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Exercise May Improve Cognitive Skills in Older Population CME

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February 3, 2010 — Participating in a sustained exercise program may decrease cognitive decline in patients older than 55 years, according to results from 2 new studies published in the January 25 issue of the *Archives of Internal Medicine*.

In a cohort study from Germany, investigators found that moderate or high physical activity was associated with a lower risk of developing cognitive impairment in patients older than 55 years.

The second randomized controlled study showed that resistance training programs improved the cognitive skills of attention and conflict resolution in women between the ages of 65 and 75 years in Canada.

"Our population-based prospective study of a large cohort of elderly subjects found that lack of physical activity yielded a significant association with incident cognitive impairment after 2 years," write Thorleif Etgen, MD, assistant professor in the Department of Psychiatry and Psychotherapy at the Technische Universität in Munich, Germany, and colleagues.

In an interview with *Medscape Neurology*, Dr. Etgen said that he was amazed at the extent of the findings. "Physical activity cut in half the odds of developing incident cognitive impairment. We were also surprised that moderate physical activity had nearly the same effect as high physical activity."

"The population of older adults is expanding, and with this, the incidence of cognitive decline and dementia is growing," he added. "There is a high demand for powerful and inexpensive methods of preventing or delaying these declines."

Study Shows Decreased Impairment

In their study, Dr. Etgen and his team examined a cohort of 3903 patients enrolled in the Intervention Project on Cerebrovascular Diseases and Dementia in the Community of Ebersberg, Bavaria study (INVADE) between 2001 and 2003 and followed up every 3 months for 2 years. All patients had filled out 6-item Cognitive Impairment Tests and a questionnaire that divided them by activity levels: none (n = 584), moderate (n = 1523), and high (n = 1796).

Moderate activity was defined as strenuous activities (including walking, hiking, bicycling, and swimming) performed fewer than 3 days a week, whereas high activity was defined as 3 or more times a week of participation.

"We were hoping to establish some protective effect of physical activity," said Dr. Etgen. "As most studies in the past focused on dementia, our aim of this part of the INVADE study was to further explore the association between cognitive impairment (as an early form of dementia) and physical activity."

At baseline, 418 participants (10.7%) had cognitive impairment. Of these, 21.4% were in the no activity group compared with 10.5% and 7.3% in the moderate and high activity groups, respectively.

At the end of 2 years, the investigators found that 207 additional patients (5.9%) had developed impairment. Although the incidence of new cognitive impairment among those with no physical activity was 13.9%, the incidence was significantly lower at only 6.7% (odds ratio [OR], 0.57; 95% confidence interval [CI], 0.37 – 0.87; $P = .01$) and 5.1% (OR, 0.54; 95% CI, 0.35 – 0.83; $P = .005$) in those who underwent moderate and high activity, respectively.

This association remained statistically significant even after adjusting for age, sex, depression, chronic kidney disease, and cardiovascular risk factors.

"The take-home message is: keep on moving," said Dr. Etgen. "Clinicians should more actively ask their patients about their physical activity and alert their elder patients to perform some sort of regular physical activity."

Resistance Training Improves Cognitive Skills

In the second study, investigators sought to examine the association between resistance training and improved cognition in older women.

"To our knowledge, no study to date has examined the minimum frequency of resistance training required for cognitive benefits," write Teresa Liu-Ambrose, PhD, PT, researcher at the Center for Hip Health and Mobility at Vancouver General Hospital and assistant professor at the Department of Physical Therapy at the University of British Columbia in Canada, and colleagues.

"We were interested in resistance training specifically because it has multiple benefits over other training as it relates to falls and fracture prevention," added Dr. Liu-Ambrose to *Medscape Neurology*. "We know that it benefits bone health, prevents muscle loss, and helps strengthen mass. However, most studies looking at the benefits of exercise for cognition have focused on aerobic training."

Her team enrolled 155 women between the ages of 65 and 75 years and randomized them to undergo either once-weekly (n = 54) or twice-weekly (n = 52) resistance training classes or twice-weekly balance and tone training classes (control group, n = 49) between May 2007 and April 2008.

All patients took the Stroop executive test on selective attention and conflict resolution and Trail Making Tests. Gait speed and whole brain volume were also measured.

