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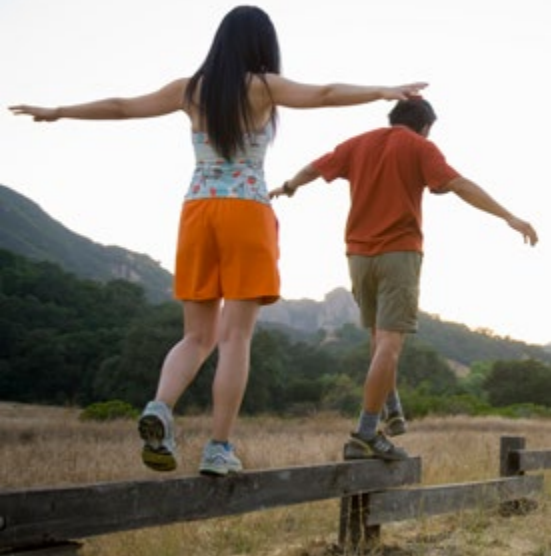

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Letter from the Editor

by Dixie L. Thompson, Ph.D., FACSM

Welcome to the December 2014 edition of the *ACSM Fit Society® Page*, sponsored by Liberty Mutual. We all know that exercise can strengthen our hearts and build stronger muscles and bones. However, can exercise actually improve our brain, too? In this issue, you'll read about how exercise can improve cognition, help individuals struggling with Parkinson's and other neurological diseases, impact kids' performance in school and more.

After you read this information from ACSM experts, please feel free to share it with friends and family. We hope these articles will be helpful you as you pursue a healthy and active life.

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THEME: EXERCISE AND THE BRAIN

Exercise and the Brain: More Reasons to Keep Moving

by Brad A. Roy, Ph.D., FACSM

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This article originally appeared in the September/October 2012 issue of ACSM's Health & Fitness Journal. The benefits of physical activity in preventing chronic health conditions and as a therapeutic approach for people diagnosed with them are well recognized. There is a plethora of medical and scientific evidence documenting how regular physical activity can help prevent and/or treat hypertension, type 2 diabetes, abnormal blood lipids, coronary artery disease, stroke, osteoporosis, arthritis, certain cancers and other conditions. The strength of this evidence has resulted in the American College of Sports Medicine and U.S. Department of Health and Human Services recommending that all Americans undertake a minimum of 150 minutes per week of moderate-intensity aerobic exercise and that children and adolescents participate in 60 minutes or more of daily physical activity. Unfortunately, most Americans do not achieve these recommended minimum levels.

Frequently, people who are physically active will comment that the reason they exercise is because "it feels so good when I'm finished," and while the comment is often made with a bit of sarcasm, it actually may be quite insightful. A growing body of research has begun to demonstrate a number of positive effects of physical activity on brain function, both in youth and adults of all ages. The brain is an amazing organ, consisting of more than 100 billion nerve cells or neurons that communicate with the assistance of hundreds of different chemicals. The neurons have specialized extensions referred to as "dendrites" and "axons." Dendrites serve as the receiving branch of the nerve cell, whereas axons handle outgoing messages to the next neuron. Dendrites and axons do not touch each other but, instead, communicate through a small chemical gap called a "synaptic junction." It is at this junction that the electrical message from the axon is chemically converted and taken across the gap by a neurotransmitter to the receiving dendrite where it is reconverted to an electrical signal.

Communication within the brain and across the various synaptic junctions is regulated by a variety of different chemicals or neurotransmitters. A few of the more common neurochemicals that affect brain function, along with some of their basic roles, are:

- glutamate: stimulates activity
- gamma-aminobutyric acid: attenuates or slows down activity
- serotonin: influences mood, impulsivity, anger, aggressiveness
- norepinephrine: influences attention, perception, motivation, arousal
- dopamine: influences voluntary movement, cognition, working memory and learning, ability to experience pleasure and pain
- brain-derived neurotrophic factor: improves the function of neurons and encourages their growth and enhances communication and learning

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- insulin-like growth factor 1: within the brain, insulin-like growth factor 1 plays a role in neurogenesis (cell growth) and learning.

