As breeding season gets started, farm managers are well aware of mares' ages and their potential to colic

Just a Number?

STUDIES OFFER CLUES ON WHEN MARE AGE IS A CONCERN, AND WHEN IT ISN'T

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

AS BREEDING SEASON draws closer, Thoroughbred broodmares are being prepped for another year of being productive members of the herd. As experts in their field, farm managers are well versed in broodmare basics and have it down to an art form in many regards.

However, some areas will always be an issue when it comes to getting and keeping a mare in foal, no matter how advanced management skills and science become. One of those is a mare's age; another is that broodmares can be prone to colic.

A quick flip through sale results will highlight one of the most common knocks against any given broodmare. The older a mare becomes, the less desirable she might be as an addition to a broodmare band. However, data suggest mares of the same age are unlikely to have the same breeding successes or failures based on that single fact.

The *Journal of Equine Science* examined this issue in its June 2021 edition with the study "Effect of advancing age on the reproductive performance of Japanese Thoroughbred broodmares."

"Improving reproductive efficiency is one of the main goals of horse breeding," explained researchers. "One factor that is known to have a strong effect is the age of the mare at the time of mating. Many studies have reported that the increase in the age of the mare has a negative effect on not only the pregnancy rate, gestation length, and birth rate, but also the weight and racing performance of the foal. This may be due to several factors, such as the ovulation rate, uterine blood flow, fetal development, birth weight of the foal, and high wastage element that occurs during breeding.

"However, although the ages at first and last mating vary among broodmares, it is unknown how this variation affects the correlation between age and reproductive performance in mares."

For the study, researchers reviewed all matings among Thoroughbreds recorded in Japan between 1997 and 2017. Because the data spanned two decades, it allowed them to examine not only the effect of advancing age in the mares but also how the ages at first and last mating affected the relationship between advancing age and reproductive performance.

Researchers performed statistical tests on the data, noting that because the number of mares with data for age at both first and last mating was limited, the logistic regression between the birth rate and the number of years since the first mating was only estimated with mares for which the age at first mating could be determined. Furthermore, the logistic regression between the birth rate and the age at last mating was only estimated with mares for which the age at last mating could be determined.

In total, the dataset included 364,724 mating events, with around 16,000-19,000 matings taking place each year. Of those events, 40%-43% resulted in the birth of a live foal. As some would be given additional opportunities, 70%-75% of the mares mated each year successfully produced a live foal. Although the live foal birth rate remained similar both per mating and per season, the number of matings and

A recent study in Japan found that the number of years since the first mating contributes more to the decline in birth rate than increase in age

mares mated declined over the years. Researchers also examined the resulting earnings of foals that went on to make at least one start.

"The age at first mating did not have a strong effect on the mean earnings of the foals although the earnings of the foals produced by the first mating, i.e., by maiden mares, tended to be low," researchers found. "On the other hand, the age at last mating clearly had a strong effect. The mean earnings of foals produced by mares that continued to be mated after the age of 18 were much higher than those of the foals produced by mares that were retired at a younger age. Indeed, the age at last mating and the earnings showed a significant positive correlation at each mating age from 4 to 15."

Approximately 99% of the matings were with mares that ranged from 3 to 20 in age although some were as young as 2 or as old as 28. While 96% of the mares were mated for the first time between the ages of 3 and 7, the range for their final mating was much more varied. Additionally, the live

foal birth rates, both per mating event (birth/mating) and per mare mated each season (birth/season), gradually decreased.

"Importantly, we found two significant factors that influence the observed correlation between the age of the mare and both the live foal birth rate and the racing performance of the foal," said researchers. "One is the age of the mare at its first mating. Our results show that the increase in the number of years since the first mating contributes more to the decline in the birth rate than the increase in age. Another important factor is the age of the mare at its last mating. Traits such as the live foal birth rate and the racing performance of the produced foal may vary among mares and are most likely to be prime targets of selective breeding.

