

Physical Activity and Cognition

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Exercise and Cognition

- *Walking is the best possible exercise. Habituate yourself to walk very far.* Thomas Jefferson (1743–1826)
- Researchers have found a robust relationship between physical activity and cognitive ability. We will explore this relationship and a variety of types of exercise.



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Exercise Benefits Older Adults' Cognition and Quality of Life

- Physical exercise has been shown to improve **executive functioning**, which includes:
 - Attention
 - Cognitive inhibition (controlling distractibility)
 - Behavioral (or response) inhibition
 - Problem solving
 - Reasoning
 - Planning
 - Working (or short-term) memory

Classic Study

- Colcombe and Kramer reported the results of an 18-study meta-analysis on the effects of exercise on cognition.
 - Age [Older (66-70 or 71-80) > Younger (55-65)]
 - Type of exercise (Aerobic + Strength > Aerobic)
 - Length (6+ months > 5 or less months)

Exercise and Cognition

- Researchers have since found that physical exercise leads to improvement in executive functioning.
- There are short term benefits (same day and next) and long term benefits that are seen after 6 months.

What type of exercise is best?

- A mixture of aerobic and strength (or resistance) training seems to be quite effective.



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What type of exercise is best?

- Researchers reported that either once-a-week or twice-a-week resistance training sessions for 12 months led to improvements in older adults' cognition and attention.
 - 11% improvement for once-a-week
 - 13% improvement for twice-a-week

Strength or Resistance Training

- Then, researchers found that twice a week resistance training in 70 to 80 year old women, with Mild Cognitive Impairment, led to significant improvement in attention and memory ability.

Yoga can improve cognition

- In a meta-analysis that combined data from 15 studies assessing the effects of yoga on cognition. The improvements were significant and benefitted executive functioning.

Why might Yoga help?

- Increased attention and focus
- Reduced stress
- Physical exercise (both resistance and aerobic)

Tai Chi Can Benefit Mental and Physical Health



Public domain image: https://commons.wikimedia.org/wiki/File:Tai_Chi,_Cannon_Beach.jpg

Tai Chi

- Researchers combined data from 20 studies looking at the effects of Tai Chi on cognition and memory ability in older adults and concluded that Tai Chi has the potential to improve **executive functioning**. Other researchers have shown executive functioning predicts ability to care for oneself and chance of falling.

High Intensity Interval Training (HIIT)

- Research on HIIT has exploded in recent years.
 - Is as good or better than moderate continuous exercise for executive functioning
 - Appears to be quite effective post stroke for walking distance, balance and executive functioning
 - May be more efficient with less time needed

Dance

- Dancing has long been associated with cognitive improvements in older adults.
 - Executive functioning
 - Spatial ability
 - Social engagement
 - Often has dual tasking components

Dual Tasking

Dual tasking is doing a motor and cognitive task simultaneously whereas multitasking is generally attempting to engage in two cognitive tasks at (almost) the same time.

Multitasking by definition will disrupt performance (increased errors and slows reaction time), especially in complex and challenging situations, such as those that occur in military professions.

Dual Tasking

- Pulling named items out of a bag
- Pouring water back and forth between two cups
- Changing speeds to match the coordinator's references to speeds, “Turtle, cheetah, sloth, snail, falcon”
- Exact amount of change from your pocket, “37 cents”

Dual Tasking

- Dual tasking improves cognition greater than no intervention
- Dual tasking improved cognition better than exercise alone
- Dual tasking improves cognition more in older participants
- Dual tasking effects appear to last longer than single task

Open Skill Exercise

- Open skills are performed in a dynamic and changing environment, while closed skills are performed in a more predictable and static environment.
 - Ping pong
 - Pickleball
 - Racquetball
 - Catching

Open Skill Exercise

- Open skills have been associated with improved cognition (e.g., executive functioning) in older adults, possibly because more frontal lobe engagement is needed.