The positive effects of regular exercise on these and other neurochemicals and their associated impact on overall brain function are numerous and just beginning to be understood. Exercise has been shown to stimulate the growth of cerebral blood vessels, enhance communication across synapses, boost mood and act as a natural antidepressant, augment memory and learning and increase brain density. The latter is true in white matter, which contains the nerve fibers that run throughout the brain. In essence, exercise primes the brain to enhance learning and memory and helps people age somewhat gracefully with better maintenance of cognitive function.

Research also has demonstrated that exercise and physical fitness are associated with enhanced learning and academic performance in school-aged youth. This effect appears to extend to older populations and even individuals with medical conditions, such as multiple sclerosis (MS), where highly fit patients with MS have demonstrated better performance on cognitive function tests than patients with MS who are less fit.

Although our complete understanding regarding the effect of exercise on cognitive function is still in its infancy, the data are compelling and provide one more important reason to not skip daily physical activity. Regular exercise is critical to everyone's health, physical function and cognitive well-being.

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Q&A

by James MacDonald, M.D., FACSM

Q: I have two children in elementary school, one of whom (my son) was recently given a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD). I do not want to have him go on medicines just yet. Are there ways of potentially helping someone with ADHD that involve lifestyle modification, such as exercise?

A: There is news hot off the press that addresses this concern.

In a recent release from the prestigious journal Pediatrics, researchers looked at 221 children aged seven to nine years old to see how they might respond to an exercise intervention. The students involved were divided into two groups: one received 70 minutes of 'moderate to vigorous physical activity' (MVPA), or the equivalent of 4500 steps; the ones in the other group were put on a 'wait list' with no intervention. Both groups were evaluated after nine months to look at not only physical fitness levels but also cognitive ability—performing tasks requiring inhibition, cognitive flexibility and attention—the types of activities difficult for kids with ADHD.

Not surprisingly, the exercise intervention group was found to have improved physical fitness as measured by $V0_{2max}$, and this change was significantly better than in the 'wait list' group. What was especially intriguing about this study is that researchers also showed improvements in all areas of cognition in the intervention group. There were no statistically significant changes in the 'wait list' group.

Another recent study in the *Journal of Abnormal Child Psychology* looked at 202 kindergartners to second graders both with and without ADHD. In this study, the children were divided into two groups as well: one received 31 minutes of aerobic activity prior to school, the other received 31 minutes of classroom activity. In this study the exercise intervention arm also improved in attention and mood measures and the control group did not. Most significantly, the improvements with exercise were greatest in the children who already had a diagnosis of ADHD. In other words, exercise improved the attention and mood of all the kids, but had its strongest effect on those with ADHD.

These are only two studies that show a link between exercise and activity levels and improvement in brain function in individuals with ADHD. Encouraging your child in maintaining the American Academy of Pediatrics (AAP)-recommended minimum daily level of 60 minutes of MVPA can go a long way toward managing his condition. Ensuring that physical education is offered in your child's school is another approach that will not only help him but also all the children in school.

If you are unsure of what play activities meet the definition of "MVPA" for kids, go to the Centers for Disease Control and Prevention (CDC) website for some useful tips: **http://www.cdc.gov/physicalactivity/everyone/guidelines/children.html**

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THEME: EXERCISE AND THE BRAIN

The Benefits of Exercise for Persons with Parkinson's Disease

by Paul M. Gallo, Ed.D., ATC, CES, HFS, CSCS

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Parkinson's disease (PD) is a progressive neurodegenerative condition caused by a deficiency of dopamine (a chemical neurotransmitter) and damage to the midbrain, a portion of the brain required for control and coordination of movement during activities of daily living. Roughly one million Americans have been diagnosed with PD, with the highest prevalence in caucasian men age 50 years and older. Classic motor signs and symptoms of PD include slowness of movement, tremor at rest, muscle rigidity (tightness) of the spine and trunk and postural instability. Motor signs and symptoms may result in balance and coordination decrements as well as impaired walking mechanics contributing to physical inactivity and poor quality of life. Nonmotor signs and symptoms such as cognitive deficit, autonomic dysfunction (i.e., variability of heart rate), gastrointestinal dysfunction, fatigue and dementia are common with many cases of PD.

Benefits of Exercise and PD

The primary method of managing PD includes the use of medication to correct dopamine deficiencies and improve movement coordination. In addition to medication, exercise is commonly recommended as a method of managing PD. Some evidence exists showing the benefits of exercise in persons with PD including improvements in aerobic fitness, muscular strength, balance, walking mechanics and physical function.