"The age of the mare is often considered when assessing its potential value. Here, we have shown that the ages at the first and last mating affect the correlation between age and reproductive performance in mares. Our results should help us to better understand the effect of the advancing age in mares and to design more effective breeding and management strategies."

A broodmare's age and produce record also appear to play an important role when it comes to breeding success after a common medical emergency that continues to plague equines: colic.

In its paper "Colic: Minimizing its Incidence and Impact in your Horse," the American Association of Equine Practitioners (AAEP) explains: "Colic is the number-one killer of horses. The good news is that most cases of colic are mild and resolve with simple medical treatment, and sometimes with no specific treatment at all. Less than 10% of all colic cases are severe enough to require surgery or cause the death of the horse. Nevertheless, every case of colic should be taken seriously because it can be difficult to tell the mild ones from the potentially serious ones in the early stages."

Good management is important, both when it comes to preventing colic in the first place and when providing quick care when it is unavoidable. However, because it is a problem with multiple causes and contributing factors, colic remains one area where, despite best efforts and best management practices, total prevention in any equine population is impossible.

When a pregnant broodmare experiences an episode of colic, it can impact not only her health but that of the foal she is carrying as well as the potential for any future pregnancies.

The November 2021 issue of *Veterinary Surgery* examined what happens after a mare suffers from colic in "Outcomes of pregnant broodmares treated for colic at a tertiary care facility." The purpose of this observational cohort study, which included multiple breeds including Thoroughbreds, was to evaluate broodmare survival; the frequency of recurrent colic and its associated variables; and the pregnancy outcome and variables associated with a negative result following colic admission during pregnancy.

Information from 104 broodmare admissions was compiled, using pregnant mares that were admitted to the clinic from June 2010 through October 2016. Data were collected through November 2017. In all, 73 of the 104 broodmares (70.2%) were discharged alive, and both age and breed—namely being a Thoroughbred—contributed to colic recurrence.

"Lesion category, admission hyperlactatemia, and admission high packed cell volume were associated with reduced survival," researchers found. "Recurrent colic was observed in broodmares from 33/70 admissions (47.1%). The final multivariable model for recurrent colic included Thoroughbred breed and age.

"Overall, negative pregnancy outcome was 14/65 (21.5%). Lesion category, evidence of systemic inflammatory response syndrome (SIRS) in hospital,

ELLEN PONS

A colic episode in a pregnant broodmare can impact not only her health but that of the foal she is carrying

and diarrhea in hospital were associated with increased negative pregnancy outcome. Altrenogest administration was inversely associated with negative pregnancy outcome. Pregnant broodmares admitted for colic had lower survival than anticipated and were at risk of recurrent colic."

Large colon volvulus is a specific acute, severe abdominal calamity, and previous studies have found that it is responsible for 10%-20% of horses presented with colic that undergo exploratory laparotomy. Survival rates have varied tremendously, with reported ranges of 35%-85%, but even less is known about breeding productivity following such a traumatic episode.

Researchers examined the topic in "Reproductive careers of Thoroughbred broodmares before and after surgical correction of ≥360 degree large colon volvulus," which was published in the *Equine Veterinary Journal* in March 2018.

Because limited data existed that examine broodmare longevity and reproductive efficiency after surgical correction of ≥360 degree large colon volvulus, the study aimed to compare career duration and foals delivered before and after such a surgery.

To do so, researchers did a retrospective case series using broodmares registered with The Jockey Club that had surgical correction of ≥360° LCV and survived to hospital discharge at Rood & Riddle Equine Hospital. Information from the hospital and produce records were then compared for mares that had undergone the surgery from January 2000 to December 2015.

"Mares that were bred but never foaled prior to surgery had shorter careers and fewer foals compared with mares that delivered at least one foal before surgery," researchers found. "Broodmares that delivered foals before surgery produced more foals in the years before surgery than after surgery and had longer breeding careers years before compared with after surgery. No significant differences in career length or number of foals delivered were detected for mares with a single surgery, compared with those mares with multiple LCV surgeries.

