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Alzheimer's Gene Alters Brain Function in Young Adults

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(PhysOrg.com) -- The gene most closely linked to an increased risk of developing Alzheimer's disease affects brain activity in young adults -- much earlier in life than previously reported -- according to researchers at Duke University Medical Center and The Pennsylvania State University.

Study participants in their mid-20s with a gene variant known as APOE4 demonstrated increased brain activity and altered connectivity in parts of the brain that are the first to show signs of Alzheimer's disease in older adults.

"While young people with and without the APOE4 gene had similar scores on a battery of memory tests, the brains of young people with the gene appear to be working harder or less efficiently to achieve the same results as people without the gene," said Jeffrey Browndyke, PhD, study co-author and director of the Functional Imaging Neurogenomics of Disease Lab at Duke.

While some researchers have theorized that APOE4 may enhance memory abilities in early life, the new findings suggest that the heightened activity may be the brain's way of compensating for a weakened ability to create memories.

In addition to the differences seen in an area of the brain known as the medial temporal lobes (MTL), researchers also found differences among people with the APOE4 gene in the MTL's communication with areas of

the brain associated with memory processing.

"APOE4 gene carriers show increased activity in the MTL and increased communication between that region and other brain regions known to be effected by Alzheimer's disease, while those without the gene tend to show widespread cortical connectivity with the MTL," said Nancy A. Dennis, PhD, study co-author and assistant professor of Psychology at Penn State.

The study findings are published online in the journal *Alzheimer's & Dementia*, the official journal of the Alzheimer's Association.

Twenty-four healthy adults in their mid-twenties, twelve carriers and twelve non-carriers of the APOE4 gene, completed a memory test while undergoing functional magnetic resonance imaging (fMRI).

The young adults were shown a series of images and asked to provide feedback about what they saw. The next day participants were brought back to the lab and presented with a surprise test to determine how well they remembered the images.

Brain activity for remembered versus forgotten items was compared between the study groups. The fMRI data provided the research team with information about the areas of the brain that became active when the individuals looked at pictures that were subsequently remembered a day after the brain scan.

The researchers said that the memory scores of the study participants and their brain structures were comparable in the two groups. People with and without the APOE4 gene variant were able to recall a similar amount of information and completed the tests with a similar level of accuracy and speed.

There were no differences in the volume of white matter, the communication channels of the brain, or grey matter, the information storage center of the brain.

"While all of the young adults performed similarly and their brains appeared the same, there are clear differences in brain activity and interconnection in people with the APOE4 gene that appear earlier in life than previously observed," Browndyke said.

"We need to further explore the gene's effect on brain development and early cognitive function to determine who ultimately is at risk for Alzheimer's disease."

The authors caution that the study findings need to be replicated in a larger population of young people with and without the APOE4 gene. They also said that the gene variant only confers an increased risk for Alzheimer's disease, not a diagnostic certainty.

Provided by Duke University (news : web)