Science continues to evolve in the area of broodmare and foal health

Giving Broodmares the Best Chance of Succeeding

NON-TRADITIONAL WAYS OF **STUDYING PREGNANCIES**

By **AMANDA DUCKWORTH** / *Photos by* **ANNE M. EBERHARDT**

HAVING A BROODMARE safely maintain her pregnancy until it is time to deliver a hale and hearty foal is a straightforward goal that is not always easy to achieve. Research surrounding broodmares continues to investigate ways to help them be productive members of their broodmare band.

As a baseline, a broodmare is more likely to have an easier time with pregnancy if she is healthy herself. A key component of that is making sure she is neither too light or too heavy. Working with a trusted veterinarian can help determine the best range for each individual.

Another early step is picking the proper stallion for a mare, which is a multi-factorial process that has long-term implications. Science is now also examining if that selection could be impacting a mare's ability to get in foal in the first place. In July 2024, the Equine Veterinary Journal published "Does inbreeding contribute to pregnancy loss in Thoroughbred horses?"

"Excessive inbreeding increases the probability of uncovering homozygous recessive genotypes and has been associated with an increased risk of retained placenta and lower semen quality," explained researchers. "No genomic analysis has investigated the association between inbreeding levels and pregnancy loss."

Researchers aimed to compare genetic inbreeding coefficients (F) of naturally occurring Thoroughbred Early Pregnancy Loss (EPLs), Mid- and Late-term Pregnancy Loss (MLPL), and controls. Inbreeding coefficients using Runs of Homozygosity (ROH) were calculated using PLINK software, and the ROHs were split into size categories to investigate the recency of inbreeding.

The control group was made up of 59 Thoroughbred mares who were all over the age of 3. Additionally, hair samples from 53 Thoroughbreds, from across eight United Kingdom stud farms, were submitted anonymously by the attending veterinarians between 2017 and 2021. Outside of knowing the name of the stud farm that the sample came from, no additional clinical data was collected besides confirming the horse was a registered Thoroughbred and over the age of 3.

"MLPLs had significantly higher median number of ROH, length of ROH, and total number of ROH, and F_{ROH} when compared with the Controls and the EPLs," researchers explained. "There was no significant difference in any of the inbreeding indices between the EPLs and Controls. The MLPLs had a significantly higher proportion of long ROH than the Controls. No unique ROHs were found in the EPL or MLPL populations.

"In conclusion, we observed higher inbreeding metrics in UK Thoroughbred pregnancies lost in mid and late gestation compared to the adult population, evidencing that lack of heterogeneity is a contributor to pregnancy failure after the early pregnancy period. We hypothesize that this is due to an increase in the occurrence of homozygous recessive alleles, highlighting that studies into the role of specific gene mutations are both required and warranted. Our data high-

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lights the importance of cognizance in mating decisions in the Thoroughbred industry, and continued work in the laboratory to identify possible deleterious mutations."

As science progresses, fetal sexing has become more common. In a related vein, scientists are researching if what the sex will be can be massaged early in the process. In August 2024, Animal Reproduction published "Foal sex in Thoroughbred horses: related factors."

"Reproductive biotechniques in the equine species have advanced in the last decade and horse breeders have started to question the possibilities of interfering in the determination of foal sex," explained researchers. "The aim of the present study was to verify whether the variables mares and stallion's age, side of the ovary containing the preovulatory follicle, preovulatory follicle diameter, time between breeding and ovulation, and ovulation inducing hormones influence the sex of the foal."

A 2024 study by Veterinary Sciences looked at "The Effect of Supplemental Lighting during the Late Gestation Period on Post-Partum Mechanical Properties of Mare and Foal Guard Hair"

In all, researchers examined the 259 reproductive cycles of 160 mares and 22 Thoroughbred stallions for the study. They noted that of the total foals born, 136 were males (52.51%) and 123 were females (47.49%). Statistical analysis was performed, including Pearson's chi-square test and logistic regression.