Open Skill Exercise

- Some practical ideas:
 - Bouncing a ball on a treadmill
 - Throw a Kleenex or wash cloth and have people hit it with a racquet, on a treadmill
 - Drop two Kleenexes from your left and right hands, the client needs to watch and then catch (assesses unilateral neglect)

Benefits for Cognitively Impaired

- A recent study found it actually saved \$12,000 per year to offer high quality physical exercise programs to memory care residents relative to a control group that received more typical services.
 - More independent and able to do ADLs
 - More mobile
 - Maybe less likely to experience heart disease and other co-morbidities

Frequency, Intensity, Time and Type (FITT)

	Aerobic	Strength	Flexibility & Balance
Frequency	≥3 days per week, trend to ≥5 days per week *	≥2 days week	2 to 3 days per week
Intensity	Moderate to vigorous **	50% to 80% of 1RM ****	To point of light to mild tension
Time	≥150 minutes/week (moderate-intensity) ***	5 to 30 repetitions, 3 to 14 seconds/rep, 1 to 3 sets	10 to 40 seconds per stretch or position
Type	Rhythmic, continuous physical activity	Body & external weights; all muscle groups *****	Stretch, balance, yoga, all major muscle groups

From: <http://www.healthedpartners.org/ceu/pa-healthyaging/>

Why the link between exercise and memory?

- These are hypotheses:
 - Less stress hormones, which negatively impact brain health
 - Better blood flow
 - More neurogenesis (new neurons)
 - Larger hippocampus
 - Better connections among brain cells

19 Health Benefits Associated with Physical Exercise

1. Reduces the risk of dying prematurely.
2. Reduces the risk of dying from heart disease.
3. Reduces the risk of developing diabetes.
4. Reduces the risk of developing high blood pressure.
5. Helps reduce blood pressure in people who already have high blood pressure.
6. Reduces the risk of developing colon cancer.
7. Reduces feelings of depression.
8. Reduces feelings of anxiety.
9. Helps control weight.
10. Helps build and maintain healthy bones, muscles, and joints.

19 Health Benefits Associated with Physical Exercise

11. Helps older adults become stronger and better able to move about without falling.
12. Promotes psychological well-being.
13. Reduces stress.
14. Reduces chance of dementia.
15. Increases neural plasticity.
16. Faster wound healing and less permanent damage after brain injury.
17. Reduces nicotine craving for people who are trying to quit smoking.
18. Increases speed of reflex and improves balance for those who have experienced a stroke.
19. Helps older adults maintain their driving ability.

Benefit #20

- Physical Exercise Improves Cognitive Ability!

Physical Activity as a Rx for Depression

- In an exhaustive review, Strohle reported that:
 - “A great number of studies suggest that exercise training may reduce depressive symptoms in nonclinical and clinical populations.”
 - Exercise was about as effective as pharmacotherapy or psychotherapy.
 - The longer the exercise program intervention, the greater the cognitive improvement.

Physical Activity as a Rx for Depression

- In an exhaustive review, Strohle (2009) reported that:
 - A dose dependent relationship exists (5X per week was much more effective at reducing depressive symptoms as compared to 3X per week)

Physical Activity as a Rx for Anxiety

- Physical exercise is one of the best and most effective interventions for depression.

Ways to increase overall physical activity levels

1. Take the stairs instead of the elevator.
2. When at an airport, walk instead of using the moving walkways.
3. Try to take a 30-minute walk daily.
4. Plant a garden.
5. Walk or ride a bicycle to run errands, if possible.
6. Join a gym.
7. If you already have a gym membership, schedule some time with a personal trainer to change your workout.
8. Swim.
9. Ask a friend or spouse to exercise with you.
10. Put audio books or interesting podcasts on your device so your workout goes quicker (10% more calories burned).

Summary

- Physical Exercise is great for both our physical and mental health
 - Aerobic and resistance training together appears to better than either alone
 - Tai Chi, Yoga, and HIIT training have all been associated with improvements in executive functioning
 - There are numerous additional benefits of physical exercise
 - Keep the benefits in mind, when trying to motivate clients and connect the exercise to their goals

Up Next

Next, we will discuss ***Nutrition, Cognition and the Brain***