Animal studies demonstrate that exercise may have protective effects associated with PD-specific areas of the brain (referred to as neuroplasticity), resulting in slowed progression of disease or improved motor control. These findings are promising with regard to the benefits of exercise in PD; however, results from animal studies are difficult to replicate in humans and should be interpreted carefully.

Currently, there are no established exercise recommendations for PD. The inability to provide specific recommendations is due to confounding results in the scientific literature caused by variability in motor and nonmotor signs and symptoms as well as side effects of medication. However, it is reasonable to apply established exercise recommendations for healthy adults to persons with PD while allowing for modifications to address disease-related limitations.

What are the Specific Types of Exercise that Persons with PD Should Perform?

Persons with PD who engaged in stationary cycling or treadmill walking for durations of 30-60 minutes, 2-5 days per week, have seen improvements in aerobic fitness. Treadmill walking and stationary cycling appeared to improve balance and motor coordination in persons with PD. Treadmill walking alone has shown the greatest improvement in balance and resulted in enhanced walking mechanics in persons with PD.

Weight lifting exercises performed for each major muscle group 2-3 days per week with 1-3 sets of 8-15 repetitions can yield muscular strength gains in persons with PD. Additional PD-related benefits of weight lifting may include improved motor coordination, balance and walking mechanics, especially when focusing on lower body weight lifting exercises.

There is limited evidence regarding flexibility improvements in persons with PD. Muscular rigidity of the spine/trunk can occur in early stages of PD and may contribute to poorer walking mechanics and postural instability. Static stretching may be most beneficial if initiated in early stages of PD and should focus on the muscles of the spine/torso. General recommendations for static stretching include holding each stretch for a total of 60 seconds and targeting all major muscle groups. Stretching can be performed on a daily basis.

Persons with PD should exercise at a time of day when they are experiencing the peak effect of medication and/or have minimal motor fluctuations. During exercise, precautions should be taken to prevent falling, especially in more advanced stages of PD. Persons with PD initiating exercise may benefit from consulting with a qualified health-fitness professional.

Most persons with PD will benefit from a well-rounded exercise program. Established exercise recommendations for healthy adults can be safely applied to persons with PD including the aforementioned disease-specific modifications. Exercise programming should be specific to individual needs and may include exercises such as walking, stationary cycling, weight lifting and stretching exercises.

THEME: EXERCISE AND THE BRAIN

Exercise and Mood

by Greg Chertok, M.Ed., CC-AASP

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Many of us who exercise do so for aesthetic or cosmetic reasons: to look good, to impress, to turn heads. This makes sense. The first and most noticeable changes resulting from physical activity are, after all, cosmetic. And it is far easier to evaluate the success of exercise based on our physical sensations and developments than on our mental or emotional ones. Noticing abdominal soreness takes far less time and cognitive strain (that is, easier to identify) than noticing boosts in mood. However, the effects that exercise has on our mental health, particularly mood, are striking. Understanding how physical activity strengthens our mood may keep us going to the gym long after the allure of turning heads has weakened.

Exercise seems to be the best preventive drug available for a number of health problems. Studies show that exercise reduces the risk of early death, heart disease, stroke and type 2 diabetes. It also improves sleep, memory and concentration, as well as lowers the risk of depression and anxiety disorders. In fact, exercise is as good as medication or psychotherapy in the treatment of mild and moderate depression. Some experts speculate that the benefits of exercise in treating depression is related to perceptions about control: those who engaged in exercise felt that they were doing something directly about their depression and therefore, had control over their wellness. When we feel confident that our actions are creating change, we gain a feeling of power, competence and

Exercise and Mood (continued from page 3)

self-worth, and we are likely to stick with those actions.

Our mood improves with the minimization of stress, and exercise plays a large role in reducing stress-related issues. Physical exercise actually creates biochemical changes in the brain that protect it and prevent it from being damaged during stress. Exercise produces a beneficial decrease in perceived stress—that is, we tend to view our lives as less stressful—when we engage in exercise routinely, for at least several weeks. However, the effect of even a single session of exercise has been shown to improve mood and reduce subjective symptoms of anxiety.

