Deer antlers inspire a new theory on osteoporosis

January 3 2012

This is three broken antlers and an intact one. The weakening is due to manganese depletion. Credit: IREC

The loss of manganese could mean that calcium does not stick to bones and could cause osteoporosis. This is the new theory put forward by researchers at the University of Castilla-La Mancha (UCLM) in Spain after studying deer antlers. The hypothesis published this month in the *Frontiers of Bioscience* journal still needs to be confirmed by the scientific community.

Through the study of deer antlers, researchers of the Research Institute of Hunting Resources (IREC, joint centre UCLM-CSIC-JCCM) suggest that the origin of osteoporosis could not be directly linked to the lack of calcium but rather to the lack of a mineral essential to calcium

absorption. In particular they believe that this could be manganese, according to a new theory published in the latest issue of the *Frontiers of Bioscience* journal.

According to Tomás Landete, sub-director of the IREC and one of team's researchers, "previous antler studies show that manganese is necessary for calcium absorption. Our hypothesis is that when the human body absorbs less manganese or when it is sent from the skeleton to other organs that require it, such as the brain, the calcium that is extracted at the same time is then not properly absorbed and is excreted in the urine. It is in this way that osteoporosis can slowly strike."

The theory must now be validated with more studies and medical trials but its creators believe that it is a "step in a totally new direction in osteoporosis research as it considers calcium loss to be a consequence of the disease and not the origin."

The idea for the new proposal came from a dramatic increase in antler breakages seen in Spain in 2005. When scientists analysed these antlers in detail, they realised that weakening was due to manganese depletion caused by the deer's diet. That year saw an intensely cold winter which in turn caused plants to reduce their manganese concentrations in response to such stress.

"Antlers grow by transferring 20% of the skeleton's calcium towards their structure. We therefore saw that it was not calcium deficiency that caused the weakening but rather the deficiency of manganese," clarifies Landete. "The lack of manganese was almost as if the 'glue' that sticks calcium to antlers bones was missing."

Links to Alzheimer's and Parkinson's Disease

In the case of humans, the researchers suggest that manganese is

extracted from the bones when it is required by the "most important" organs, such as the brain. The researcher adds that "maintaining the bones is important, but even more so is sustaining the working of the brain, which uses 25% of our energy intake when at rest."

The team also points out that when this vital mineral runs out after the onset of osteoporosis, conditions like Alzheimer's disease, Parkinson's disease, and senile dementia could strike. To put this theory to the test, they analysed data from 113 patients who were operated on for osteoporosis and osteoarthritis (wear and tear of joint cartilage) at Hellín Hospital in Albacete, Spain between 2008 and 2009. Some 40% of those operated on for osteoporosis showed some form of cerebral dysfunction whereas this was not the case in any of the 68 patients operated on for osteoarthritis.

Furthermore, the percentage increased with age and only amongst those patients with osteoporosis. The exhaustion of manganese reserves could be behind the bone disease and the cerebral degeneration. "We are collecting human bones to confirm this. However, studies on rats in which Alzheimer's disease has been induced by aluminium intoxication show that as the severity of this disease increases, manganese levels in the bones decrease," says Landete.

The researcher also recalls studies that link manganese to Parkinson's disease and show that astrocytes, which provide support to neurons, have specific enzymes that require manganese. In any case, researchers outline that their theory "is not a final solution to such diseases but constitutes the first step in a new direction" – a new direction that requires validation and confirmation from the scientific community.

More information: Tomas Landete-Castillejos, Inmaculada Molina-Quilez, Jose Antonio Estevez, Francisco Ceacero, Andrés José García, Laureano Gallego. "Alternative hypothesis for the origin of osteoporosis:

The role of Mn". *Frontiers in Bioscience* (Elite Edition) 4: 1385-1390, January 2012. Doi: 10.2741/468