"Mares that were 3-11 years old at the time of surgery had significantly

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WHEN IT COMES TO HORSE HEALTH & SAFETY, DON'T HIT THE EASY BUTTON

Many horse owners want to reduce the cost of treatment by reaching for a "compounded" version of altrenogest (a progestin used in veterinary medicine to suppress or synchronize estrus in horses) in long-acting injectable formulations. BUT AT WHAT COST TO YOUR HORSE?

A compounder simply mixes up a drug preparation and sells it *without any required testing for purity and concentration*. This has been illustrated many times by horses DYING from compounded medications that weren't tested before being sold. *Compounded products require no proof of efficacy*, so you have no proof the product is even altrenogest or is safe.

When you use only FDA approved altrenogest products such as Altren® (altrenogest) Oral Solution manufactured by Aurora Pharmaceutical, the veterinarian and the horseman know the *ingredients have been tested for purity* and the final product has been *tested for purity and stability.* NO EXCEPTIONS. Also, before any drug formula is approved by the FDA, it must pass rigorous research trials that prove it is safe and works for its intended purpose.

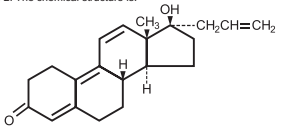
So, the question every equine enthusiast must ask is *whether convenience is more important than the peace of mind that comes from using the approved and tested product in your expensive mare*? The answer should always be NO. Your equine partner will thank you.

—Content provided by Aurora Pharmaceutical, Northfield, Minn. https://aurorapharmaceutical.com

Altren®
(altrenogest)
SOLUTION 0.22% (2.2 mg/mL)

CAUTION:
Federal law restricts this drug to use by or on the order of a licensed veterinarian.

DESCRIPTION:
Altren® (altrenogest) Solution 0.22% contains the active synthetic progestin, altrenogest. The chemical name is 17α-allyl-17β-hydroxyestra-4,9,11-trien-3-one. The CAS Registry Number is 850-52-2. The chemical structure is:



Each mL of Altren® (altrenogest) Solution 0.22% contains 2.2 mg of altrenogest in an oil solution.

ACTIONS:
Altren® (altrenogest) Solution 0.22% produces a progestational effect in mares.

INDICATIONS:
Altren® (altrenogest) Solution 0.22% is indicated to suppress estrus in mares. Suppression of estrus allows for a predictable occurrence of estrus following drug withdrawal. This facilitates the attainment of regular cyclicity during the transition from winter anestrus to the physiological breeding season. Suppression of estrus will also facilitate management of prolonged estrus conditions. Suppression of estrus may be used to facilitate scheduled breeding during the physiological breeding season.

CONTRAINDICATIONS:
Altren® (altrenogest) Solution 0.22% is contraindicated for use in mares having a previous or current history of uterine inflammation (i.e., acute, subacute, or chronic endometritis). Natural or synthetic gestagen therapy may exacerbate existing low-grade or "smoldering" uterine inflammation into a fulminating uterine infection in some instances.

PRECAUTIONS:
Various synthetic progestins, including altrenogest, when administered to rats during the embryogenic stage of pregnancy at doses manyfold greater than the recommended equine dose caused fetal anomalies, specifically masculinization of the female genitalia.

DOSAGE AND DIRECTIONS:
While wearing protective gloves, remove shipping cap and seal; replace with enclosed plastic dispensing cap. Remove cover from bottle dispensing tip and connect luer lock syringe (without needle). Draw out appropriate volume of Altren® solution. (Note: Do not remove syringe while bottle is inverted as spillage may result.) Detach syringe and administer solution orally at the rate of 1 mL per 110 pounds of body weight (0.044 mg/kg) once daily for 15 consecutive days. Administer solution directly on the base of the mare's tongue or on the mare's usual grain ration. Replace cover on bottle dispensing tip to prevent leakage. Excessive use of a syringe may cause the syringe to stick; therefore, replace syringe as necessary.