Results at the end of 1 year showed that the patients in both of the resistance training groups had significantly improved scores on the Stroop test compared with the control group patients ($P \leq .03$). In addition, "task performance improved by 12.6% and 10.9% in the once-weekly and twice-weekly resistance training groups, respectively. It deteriorated by 0.5% in the balance and tone group," write the study authors.

However, surprisingly, both resistance training groups also showed significant reductions in whole-brain volume compared with the control group ($P \leq .03$).

"This reduction was a surprising finding because that's usually associated with poor cognitive function. We are currently looking at more data to specifically assess grey and white matter volume," said Dr. Liu-Ambrose.

Finally, enhanced selective attention and conflict resolution were significantly associated with increased gait speed ($P < .01$).

"This finding was quite clinically relevant because walking speed is a big indicator of a person's general well-being and also a predictor of mortality," explained Dr. Liu-Ambrose.

Overall, "the results have important clinical implications," write the study authors. However, because of the patient population studied, "the findings may not generalize to men or to women of other ages."

In addition, they note that the cognitive benefits were found after 12 months of training but not at the 6-month trial midpoint.

"This could be because there was a lot of motor learning and motor teaching in terms of resistance training for this

group, especially for the first 2 to 3 months of this study," explained Dr. Liu-Ambrose. "So there was a lag time between teaching the technique and them becoming comfortable with it."

She said that her takeaway from this study is that resistance training should be more widely promoted. "I think that exercise is currently promoted clinically but I think it's typically more, 'Take more walks.' But there is a lot of emerging evidence that shows that resistance training not only has similar benefits as aerobic training, but it also has very specific benefits. It's also an option for seniors with limited mobility."

Dr. Ambrose reported that her team hopes to continue following this patient group and is in the middle of a new trial comparing aerobic training to resistance training and to tone and balance training in an at-risk patient population.

Promising Evidence

"Both studies provide very promising evidence that physical activity in any form can improve cognitive function," Marco Pahor, MD, professor and director at the Institute on Aging and chair of the Department of Aging and Geriatric Research at the University of Florida in Gainesville, told *Medscape Neurology*. Dr. Pahor wrote the accompanying editorial with his colleague Jeff Williamson, MD, MHS, chief of the Division of Geriatric Medicine at Wake Forest University Medical Center in Winston-Salem, North Carolina.

"However, both studies have some limitations," cautioned Dr. Pahor. "The primary limitation of the Etgen study is that it is observational and doesn't provide definitive evidence of cause and effect. The Canadian study is a randomized controlled trial but has a limited sample size of participants and a short duration of 12 months, which is a short time to access the effects on cognition."

"The takeaway is that they provide 1 more piece of evidence that physical activity is a very important factor for improving health in older adults," he concluded. "Both studies are extremely compelling and set the stage for larger multicenter trials to come."

The first study was funded by Allgemeine Ortskrankenkasse (a Bavarian health insurance company). The second study was funded by grants from The Vancouver Foundation, the Natural Sciences and Engineering Research Council of Canada, and the Michael Smith Foundation for Health Research and by a New Opportunities Fund from the Canada Foundation for Innovation. None of the study or editorial authors have disclosed any relevant financial relationships.

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Clinical Context

Cognitive impairment is prevalent among the elderly population, affecting between 10% and 22%. The focus of aging research is developing effective prevention strategies to combat cognitive impairment. Data regarding the relationship between physical activity and cognitive impairment are limited and controversial; however, new evidence has suggested that physical exercise enhances cognitive function in older adults. In addition, specific exercise training may combat cognitive decline.

The aim of the study by Etgen and colleagues (INVADE) was to examine the association between physical activity and cognitive function. Additionally, a study by Liu-Ambrose and colleagues evaluated the types of physical activity on cognitive decline by comparing the effect of once-weekly and twice-weekly resistance training vs twice-weekly balance and tone exercise training on the performance of executive cognitive functions in older women.