In addition to mood-boosting benefits repeatedly found in studies of regular exercise, removing exercise from our lives has been shown to negatively impact mood. For instance, researchers have tested volunteers who were accustomed to working out six days a week. After skipping two workouts, all experienced one or more of a variety of mood swings, including depression, anxiety, confusion and sluggishness. Resuming their exercise routine improved their mood immediately. While many of us find it difficult and irritating to stray from our routines, another valid interpretation of this is that exercise activates the pleasure circuits of the brain and seems to trigger the release of chemicals called endorphins, leading to a level of relaxation. Removing exercise, then, may elicit the mood swings.

For the aging population as well, participation in physical activity has mood-enhancing qualities. High levels of cardiorespiratory fitness can protect the brain's structure and function and may delay the onset of age-related cognitive decline, which is linked to mood.

We take ownership of what we're doing when we know the "why" behind our actions. All exercisers should firmly understand the benefits that accompany the physical activity of choice, and that means the mental and emotional improvements in addition to the physical benefits. While a single exercise session may have positive effects on mood, chances are we will begin to feel the effects after some consistent and regular exercise. Stay the course and enjoy the journey.

THEME: EXERCISE AND THE BRAIN

Brain games

by Anthony Luke, M.D., FACSM

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Technology is becoming a reality in many aspects of our lives, personally and professionally. Many people have tablets and smart phones, but how do people use them? One popular pastime is playing games. Games can be entertaining, challenging and fun. Not always a waste of time, software companies are now using games to make people smarter. Brain games can help people's cognition and memory, and computer developers are opening a new field. Just like working out at the gym, playing cognitive games can work out brain function and test memory.

Applications for this can be quite extensive and apply to everyone. Working one's mind to be sharp and improve memory can be helpful for work and everyday life. If playing brain games might help you solve a calculation faster, or remember your co-worker's or classmate's name, wouldn't it be worth it?

There is science behind the use of technology to improve brain function. The brain demonstrates some ability to continue to improve function at any age. Research shows that, even in the aging brain, mental challenges can lead to enhanced function. One group of experts is at the University of California, San Francisco led by Adam Gazzaley. He and his team published a "game-changing" paper in *Nature* in January 2013 that explained how multitasking training was achieved through a video game called NeuroRacer. They showed that even older adults (60 to 85 years old) made multitasking easier with gains lasting for six months. They showed there were enhanced changes in measured brain activity caused by multitasking training. This paper was one of the first to show that a custom-designed video game can be used to assess cognitive abilities across the lifespan. Their lab continues to assess underlying neural mechanisms and improve cognitive training using video games.

So how do brain games work? Many multitasking processes require both attention and working memory. Subtle neurocognitive tasks such as pattern recognition, memory, verbal and visual reactions and color perception are examples of tasks that can be incorporated into the game. By making games fun, there is easy motivation to do the training tasks. Gaming theory includes rewards for desired behaviors, making sure people continue to play.

One of the most popular brain game companies is Lumosity (**www.lumosity.com**). This company has taken neurocognitive tests and turned them into several fun games, which people do for 15 minutes each day to train and exercise their brain. Most games are free but customers pay annual fees to tailor programs for specific goals like memory improvement.

The applications of simple brain games could have enormous impact. As the baby boomers continue to grow in number, there are more people suffering from neurocognitive degenerative diseases like Alzheimer's and Parkinson's disease. It would be exciting to see if there were simple training tasks to slow the progression or help improve cognitive function. Even just regular reading and comprehension stimulate the brain, but combining multiple tasks is clearly beneficial. Combining exercise with cognitive tasks can develop both physical and cognitive benefits.

So a brain game a day? Game on!

THEME: EXERCISE AND THE BRAIN

Exercise, Children and Academic Performance

by Dawn Coe, Ph.D., FACSM

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A great deal of importance has been placed on children's academic achievement in recent years. Standards and goals for schools have been set by federal mandates (*e.g.,* No Child Left Behind) in order to achieve competencies at the student and school level in basic skills and academic subjects. These standards and goals link children's academic achievement to teacher evaluations, school funding and students' potential to continue and succeed in their academic careers.

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Academic Performance (continued from page 4)

Current physical activity guidelines recommend that children participate in at least 60 minutes per day of moderate-to-vigorous physical activity that is developmentally appropriate. Validated by research, physical activity that meets or exceeds these guidelines is generally related to enhanced overall health, cognition and higher academic achievement in children.

Numerous studies have shown positive relationships between academic achievement and physical activity, participation in extracurricular activities and sport participation. Students who have higher levels of habitual physical activity, including those who participate in after-school activities/programs and sport, tend to perform better academically than their less active counterparts. This relationship has been found in students ranging from elementary to high school.

