Vitamin D could help combat the effects of aging in eyes

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Researchers funded by the Biotechnology and Biological Sciences Research Council (BBSRC) have found that vitamin D reduces the effects of ageing in mouse eyes and improves the vision of older mice significantly. The researchers hope that this might mean that vitamin D supplements could provide a simple and effective way to combat age-related eye diseases, such as macular degeneration (AMD), in people.

The research was carried out by a team from the Institute of Ophthalmology at University College London and is published in the current issue of the journal *Neurobiology of Ageing*.

Professor Glen Jeffery, who led the work, explains "In the back of the eyes of mammals, like mice and humans, is a layer of tissue called the retina. Cells in the retina detect light as it comes into the eyes and then send messages to the brain, which is how we see. This is a demanding job, and the retina actually requires proportionally more energy than any other tissue in the body, so it has to have a good supply of blood. However, with ageing the high energy demand produces debris and there is progressive inflammation even in normal animals. In humans this can result in a decline of up to 30% in the numbers of light receptive cells in the eye by the time we are 70 and so lead to poorer vision."

The researchers found that when old mice were given vitamin D for just six weeks, inflammation was reduced, the debris partially removed, and tests showed that their vision was improved.

The researchers identified two changes taking place in the eyes of the mice that they think accounted for this improvement. Firstly, the number of potentially damaging cells, called macrophages, were reduced considerably in the eyes of the mice given vitamin D. Macrophages are an important component of our immune systems where they work to fight off infections. However in combating threats to the aged body they can sometimes bring about damage and inflammation. Giving mice vitamin D not only led to reduced numbers of macrophages in the eye, but also triggered the remaining macrophages to change to a different configuration. Rather than damaging the eye the researchers think that in their new configuration macrophages actively worked to reduce inflammation and clear up debris.

The second change the researchers saw in the eyes of mice given vitamin D was a reduction in deposits of a toxic molecule called amyloid beta that accumulates with age. Inflammation and the accumulation of amyloid beta are known to contribute, in humans, to an increased risk of age-related macular degeneration (AMD), the largest cause of blindness in people over 50 in the developed world. The researchers think that, based on their findings in mice, giving vitamin D supplements to people who are at risk of AMD might be a simple way of helping to prevent the disease.

Professor Jeffery said "When we gave older mice the vitamin D we found that deposits of amyloid beta were reduced in their eyes and the mice showed an associated improvement of vision. People might have heard of amyloid beta as being linked to Alzheimer's disease and new evidence suggests that vitamin D could have a role in reducing its build up in the brain. So, when we saw this effect in the eyes as well, we immediately wondered where else these deposits might be being reduced."

Professor Jeffery and his team then went on to study some of the blood vessels of their mice. They found that the mice that had been given the vitamin D supplement also had significantly less amyloid beta built up in their blood vessels, including in the aorta.

Professor Jeffery continues "Finding that amyloid deposits were reduced in the blood vessels of mice

that had been given vitamin D supplements suggests that vitamin D could be useful in helping to prevent a range of age-related health problems, from deteriorating vision to heart disease."

Professor Jeffery thinks that this link between vitamin D and a range of age-related diseases might be linked to our evolutionary history. For much of human history our ancestors lived in Africa, probably without clothes, and so were exposed to strong sunlight all year round. This would have triggered vitamin D production in the skin. Humans have only moved to less sunny parts of the world and adopted clothing relatively recently and so might not be well adapted to reduced exposure to the sun. Secondly, life expectancy in the developed world has increased greatly over the past few centuries, so reduced exposure to vitamin D is now coupled with exceptionally long lifespan.

Professor Jeffery said "Researchers need to run full clinical trials in humans before we can say confidently that older people should start taking vitamin D supplements, but there is growing evidence that many of us in the Western world are deficient in vitamin D and this could be having significant health implications."

Professor Douglas Kell, BBSRC Chief Executive said "Many people are living to an unprecedented old age in the developed world. All too often though, a long life does not mean a healthy one and the lives of many older people are blighted by ill health as parts of their bodies start to malfunction.

"If we are to have any hope of ensuring that more people can enjoy a healthy, productive retirement then we must learn more about the changes that take place as animals age. This research shows how close study of one part of the body can lead scientists to discover new knowledge that is more widely applicable. By studying the fundamental biology of one organ scientists can begin to draw links between a number of diseases in the hope of developing preventive strategies."

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