Researchers concluded that in terms

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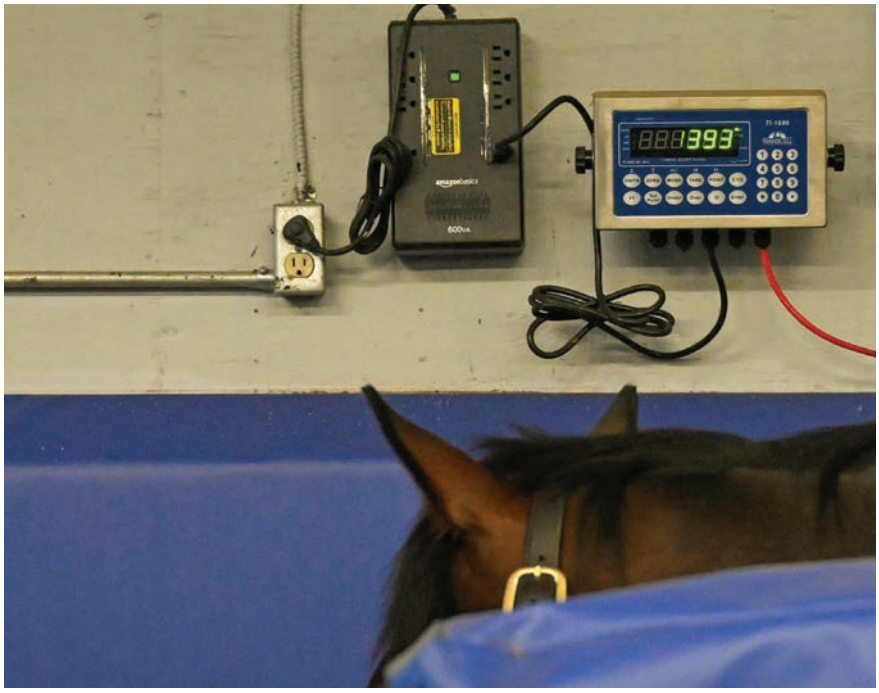

The optimal weight for a broodmare depends upon the individual

of mares who ovulated with -24h after ovulation induction, 104 of their foals (54.74%) were males and 86 (45.26%) were females. Meanwhile, when it came to mares who ovulated with +24h, 32 foals (46.38%) were males and 37 (53.62%) were females. Stallions up to 15 years old had 44.14% (n=49) females and those over 15 years had 49.66% (n=73) females.

"The determination of sex is important, as the sex of the foal has a great influence on its commercial value," researchers explained. "The simple logistic regression model showed that mares and stallions under 15 years old, mares with ovulation time less than 24 hours and treated with Deslorelin had a higher probability of having male foals, but the Pearson's chi-square test showed that foals' gender were not influenced by the variables studied."

No matter the stallion selected or the potential sex of the foal, determining if a mare is pregnant and figuring out why she might not be keeping her pregnancy are important pieces of the gestation puzzle. As technology changes, methods are being examined beyond what has been considered traditional. In October 2024, the International Journal of Molecular Sciences published "Plasma Lipidomics Reveals Lipid Signatures of Early Pregnancy in Mares."

"Understanding the systemic biochemistry of early pregnancy in the mare is essential for developing new diagnostics and identifying causes for pregnancy loss," explained researchers. "This study aimed to elucidate the dynamic lipidomic changes occurring during the initial stages of equine pregnancy, with a specific focus on days 7 and 14 post-ovulation.

"By analyzing and comparing the plasma lipid profiles of pregnant and non-pregnant mares, the objective of this study was to identify potential biomarkers for pregnancy and gain insights into the biochemical adaptations essential for supporting maternal recognition of pregnancy and early embryonic development."

In all, 28 Thoroughbred mares who ranged in age from 3 to 16 were randomly selected from two breeding farms in the Hunter Valley region of New South Wales, Australia. All of the mares were healthy, which was determined through veterinary records and physical exams.

As part of the study, an expert veterinary surgeon used ultrasound scanning to monitor ovarian and uterine activity during estrus. The mares were then bred by live cover one day before, or on the day of, estimated ovulation, and ovulation was confirmed the following day. Mares were checked for pregnancy 12–14 days later, and researchers analyzed plasma samples twice post conception for both pregnant and non-pregnant mares.