A similar relationship has been found between health-related fitness levels and academic achievement. Health-related fitness encompasses cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition. The majority of the studies have found this relationship to be strongest for cardiorespiratory endurance and body composition. Students who are more aerobically fit and have a healthy weight status have higher academic achievement compared to their less fit, overweight/obese peers. Studies using a composite of the fitness variables found that students who are considered "fit" in multiple components of health-related fitness achieved better classroom grades and/or standardized test scores compared to less fit students.

The specific factors that lead to higher academic achievement as a result of physical activity and fitness are not fully understood. There are some mechanisms for this relationship that have been proposed by researchers. One of these factors is improved cognition. Studies have shown that cognitive function is improved after an acute bout of physical activity and also in children who have higher fitness levels. Other factors include increased arousal and reduced boredom, which may lead to improved attention span and concentration. These factors can potentially play a role in students' classroom behaviors, which appear to influence academic achievement. Positive general classroom behavior, increased classroom participation and greater on-task behavior during academic classes have been shown to positively impact academic achievement. Studies that have included a bout of physical activity during the school day have found that students have greater on-task behavior in the classroom after the activity.

Overall, there is a general consensus that physical activity and fitness have a positive impact on academic achievement. These findings also stress the importance of optimizing in-school physical activity opportunities, such as recess and physical education classes, and the promotion of physical activity outside of school.

THE ATHLETE'S KITCHEN

When Food Has Too Much Power Over You

by Nancy Clark MS RD CSSD

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"I think about food all the time. I finish one meal and start thinking about the next."

"I don't keep cookies in the house; I end up eating them all."

"I'm afraid if I start eating, I won't be able to stop…"

If any of those thoughts sound familiar, you are among a large group of athletes who struggle with food. I routinely counsel food-obsessed exercisers/athletes who fear food as being the fattening enemy. They think about food all day, stay away from social events involving food, give themselves permission to eat only if they have exercised hard and white-knuckle themselves to one meager portion at dinner.

If you (or someone you know) struggles with food, keep reading. This article can help food-obsessed athletes take a step toward transforming their food fears into peaceful fueling patterns and better quality of life. Much of the information is from Glenn Waller's book *Beating Your Eating Disorder*, an excellent self-help book for adults at war with food and their bodies.

Food Is Not the Problem

Food is not the problem. Food is fuel. Food is needed for good health. Food is an inanimate object, just like a desk, rug, or book. It has no inherent power over you. But if you feel as though a food (let's say, bread) has power over you, bread is the symptom, not the problem. That is, the urge to over-eat bread can stem from:

1. Getting too hungry and, as a result, craving carbs. The solution is to prevent hunger, so you don't start craving carbs in the first place.
2. Denying yourself permission to eat bread because it is a "bad" food. The solution is to learn to routinely enjoy bread and other carbs, which are the foundation of a quality sports diet.

Living by rigid, restrictive "food rules" can be a symptom that something has gone awry. Food rules serve a purpose; they can be a coping strategy to block out emotions and distract you from feeling your feelings. That is, if you are spending 99 percent of your waking hours debating whether or not to eat bread, you are not thinking about how angry you are with your boyfriend, how scared you are to go away to college or how sad and lonely you've been since your dog died.

Being able to abide by strict food rules also gives you a (unfounded) sense of superiority that you can say "no thank you" to pizza, sandwiches and even birthday cake with your friends. You can then take pride in being able to sustain yourself on lettuce leaves and Diet Coke. Why would you want to change this menu when you are so in control, have such a perfect diet and are exercising seemingly well? Why? Because your quality of life stinks and you are potentially alienating your friends.

Some of my clients can revise their restrictive eating patterns with simple nutrition education. I teach them how much is OK to eat, how to fit bread (or whatever) into their sports diet, and how to enjoy food as one of life's pleasures. For example, one client believed eating an English muffin plus an egg and a yogurt at breakfast sounded "piggy." After one English muffin, she would stop eating because she "thought she should," but then would succumb to the hungry horrors by 9:30 a.m. When she added the egg and the yogurt into her breakfast, she felt satisfied all morning, with no nagging food thoughts until she was appropriately hungry at lunchtime.