DOSAGE CHART:

Approximate Weight in Pounds	Dose in mL
770	7
880	8
990	9
1100	10
1210	11
1320	12

WHICH MARES WILL RESPOND TO ALTREN® (altrenogest) SOLUTION 0.22%:
Extensive clinical trials have demonstrated that estrus will be suppressed in approximately 95% of the mares within three days; however, the post-treatment response depended on the level of ovarian activity when treatment was initiated. Estrus in mares exhibiting regular estrus cycles during the breeding season will be suppressed during treatment; these mares return to estrus four to five days following treatment and continue to cycle normally. Mares in winter anestrus with small follicles continued in anestrus and failed to exhibit normal estrus following withdrawal.

Response in mares in the transition phase between winter anestrus and the summer breeding season depended on the degree of follicular activity. Mares with inactive ovaries and small follicles failed to respond with normal cycles post-treatment, whereas a higher proportion of mares with ovarian follicles 20 mm or greater in diameter exhibited normal estrus cycles post-treatment. Altrenogest Solution 0.22% was very effective for suppressing the prolonged estrus behavior frequently observed in mares during the transition period (February, March and April). In addition, a high proportion of these mares responded with regular estrus cycles post-treatment.

SPECIFIC USES FOR ALTREN® (altrenogest) SOLUTION 0.22%:

SUPPRESSION OF ESTRUS TO:

1. Facilitate attainment of regular cycles during the transition period from winter anestrus to the physiological breeding season. To facilitate attainment of regular cycles during the transition phase, mares should be examined to determine the degree of ovarian activity. Estrus in mares with inactive ovaries (no follicles greater than 20 mm in diameter) will be suppressed but these mares may not begin regular cycles following treatment. However, mares with active ovaries (follicles greater than 20 mm in diameter) frequently respond with regular post-treatment estrus cycles.
2. Facilitate management of the mare exhibiting prolonged estrus during the transition period. Estrus will be suppressed in mares exhibiting prolonged behavioral estrus either early or late during the transition period. Again, the post-treatment response depends on the level of ovarian activity. The mares with greater ovarian activity initiate regular cycles and conceive sooner than the inactive mares. Altren® (altrenogest) Solution 0.22% may be administered early in the transition period to suppress estrus in mares with inactive ovaries to aid in the management of these mares or to mares later in the transition period with active ovaries to prepare and schedule the mare for breeding.
3. Permit scheduled breeding of mares during the physiological breeding season. To permit scheduled breeding, mares which are regularly cycling or which have active ovarian function should be given Altren® (altrenogest) Solution 0.22% daily for 15 consecutive days beginning 20 days before the date of the planned estrus. Ovulation will occur 5 to 7 days following the onset of estrus as expected for non-treated mares. Breeding should follow usual procedures for mares in estrus. Mares may be regulated and scheduled either individually or in groups.

ADDITIONAL INFORMATION:
A 3-year well controlled reproductive safety study was conducted in 27 pregnant mares, and compared with 24 untreated control mares. Treated mares received 2 mL altrenogest solution 0.22%/110 lb body weight (2x dosage recommended for estrus suppression) from day 20 to day 325 of gestation. This study provided the following data:

1. In filly offspring (all ages) of treated mares, clitoral size was increased.
2. Filly offspring from treated mares had shorter interval from Feb. 1 to first ovulation than fillies from their untreated mare counterparts.
3. There were no significant differences in reproductive performance between treated and untreated animals (mares & their respective offspring) measuring the following parameters:
   - interval from Feb. 1 to first ovulation, in mares only.
   - mean interovulatory interval from first to second cycle and second to third cycle, mares only.
   - follicle size, mares only.
   - at 50 days gestation, pregnancy rate in treated mares was 81.8% (9/11) and untreated mares was 100% (4/4).
   - after 3 cycles, 11/12 treated mares were pregnant (91.7%) and 4/4 untreated mares were pregnant (100%).
   - colt offspring of treated and control mares reached puberty at approximately the same age (82 & 84 weeks respectively).
   - stallion offspring from treated and control mares showed no differences in seminal volume, spermatozoal concentration, spermatozoal motility, and total sperm per ejaculate.
   - stallion offspring from treated and control mares showed no difference in sexual behavior.
   - testicular characteristics (scrotal width, testis weight, parenchymal weight, epididymal weight and height, testicular height, width & length) were the same between stallion offspring of treated and control mares.

