or help us to lose weight or gain muscle, but also it greatly encourages brain cells to grow as we age. According to Dr. Vernon Williams, "Regular aerobic exercise may increase the size of the hippocampus- the part of the brain that is responsible for learning and verbal memory" [1]. The purpose of this paper is to explain that exercise has benefits far beyond physical fitness levels, and to educate people on the positive effects of exercise on their hippocampus and brain cells. A review of this material is relevant in order to increase knowledge on the topic itself, and to educate the author(s) of this article more so they are able to share the details with other people.

In reality, this paper is targeted at a large scope of the general population, specifically those who are not educated on the effects of exercise on memory. Many people can benefit from learning the specifics on the relationship between exercise and memory. The information throughout this paper can be shared and beneficial to family members, patients, those struggling with a disease of the brain, physicians, and so many others. If people knew that exercising is a factor in reducing one's risk of dementia or Alzheimer's, there is a high possibility that they would be more likely to get up and get active. Those living a sedentary lifestyle and not aware of memory benefits are the main target population for this paper. By reading the details incorporated throughout this article, one can expect to learn more about what exercises will enhance their memory, what occurs in the brain during exercise, and the effect that exercise has on those with a disease of the brain.

2. Methods

A literature review was conducted using resources such as Google Scholar and the Texas A&M Libraries Database. EndNote was used to access PubMed. Key words such as "exercise," "cognitive function," "effects on memory," and "Alzheimer's" were beneficial in conducting this research. When the words "exercise and its impact on memory" were typed into a search engine on Google Scholar, over 3

million results were available for further reading. To narrow the research to be more specific, adding “Alzheimer’s” as a keyword provided approximately 30,000 results. Since this is still a very large amount of results to read through, a variety of abstracts were skimmed through to determine which studies were the best to incorporate into this paper. After conclusion of the research, over 50 articles were read and 8 were used in aiding this paper with excess resources, studies, and facts.

3. Exercise Specifics

Most people who live sedentary lifestyles refuse to exercise because they think they have to go run miles and miles, or lift heavy weights to obtain some form of improvement in themselves. Fortunately, this is not the case for bettering your memory and cognition. Any form of exercise is helpful in bettering brain function. It has been shown that cardio exercises are especially beneficial in keeping your mental skills sharp, but participating in more focus related exercises, like yoga, will improve one’s concentration abilities. Weight training is effective in improving one’s selective attention and memory. As long as exercise is performed regularly, it is sure to improve brain function. For those who have not yet reached the point in their life where age-related memory loss becomes a factor, it is even more important for them to begin this exercise journey as soon as possible. No matter the form of exercise that is carried out, studies have shown that it takes about six months to yield the cognitive benefits from exercise, so Dr. McGinnis, a neurology instructor at Harvard Medical School, recommends exercising almost as if it were a medication you take daily. The time he recommends for adequate benefits is 150 minutes of moderate intensity exercise each week [5]. For those who may not be at the point in their journey to reach the 150 -minute marker, some time is better than no time.

4. The Brain

4.1. Chemical Changes

When performing any type of exercise and at any intensity, the sympathetic nervous system becomes stimulated, further releasing adrenaline and noradrenaline. Exercising at higher intensities will stimulate the hypothalamic-pituitary-adrenal or HPA to secrete corticotrophin releasing factor (CFR), vasopressin, and glucocorticoids [6]. Many studies have shown that over a supervised aerobic exercise period, VO₂ max and rating of perceived exertion was improved; nevertheless, delayed memory performance, which is linked to increases in blood flow to the left and right portion of the hippocampus, was also improved. In a study done on rats, exercising on the treadmill yielded better spatial learning and sensory-motor function. It was also found that exercise could reduce the loss of dopamine neurons in the rat model of Parkinson’s disease [6]. In regards to the population of those who are or have been, pregnant, other studies have shown that if a woman exercises during pregnancy, her offspring will have an increase in hippocampal plasticity after he or she is born.

4.2. Effects of Aging

As aging occurs, it is apparent that all humans, and even animals such as the rat, have a reduced rate of neurogenesis. Neurogenesis refers to the creation of new neurons, and is crucial for increased brain activity. In a study done on an adult rodent, exercising increased its rate of neurogenesis in the hippocampus. The hippocampus is a part of the brain that plays a very important role in memory and cognition. Overall, many chemical processes occur within the brain no matter what task is being performed; Nevertheless, when it comes to exercise, different hormones are released that directly contribute to better brain function, and can even reduce stress. It is crucial that society is informed on how much the brain needs to be stimulated through exercise to lower the risk of obtaining a disease of the brain that may lead to permanent memory loss.

5. Effects on Alzheimer’s Patients

5.1 Its not too late

This paper has previously discussed how to reduce one's risk of getting some form of memory loss like dementia or Alzheimer's. In regards to those who may already be suffering with these common diseases, there has also been a plethora of research done on how exercise may slow the degenerative effects of someone suffering. Alzheimer's is extremely common in those 65 or older. The disease refers to a buildup of plaque of amyloid-B (beta), along with atrophy of the brain and tangles of protein tau [4]. For those with mild cognitive impairment, exercise will still allow them to gain improved cognitive function. It has been shown to "improve brain flow, increase hippocampal volume, and improve neurogenesis" [2]. Though exercise may not restore all of the patient's cognition, it has been proven to help it. There is not one specific exercise that has proven itself to prevent or improve Alzheimer's but the most optimal are aerobic exercise and balance training. Aside from the memory aspect of exercise on those suffering from Alzheimer's, it is important to keep them active to reduce their risk of depression and restlessness, and will improve their sleeping habits and physical abilities.

6 Summary/Practical Applications

Exercise is crucial in maintaining physical fitness, but it is so important that society is educated on the positive effects it has on the brain and memory/cognition. Aerobic training and balance exercises in particular yield an improvement in executive brain function, increased attention capacity and procedural memory ability, and a quicker processing speed time. Though exercise is extremely important to make a habit at a young age to prevent diseases related to memory loss, it might also be a key in improving brain function for those already suffering from it.

However, it has been proven through studies on rats and their dopamine levels that exercise will benefit their memory, more research is needed to add to and strengthen the research that has been done. For example, there is a lack of research thus far on exercise aiding memory in humans and which types of exercise are beneficial. Future research will aim to solve these missing pieces in an attempt to help those suffering from memory loss, and those hoping to avoid it for as long as possible.

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Conceptualization, MW; Methodology, MW; Formal Analysis, MW; Writing-Original Draft Preparation, MW; Writing-Review & Editing, RK, MP, MN. All authors read and approved final manuscript.

Conflicts of Interest

Authors have no competing interests to declare. Comments and conclusions drawn do not constitute endorsement by the authors and/or the institution. Authors independently reviewed, analyzed and interpreted the results from this review and have no financial interests in the results of this study.

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