In comparison, another client refused to eat more breakfast. She was convinced that eating an additional packet of oatmeal would result in immediate weight gain. "I couldn't eat more breakfast. I'd get fat!!!" She believed her body was different from everyone else's and would instantly blow up.

I reminded her that hunger is simply the body's request for fuel. The body is saying, "I have burned off what you fed me. May I please have some more food?" Her response was "NO! Food is fattening." She lived her days feeling hungry all the time, lagging energy, enduring cold hands and feet, obsessing about food, feeling anxious she'd succumb to sweets, and avoiding social situations that involved food. Her food rules undermined her quality of life.

Athlete's Kitchen (continued from page 5)

Time for a change?

How can you break away from your restrictive food rules and start anew? One strategy is to understand that a few minutes of control (such as eating only one English muffin) can turn into a lifetime of misery. But a few minutes of anxiety (eating the English Muffin plus egg and a yogurt) can contribute to a peaceful future of enjoyable meals. You have to learn to sit through the anxiety and see that nothing bad happens when you eat an appropriate amount of food.

While you may believe that eating more breakfast will make you instantly fat, try this experiment:

- Weigh yourself (first thing in the morning) on day one of the experiment.
- Make one dietary change that you are sure will make you get fat (such as eating an egg and a yogurt along with the English muffin).
- Maintain this one change for seven days (without making any other food or exercise changes), and then weigh yourself again.
- Repeat this experiment for another seven days and average the weights. (Weight fluctuates due to shifts in water.)

Have you gotten fat? Doubtful. But take note: if the scale has gone up a tiny bit, the gain is likely due to replenishment of depleted muscle glycogen (carb) stores. For each one ounce of carbs stored in your muscles as glycogen, your muscles also store about three ounces of water. Hence, do not obsess about a number on the scale. Rather, observe how much better you feel during the day and also during your workout.

Easier said than done?

While food experiments sound like a good idea, the reality is they can cause anxiety and hard work. (If changing were simple, you would have been able to resolve your food issues ages ago, right?) Eating more calories is hard because you are giving up a coping mechanism without being sure you will feel better in the long run.

To get rid of your eating disorder, you need to learn how to cope differently. This will involve feeling your feelings instead of starving them. A counselor might be able to help, as well as reading Beating Your Eating Disorder and other self-help books (visit **www.gurze.com**). Just imagine how nice life will be for you and your loved ones when you can wake up without food fears and rigid food rules.

Q&A (continued from page 2)

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Q: My mother was diagnosed with Alzheimer's disease (AD) two years ago. She is declining and getting too much for us to handle at home, and we have recently begun looking at moving her into a nursing home. I have read that exercise may be helpful in slowing the progression of AD. What is the evidence for this?

A: There is a great deal of research that needs to be done looking at the use of exercise as a therapeutic intervention for dementia, but there are now some studies which look promising.

The 'Preventing Loss of Independence through Exercise,' or PLIE program, is a pilot study being conducted at the University of California, San Francisco. In an 18-week study on patients with mild to moderate dementia, researchers had six individuals receive the PLIE intervention and five individuals receive usual care. The PLIE intervention involved yoga, tai chi, Feldenkrais, physical therapy, occupational therapy, mindfulness and dance movement therapy for 45 minutes, three times a week.