REFERENCES:
Shoemaker, C.F., E.L. Squires, and R.K. Shideler, 1989.

Safety of Altrenogest in Pregnant Mares and on Health and Development of Offspring. Eq. Vet. Sci. (9); No. 2: 69–72.

Squires, E.L., R.K. Shideler, and A.O. McKinnon. 1989.

Reproductive Performance of Offspring from Mares Administered Altrenogest During Gestation. Eq. Vet. Sci. (9); No. 2: 73–76.

WARNING:
For oral use in horses only. Keep this and all other medications out of the reach of children. Do not use in horses intended for human consumption.

HUMAN WARNINGS:
Skin contact must be avoided as Altren® (altrenogest) Solution 0.22% is readily absorbed through unbroken skin. Protective gloves must be worn by all persons handling this product. Pregnant women or women who suspect they are pregnant should not handle Altren® (altrenogest) Solution 0.22%. Women of child bearing age should exercise extreme caution when handling this product. Accidental absorption could lead to a disruption of the menstrual cycle or prolongation of pregnancy. Direct contact with the skin should therefore be avoided. Accidental spillage on the skin should be washed off immediately with soap and water.

INFORMATION FOR HANDLERS:
WARNING: Altren® (altrenogest) Solution 0.22% is readily absorbed by the skin. Skin contact must be avoided; protective gloves must be worn when handling this product.

Effects of Overexposure
There has been no human use of this specific product. The information contained in this section is extrapolated from data available on other products of the same pharmacological class that have been used in humans. Effects anticipated are due to the progestational activity of altrenogest.

Acute effects after a single exposure are possible; however, continued daily exposure has the potential for more untoward effects such as disruption of the menstrual cycle, uterine or abdominal cramping, increased or decreased uterine bleeding, prolongation of pregnancy and headaches. The oil base may also cause complications if swallowed.

In addition, the list of people who should not handle this product (see below) is based upon the known effects of progestins used in humans on a chronic basis.

PEOPLE WHO SHOULD NOT HANDLE THIS PRODUCT:

1. Women who are or suspect they are pregnant.
2. Anyone with thrombophlebitis or thromboembolic disorders or with a history of these events.
3. Anyone with cerebral-vascular or coronary-artery disease.
4. Women with known or suspected carcinoma of the breast.
5. People with known or suspected estrogen-dependent neoplasia.
6. Women with undiagnosed vaginal bleeding.
7. People with benign or malignant tumors which developed during the use of oral contraceptives or other estrogen-containing products.
8. Anyone with liver dysfunction or disease.

Accidental Exposure
Altrenogest is readily absorbed from contact with the skin. In addition, this oil based product can penetrate porous gloves. Altrenogest should not penetrate intact rubber or impervious gloves; however, if there is leakage (i.e., pinhole, spillage, etc.), the contaminated area covered by such occlusive materials may have increased absorption. The following measures are recommended in case of accidental exposure.

Skin Exposure: Wash immediately with soap and water.

Eye Exposure: Immediately flush with plenty of water for 15 minutes. Get medical attention.

If Swallowed: Do not induce vomiting. Altren® (altrenogest) Solution 0.22% contains an oil. Call a physician. Vomiting should be supervised by a physician because of possible pulmonary damage via aspiration of the oil base. If possible, bring the container and labeling to the physician.

Store at or below 25° C (77° F). Reclose tightly.

