

DAIRY | PRODUCTION

Holstein daughters receive more milk

Lactation study | Data shows sex of dairy cow offspring influences the animal's ability to produce milk

BY MARGARET EVANS
FREELANCE WRITER

LINDELL BEACH, B.C. — Researchers at Kansas State University and Harvard University have found that Holstein dairy cows produce significantly more milk for their daughters during lactation than for their sons.

An examination of 2.39 million lactation records from 1.49 million dairy cows showed that the sex of the fetus influenced the capacity of the mammary gland to synthesize milk.

"I was pretty surprised," said Barry Bradford, associate professor with KSU's animal sciences and industry department.

"(After doing) the math on the data that we got, and we had some pretty big numbers, I was floored with the in utero influence when cows got pregnant with a heifer."

The data was collected from lactation records managed by the Dairy Records Management Systems in Raleigh, North Carolina, from 1995-99.

"That was a conscious choice," said Bradford.

"The main reason was that semen became commercially available in early 2000 and at that point many producers didn't just randomly decide to breed for sex. Then you get a non-random distribution of males and females."

Female mammals pay high energy costs for reproduction, the greatest of which are the demands imposed from lactation. The synthesis of milk is essential to nourish the young, but few studies have looked at whether there is a fetal sex bias to promote milk production during pregnancy.

Nutritional and endocrine conditions for the fetus are known to have long-term effects on progeny, but the ways in which the progeny have sustained physiological effects on the dam have received little attention.

The development of the mammary gland begins during pregnancy and is influenced by maternal and placental hormones, especially lactogen, estrogen and progesterone. After birth, milk production is driven by the suckling of the calf.

The degree to which milk volume is driven by the sex of the calf may reflect the cellular response in the mammary gland programmed by hormone signals from the fetus-placenta unit.

Bradford's team found a hormonal influence between the female fetus and the development of the mammary gland. Their study is the first direct evidence that the sex of a growing fetus can influence milk production.

One of the questions Bradford and his colleague, Katie Hinde of Harvard's human evolutionary biology department, explored was whether this was adaptive in evolutionary terms.

"It could be that it is the way that the placental architecture exists in the cow," said Bradford.

"She happens to get more hormones from the fetus. There are lactogenic hormones coming from the female calf that are having an effect on the mammary glands, whereas they would not obviously be present

in the male calf."

Bradford's team found that the sex of the fetus can enhance or diminish milk production even during an established lactation. The data also showed that the sex of the fetus in the first pregnancy influenced milk production in the second pregnancy.

"Overall, the study showed a 1.3 per cent change in lactation," said Bradford.

"But there were larger impacts in the first lactation that resulted in a two percent (increased) effect. When the

cows became pregnant with female calves, they actually made more milk before they even gave birth. Some people argue it's driven by calving needs, but that's harder to explain. We think it's a hormonal effect."

Cows that gave birth to two heifers in back-to-back pregnancies produced 445 kilograms more milk across the two lactations than cows giving birth to two male calves in back-to-back pregnancies.

Bradford said cows have an "invasive" placenta, in which there is less

of a barrier for the blood to flow back and forth between the mother and the fetus.

He theorized that this may have something to do with the cow not having much glucose, so there is competition between the mother and the fetus for that nutrient.

As a result, the bovine placenta has, over evolutionary time, become more invasive than in many other species, and fetal hormones could access the mother's blood circulation and influence the milk produc-

ing cells in the mammary gland. Bradford said they believe it is likely that the hormones from the fetus and the placenta differ between a male and a female calf.

"We would like to follow up and do more studies to see if we can find some differences in hormones in the male and female fetuses."

The study, *Holsteins favor heifers, not bulls: biased milk production programmed during pregnancy as a function of fetal sex*, was published in the online journal *PLOS One*.



Arysta LifeScience

Always read and follow label directions. INFERNO and the INFERNO DUO logo are trademarks of Arysta LifeScience North America, LLC. Arysta LifeScience and the Arysta LifeScience logo are registered trademarks of Arysta LifeScience Corporation. All other products mentioned herein are trademarks of their respective companies. ©2014 Arysta LifeScience North America, LLC. INF-020



INFERNO™ DUO

BROADLEAVES AND GRASSES ARE TOAST

Tough broadleaves and flushing grassy weeds have met their match. No burndown product is more ruthless against problem weeds in spring wheat than new INFERNO™ DUO. Two active ingredients working together with glyphosate get hard-to-kill weeds like dandelion, hawk's beard, foxtail barley and Roundup Ready® canola, while giving you longer lasting residual control of grassy weeds like green foxtail and up to two weeks for wild oats. INFERNO DUO. It takes burndown to the next level.



BRING THIS AD TO LIFE!
HOLD YOUR TABLET / MOBILE DEVICE OVER THIS AD
AND WATCH INFERNO DUO DESTROY WEEDS LIVE!
DOWNLOAD THE APP AT infernoduoalive.ca

