Medical Xpress

Scientists link dietary DHA to male fertility

January 9 2012

Who knew that male fertility depends on sperm-cell architecture? A University of Illinois study reports that a certain omega-3 fatty acid is necessary to construct the arch that turns a round, immature sperm cell into a pointy-headed super swimmer with an extra long tail.

"Normal sperm cells contain an arc-like structure called the acrosome that is critical in fertilization because it houses, organizes, and concentrates a variety of enzymes that sperm use to penetrate an egg," said Manabu Nakamura, a U of I associate professor of biochemical and molecular nutrition.

The study shows for the first time that docosahexaenoic acid (DHA) is essential in fusing the building blocks of the acrosome together. "Without DHA, this vital structure doesn't form and sperm cells don't work," said Timothy Abbott, a doctoral student who co-authored the study.

Men concerned about their fertility may wonder what foods contain DHA. Marine fish, such as salmon or tuna, are excellent sources of this omega-3 fatty acid.

The scientists became intrigued with DHA's role in creating healthy sperm when they experimented with "knockout" mice that lack a gene essential to its synthesis. "We looked at sperm count, shape, and motility, and tested the breeding success rate. The male mice that lacked DHA were basically infertile," Nakamura said.

But when DHA was introduced into the mice's diet, fertility was completely restored. "It was very striking. When we fed the mice DHA, all these abnormalities were prevented," he said.

The scientists then used confocal laser scanning (3D) microscopy to look at thin slices of tissue in progressive stages of a sperm cell's development. By labeling enzymes with fluorescence, they could track their location in a cell.

"We could see that the acrosome is constructed when small vesicles containing enzymes fuse together in an arc. But that fusion doesn't happen without DHA," he said.

In the absence of DHA, the vesicles are formed but they don't come together to make the arch that is so important in sperm cell structure, he noted.

Nakamura finds the role this omega-3 fatty acid plays in membrane fusion particularly exciting. Because DHA is abundant in specific tissues, including the brain and the retina as well as the testes, the scientists believe their research findings could also impact research relating to brain function and vision.

"It's logical to hypothesize that DHA is involved in vesicle fusion elsewhere in the body, and because the brain contains so much of it, we wonder if deficiencies could play a role, for example, in the development of dementia. Any communication between neurons in the brain involves vesicle fusion," he noted.

The Illinois scientists will continue to study sperm; meanwhile, Nakamura has sent some of his DHA-deficient knockout mice to other laboratories where scientists are studying DHA function in the brain and the retina.

The study was published in a recent issue of *Biology of Reproduction*.

Provided by University of Illinois at Urbana-Champaign