"Our analysis revealed significant lipidomic alterations between pregnant and non-pregnant mares and between days 7 and 14 of pregnancy," explained researchers. "Key findings include the upregulation of bile acids, sphingomyelins, phosphatidylinositols, and triglycerides in

"EXCESSIVE INBREEDING INCREASES THE PROBABILITY OF UNCOVERING HOMOZYGOUS RECESSIVE GENOTYPES AND HAS BEEN ASSOCIATED WITH AN INCREASED RISK OF RETAINED PLACENTA AND LOWER SEMEN QUALITY. NO GENOMIC ANALYSIS HAS INVESTIGATED THE ASSOCIATION BETWEEN INBREEDING LEVELS AND PREGNANCY LOSS."

—EQUINE VETERINARY JOURNAL PUBLISHED "DOES INBREEDING CONTRIBUTE TO PREGNANCY LOSS IN THOROUGHBRED HORSES?" IN JULY 2024

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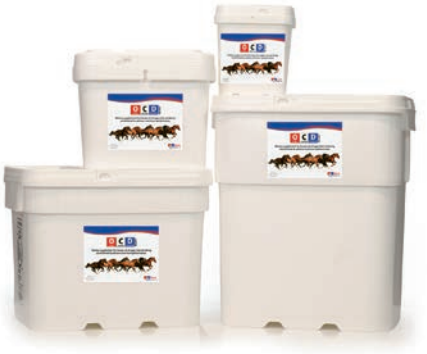

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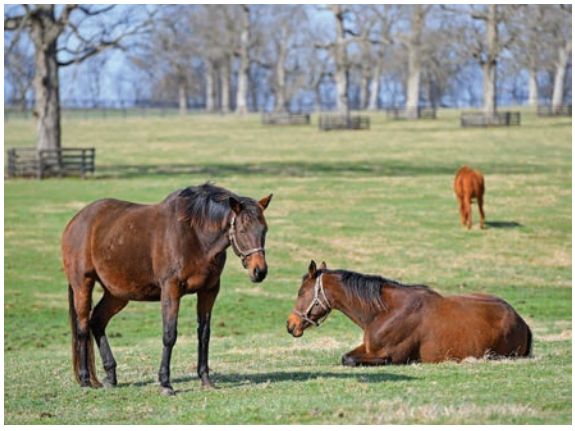
pregnant mares. These changes suggest enhanced lipid synthesis and mobilization, likely associated with the embryo's nutritional requirements and the establishment of embryo-maternal interactions. There were significant differences in lipid metabolism between pregnant and non-pregnant mares, with a notable increase in the sterol lipid BA 24:1;O5 in pregnant mares as early as day 7 of gestation, suggesting it as a sensitive biomarker for early pregnancy detection.

"The study demonstrates the profound lipidomic shifts that occur in early equine pregnancy, highlighting the critical role of lipid metabolism in supporting embryonic development. These findings provide valuable insights into the metabolic adaptations during this period and potential biomarkers for early pregnancy detection in mares."



In a comprehensive United Kingdom study that spanned several years, the effects of inbreeding were measured against healthy pregnancies