Study Highlights

- **Etgen and colleagues**

- The INVADE study consisted of a community-based prospective cohort study in southern Bavaria, Germany, where 3903 participants older than 55 years were enrolled between 2001 and 2003 and were followed up for 2 years.
- Physical activity (classified as no activity, moderate activity [< 3 times/week], and high activity [≥ 3 times/week]), cognitive function (assessed by the 6-Item Cognitive Impairment Test), and potential confounders were evaluated.
- The main outcome measure was incident cognitive impairment after 2 years of follow-up. Scores higher than 7 on the 6-item Cognitive Impairment Test were consistent with cognitive impairment.
- At baseline, 418 participants (10.7%) had cognitive impairment. The prevalence rates of cognitive impairment among participants with no, moderate, and high activity at baseline were 21.4%, 10.5%, and 7.3%, respectively.
- After a 2-year follow-up, 207 (5.9%) of 3485 initially unimpaired subjects went on to have incident cognitive impairment.
- Compared with participants without physical activity, fully adjusted multiple logistic regression analysis showed a significantly reduced risk for incident cognitive impairment after 2 years for participants with moderate or high physical activity at baseline (odds ratio [OR], 0.57; 95% confidence interval [CI], 0.37 - 0.87 [$P = .01$]; and OR, 0.54; 95% CI, 0.35 - 0.83 [$P = .005$], respectively).
- Further subanalysis including participants ($n = 2029$) without functional impairment and without prodromal phase of dementia resulted in an even higher reduction of the risk for incident cognitive impairment for participants with moderate or high physical activity (OR, 0.44; 95% CI, 0.24 - 0.83 [$P = .01$]; and OR, 0.46; 95% CI, 0.25 - 0.85 [$P = .01$], respectively) vs no activity.
- No clear dose-response relationship between physical activity and incident cognitive impairment was found.

- **Liu-Ambrose and colleagues**

- This study was a single-blinded randomized trial consisting of 155 community-dwelling women aged 65 to 75 years living in Vancouver. They were randomly allocated to once-weekly ($n = 54$) or twice-weekly ($n = 52$) resistance training or twice-weekly balance and tone training (control group) ($n = 49$).
- The primary outcome measure was performance on the Stroop test, an executive cognitive test of selective attention and conflict resolution.
- Secondary outcomes of executive cognitive functions included set shifting and working memory; gait speed, muscular function, and whole-brain volume were also assessed to better understand the effects of resistance training.
- Results demonstrated that both resistance training groups significantly improved their performance on the Stroop test vs those in the balance and tone group ($P \leq .03$).
- Task performance improved by 12.6% and 10.9% in the once-weekly and twice-weekly resistance training groups, respectively; it deteriorated by 0.5% in the balance and tone group.
- Compared with the once-weekly resistance training and twice-weekly balance and tone group, resistance training twice weekly significantly improved quadriceps muscle power ($P < .001$).
- Both resistance training groups demonstrated reductions in whole-brain volume vs the balance and tone group at the end of the study ($P \geq .03$).
- Enhanced selective attention and conflict resolution were significantly associated with increased gait speed ($r = 0.24$; $P < .01$).
- Musculoskeletal complaints developed in 29.8% in the once-weekly resistance training group, 10.9% in the twice-weekly resistance group, and 9.5% in the balance and tone group. All symptoms resolved or diminished within 4 weeks of onset.

Clinical Implications

- In a large, population-based cohort of elderly subjects by Etgen and colleagues, moderate or high physical activity vs no physical activity is associated with a reduced incidence of cognitive impairment after 2 years.
- In a Vancouver study by Liu-Ambrose and colleagues, 12 months of once-weekly or twice-weekly resistance training benefited the executive cognitive function of selective attention and conflict resolution among senior women.

CME Test

According to the study by Etgen and colleagues, which of the following levels of physical activity should be recommended to reduce the incidence of cognitive impairment in the elderly population?

- No physical activity
- Moderate physical activity
- High physical activity
- Either B or C

In the study by Liu-Ambrose and colleagues, compared with the balance and tone group, which of the following outcomes did not improve with resistance training?

- Whole-brain volume
- Selective attention
- Conflict resolution
- Quadriceps muscle power

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Target Audience

This article is intended for primary care clinicians, geriatricians, and other specialists who care for the older patients with cognitive impairment.

Goal

The goal of this activity is to provide medical news to primary care clinicians and other healthcare professionals in order to enhance patient care.

Learning Objectives

Upon completion of this activity, participants will be able to:

1. Examine the association between physical activity and cognitive function, based on the study by Etgen and colleagues.
2. Compare the effect of once-weekly and twice-weekly resistance training with twice-weekly balance and tone exercise training on the performance of executive cognitive functions in older women, based on the study by Liu-Ambrose and colleagues.

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