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Foal Disorders
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The Uterine Environment's Impact on Foal Metabolism

Want to give your foal the best chances for a long sport career? Choose your uterus wisely. Researchers in France have determined that the uterine environment—including how we feed the mare and, if it's an embryo transfer, which mare we use—can have a significant effect on the foal's future bone health, energy metabolism, and osteochondrosis risk.

The uterine environment—including how we feed the mare and, if it's an embryo transfer, which mare we use—can have a significant effect on the foal's future bone health, energy metabolism, and osteochondrosis risk.

"The concept of developmental origins of health and disease (DOHaD) issues is now well-established in humans and domestic animals and certainly applies to horses, as well," said Pauline Peugnet, PhD, of the French Agricultural Research Institute, in Jouy-en-Josas. Peugnet presented her work at the 41st French Equine Research Day, held March 12 in Paris.

"Studies using embryo transfer to modify fetal growth have clearly shown the impact of prenatal development conditions on important parameters for the sports career of the animal, such as glucose homeostasis (metabolic syndrome) and osteoarticular (bone and joint) health," Peugnet said.

Last year, Peugnet unveiled her research on transferring embryos of different-sized breeds into three different sized mares (ponies, saddle horses, and draft horses) and found significant effects on fetal growth, both in utero and after birth. Peugnet and her team have now taken data from that "FOETALIM project" and looked at how the uterine environment from "restricted" and "enhanced" gestational situations (i.e., large-breed fetuses growing in small-breed uteri, and vice versa, respectively) affects metabolism, specifically insulin resistance.

They found that pony fetuses in a very enhanced environment—ponies in draft mares—showed greater insulin resistance (at least early in life), meaning they were more at risk of equine metabolic syndrome, Peugnet said. And more of these ponies had osteochondral lesions. Osteochondrosis has multiple factors leading to its development, but energy metabolism disorders are among the factors, she added.

Furthermore, the larger mares produced more and possibly richer milk, which appeared to affect the foals' development even after birth, she said. So the metabolic and osteochondral risks also increased during the six months of nursing.

Her results are consistent with previous findings that pregnant mares consuming concentrated feeds over the winter produced foals with greater metabolic risks (higher insulin resistance), which continued during lactation, Peugnet added.

"Gestation and post-natal growth in horses are two windows of tissue plasticity to environmental stimuli," Peugnet said. "They therefore constitute two windows of potential intervention to optimize the welfare, athletic aptitudes, and especially the skeletal health of the animal over the long-term.

"In essence, the equine athlete often presents osteochondral lesions of multifactorial origin," she said. "These osteoarticular changes can suspend or even terminate the horse's career, representing major economic losses for the equine industry. Among other factors, this pathology is linked to problems of energetic metabolism and especially blood sugar regulation, a system which is sensitive to intrauterine conditions."

A next step in the FOETALIM project is to evaluate the effect of the uterine environment on the immune system and on parasite resistance. Peugnet said.A