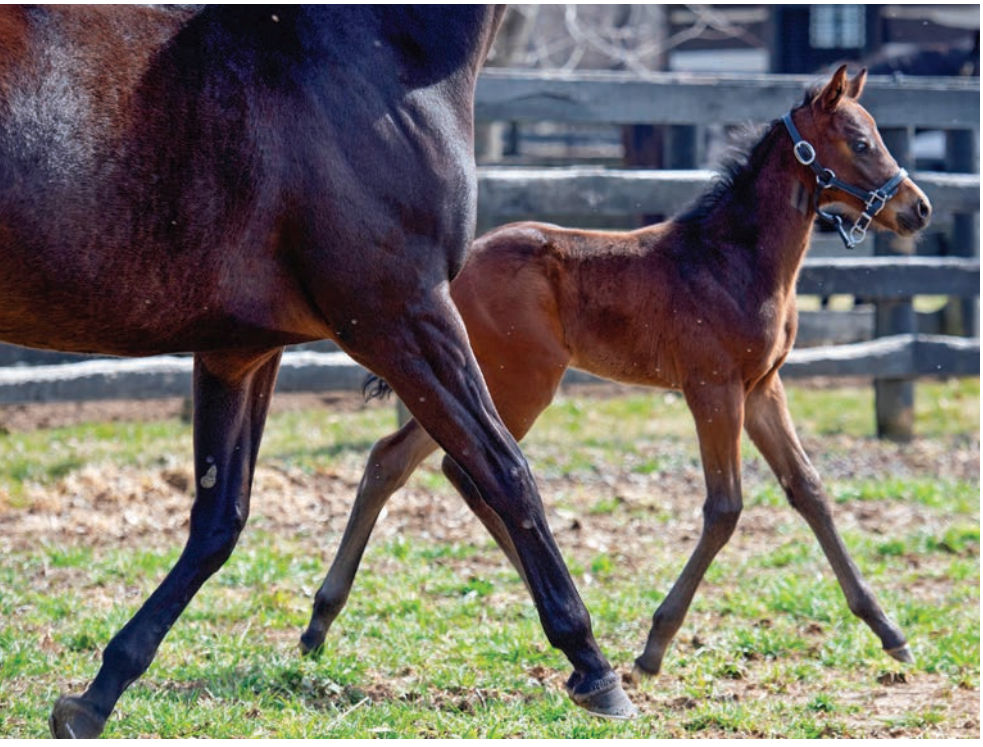
A traditional method of advancing the breeding season is to keep a mare under lights. A more advanced version of that which has gained traction in the past decade is making use of the blue light spectrum. Researchers have looked into the results, including in the study "The Effect of Supplemental Lighting during the Late Gestation Period on Post-Partum Mechanical Properties of Mare and Foal Guard Hair," which was published by Veterinary Sciences in January 2024.

"The equine species are seasonal breeders whose physiological breeding season extends from March to May," explained researchers. "However, there is a significant demand for foals born early in the year (January–February), which has led to an artificially induced breeding season. This study investigates Thoroughbred mares exposed to artificial blue light at the end of gestation. The aim is to investigate the consequences of this treatment on maternal and filial hair properties at the time of parturition."

For the study, 60 mares and their 60 foals were used. Control mares lived in light conditions reflecting the natural photoperiod typical for the time of year, while the treated mares received supplementary lighting starting 41 days before their expected foaling date. This was done with the aim of allowing the mares to breed again sooner after foaling. Guard hair samples were collected from the shoulder within 12 hours of the birth.

"The foals of the light-treated mares developed significantly shorter hair than those of the control mares," researchers concluded. "A general effect of light treatment on basal hair diameter thinning could be demonstrated. The maximum force of hair samples of light-treated mares and foals was significantly lower than that of the control. The tensile strength of the foal hair samples of the light-treated mares was significantly lower than that of the control foals. Although no significant difference was found in the elongation, the hair of the control animals (mares and foals together) was more elastic than that of the treated animals.

"In conclusion, the supplemental blue light treatment of the pregnant mares has a decreasing effect on both mares and their foals on the mechanical



With advances in science, researching if the sex of a foal can be massaged early in the process has entered the conversation

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properties of the hair, making it shorter, thinner, and weaker."

That study echoed the findings of "Effects of blue monochromatic light directed at one eye of pregnant horse mares on gestation, parturition and foal maturity," which was published by Domestic Animal Endocrinology in January 2022.

"The horse is a seasonally breeding species and extending day length by exposing mares to artificial light for several hours after dusk from early December onwards advances the onset of seasonal reproductive activity," explained researchers. "This is achieved via shortening the daily phase of melatonin release from dusk to dawn. Short wavelength light within the blue spectrum is particularly effective at suppressing melatonin secretion in the horse and low intensity blue light from light emitting diodes (LED) directed at a single eye has been used to advance the ovulatory season in mares to the same extent as illuminating the mares' stable."