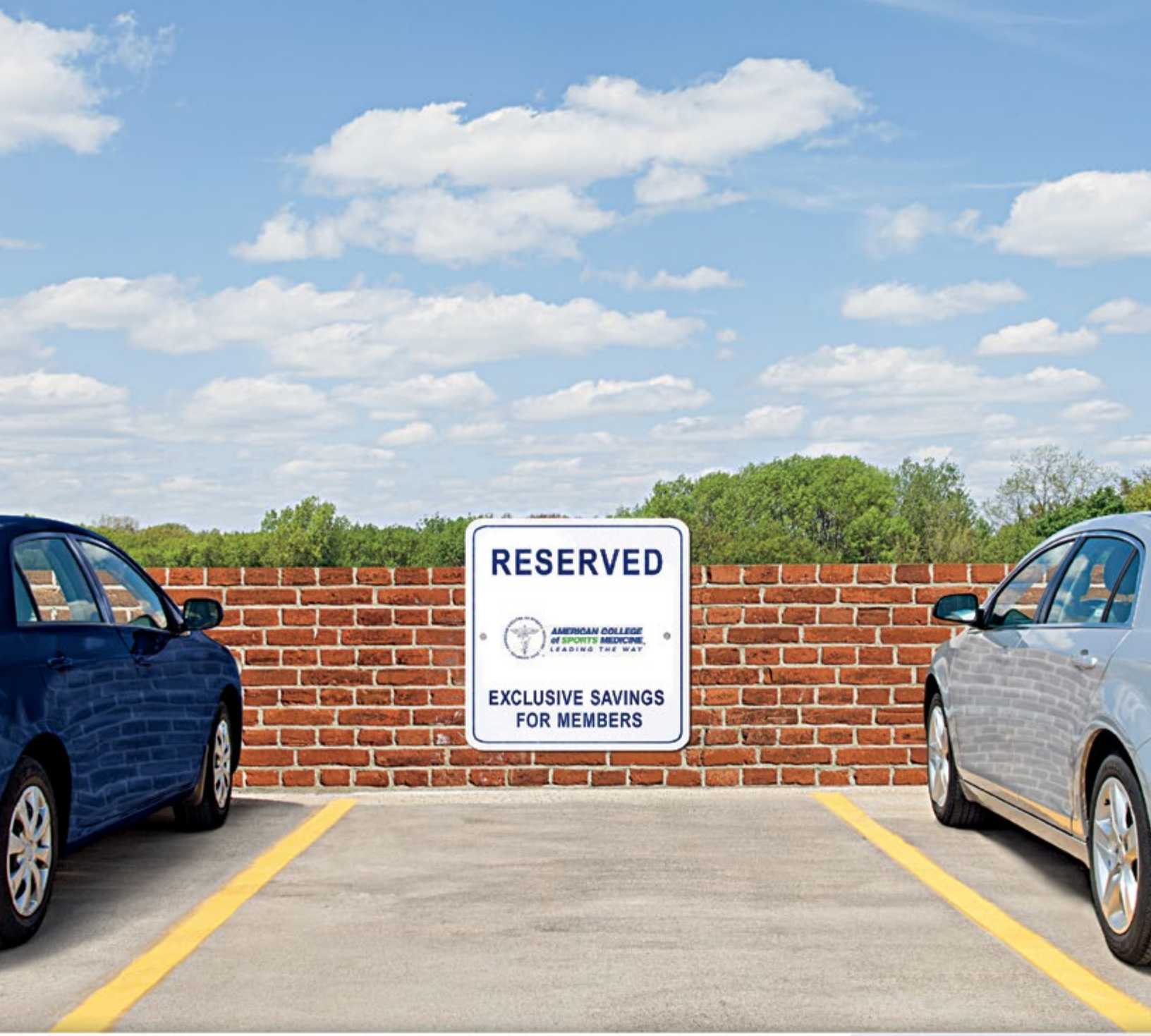
The outcomes included measures not only of cognitive and physical function in the individuals studied, but also the "Caregiver Burden Inventory," a measure of how much effort was required of caregivers helping the AD patients with their activities of daily living. The intervention group improved in all measures while the usual care individuals did not. The PLIE intervention essentially made the AD patients less of a fall risk, improved their cognition and allowed them to live more independently. This is a pilot study with small numbers and short follow up, but the results are impressive.

Another study took place at the Cleveland Clinic, with results published in May 2014. Researchers looked at almost 100 older men and women, aged 65 to 89, almost half of whom carried a gene (the e4 gene) which put them at high risk of developing AD. They set out to closely examine how the structure of the participants' brains might change over the course of 18 months using brain scans. The researchers specifically looked at a part of the brain called the hippocampus, which atrophies or shrinks in those who develop AD.

They divided the patients into four groups, based on their exercise habits and presence of the e4 gene: one group included those with the gene who did not exercise; one included those with the gene who did exercise; a third group consisted of those who were sedentary but did not have the gene; and the final group included those without the gene who did exercise. They scanned the participants' brains at the beginning of the study, and again 18 months later.

Remarkably, only the group which had the e4 gene but did not exercise showed significant shrinkage of the hippocampus in that relatively short time. The three other groups showed no changes. Possibly even more remarkable is the evidence-based conclusion that exercise exerted a protective effect regarding the possible development of AD: even those participants with the e4 gene showed no changes in their brain structure if they exercised.

Looking into what resources exist in your community for supervised, appropriate exercise for your mother would be an evidence-based step toward helping her, and you, manage her AD.



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