Study links chemical to inhibited milk synthesis, secretion in humans

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University of Cincinnati (UC) researchers have identified the neurotransmitter serotonin as the chemical responsible for inhibiting milk production and secretion in human mammary glands.

As growing demand outstrips milk supplies in some parts of the world, the finding could aid development of therapeutics or technologies that would increase milk production and yields from other mammals.

Results of the human study, led by Nelson Horseman, PhD, UC professor of molecular and cellular physiology, appear in the Oct. 8–12, 2007, early edition of *Proceedings of the National Academy of Sciences*.

“Knowing the chemical responsible for inhibiting milk production could help us to improve milk yields in other mammals,” Horseman says.

In lactating mammals, milk synthesis and secretion gradually slows to a stop when mammary glands become full. Once mammary glands are emptied, milk production begins again.

For decades, scientists have been trying to pinpoint the cause of inhibited milk production. In the 1970s, researchers in Scotland and New Zealand determined that a chemical had to regulate milk synthesis and secretion. A UC-led rodent study in 2004 identified the chemical as serotonin.

Serotonin is a naturally occurring neurotransmitter made in the brain and

intestinal tract. When produced in the intestinal tract, the chemical is stored in blood platelets and released at wound sites to promote clotting and healing. Low levels of serotonin in the brain have been linked to depression and other mood disorders.

Horseman and his team now report that serotonin is also produced in human mammary glands—building up as the mammary gland fills with milk, inhibiting further milk synthesis and secretion.

“If we can understand how to stop or reduce serotonin production in the mammary gland, we can reverse its actions,” Horseman says.

The investigator was recently issued a patent for specific drugs known to inhibit serotonin production. Inhibiting this chemical in the mammary gland, he says, has been shown to increase milk yields by up to 15 percent.

Improved milk yields, says Horseman, could help ease milk shortages in some parts of the world caused by drought and increased demand.

“Demand for milk has increased in Asia and prices for milk have gone up across the world,” says Horseman.

A United States Department of Agriculture (USDA) 2001–2005 summary of 30 American cities showed that, over a five-year period, the average price of whole milk rose by 11 percent.

“Farmers currently use a growth hormone to improve milk yields,” says Horseman. “Use of that hormone has declined in recent years at the request of consumers, but milk shortages are getting worse. Finding ways to increase yield in a way that’s acceptable to consumers is important.”

In March 2007, the USDA awarded Horseman and colleagues a

$350,000 grant to further study milk synthesis and secretion in cows.

The UC team is partnering with researchers in the University of Arizona's animal science program to study cows and cow mammary tissue.

Although the rodent and human cells they have studied have many similarities, cow cells appear to have some unique differences. For example, Horseman's team has identified one receptor for serotonin in the mammary gland of humans and rodents, and at least three in cows.

"We hope that by gaining a better understanding of how serotonin works in cows, we can find ways to inhibit its synthesis without the use of drugs or growth hormones," says Horseman. "Our ultimate goal would be to increase milk yield in a way that's effective without side effects."

Source: University of Cincinnati