For the study, 20 pregnant broodmares were observed over two consecutive years in a cross-over design. During one year, the mares received an extended photoperiod using 50 lux of blue LED light directed at a single eye from 08:00 until 23:00 daily via headworn light masks starting mid-December. The other year served as the control, and they did not receive this treatment.

"Gestation was shorter in blue LED light-treated than in control pregnancies," researchers concluded. "Foals born to blue LED light-treated mares had lower wither heights, similar weights, and took less time to stand after birth than control foals. Foals born to blue LED light-treated mares had reduced hair length compared to controls and hair regrowth in treated mares was reduced. In conclusion, blue LED light directed at one eye advanced foaling and influenced height and hair coat but not weight in foals."

Ultimately, while Mother Mature takes care of most of the work associated with a safe pregnancy and foaling, interest remains high in understanding how technology and science can be used to give a broodmare the opportunity to succeed within a program. Working with a trusted veterinarian and staying up to date on the latest research are important steps to take to help ensure each mare is given her best chance. BH

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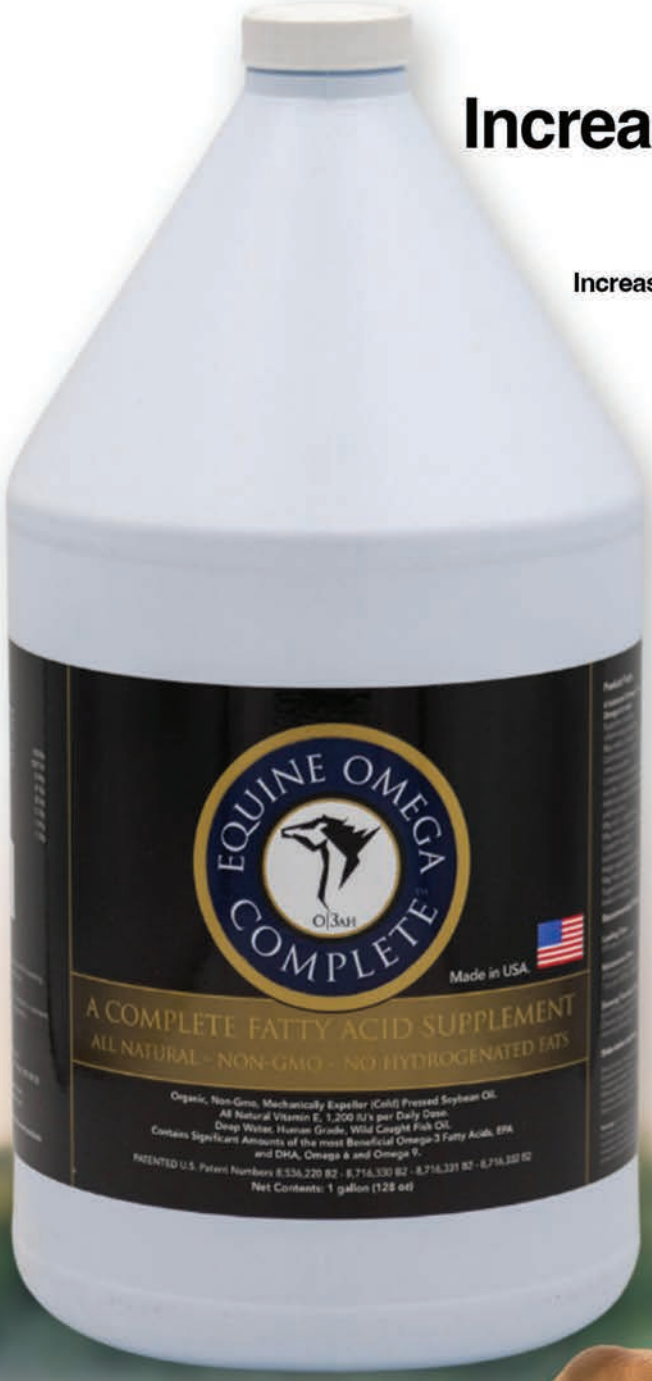

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