HOW SUPPLIED:
Altren® (altrenogest) Solution 0.22% (2.2 mg/mL). Each mL contains 2.2 mg altrenogest in an oil solution. Available in 1000 mL and 150 mL plastic bottles.

Manufactured by:
Aurora Pharmaceutical, Inc.
Northfield, Minnesota 55057

Approved by FDA under ANADA # 200-620 04/2019

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FDA-approved Altren® (altrenogest) Solution 0.22% is indicated to suppress estrus in mares. Altren is the only oral progestin available in a 150 mL single horse dosing package

FDA APPROVED – quickly and safely reduces the moodiness and temperament changes often associated with estrus and keeps your mare out of heat for all her major events

PROVEN PERFORMANCE – contains the same active ingredient and dosing regimen as Regu-Mate®

ECONOMICAL PACKAGING – unique, 150 mL individualized treatment package keeps product cost down and assures effective treatment

The Only FDA-Approved Vented Draw-Off Cap

Managing Estrus to Fit Your Schedule

Altren® (altrenogest) Solution 0.22% is contraindicated for use in mares with a previous or current history of uterine inflammation. Talk to your veterinarian about proper use and safe handling of Altren. Avoid skin contact and always wear protective gloves when administering. Pregnant women, or women who suspect they are pregnant, should not handle Altren. Refer to the package insert by visiting www.aurorapharmaceutical.com for complete product information.

Altren is a Registered Trademark of Aurora Pharmaceutical, Inc.
Regu-Mate is a Registered Trademark of Merck Animal Health

MANUFACTURED IN THE USA Ad000069 10/2019

For more information on Altren® consult your veterinarian or equine health care professional

www.aurorapharmaceutical.com

A study of Thoroughbred mares discharged from Rood & Riddle Equine Hospital after significant colic surgery found that mares that were bred but never foaled prior to surgery had shorter careers and fewer foals compared with mares that had delivered at least one foal before surgery

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more foals after surgery compared with mares at least 12 years old, as expected. Broodmares had productive careers following surgery for ≥360° LCV that were largely influenced by the mare's age at the time of surgery."

If a broodmare is prone to this form of colic, it might concern owners that any resulting foals might also be susceptible to it as well. Researchers examined this topic in "Preliminary heritability of complete rotation large colon volvulus in Thoroughbred broodmares," which was published in *The Veterinary Record* in September 2019.

"Large colon volvulus (LCV) is a life-threatening form of colic that occurs when the large colon rotates 360° or more on its axis, resulting in colonic distention and ischaemia," explained researchers. "Any horse can suffer from LCV, but the risk is greatest for periparturient Thoroughbred broodmares; the objective of this study was to estimate the heritability of LCV in these horses."

> **"EVERY CASE OF COLIC SHOULD BE TAKEN SERIOUSLY BECAUSE IT CAN BE DIFFICULT TO TELL THE MILD ONES FROM THE POTENTIALLY SERIOUS ONES IN THE EARLY STAGES."**
>
> —AMERICAN ASSOCIATION OF EQUINE PRACTITIONERS

Using the records of Thoroughbred broodmares on three farms in Central Kentucky, researchers identified a dataset that had 39 LCV cases compared with 191 control cases. Mares on the same farm with no history of surgical colic represented the control.

"Age of the LCV cases at the time of incident was significantly younger than that of the controls at the time of the study," researchers found. "A total of 2,223 horses were present when the five-generation pedigrees of the 230 study horses were combined.

"Heritability of LCV was estimated at 0.311±0.383 from the fit of a logit sire model with binomial data, including year of birth and farm as fixed effects. Further data on broodmares from these and other farms will help to improve this estimate, which suggests LCV is moderately heritable."

While a mare's age and medical history cannot be changed, understanding what both of those factors mean can prove vital in terms of her ongoing breeding productivity. Age might be just a number, but what that figure represents in relation to a mare's ability to handle a pregnancy in the future can vary significantly based on what she has experienced in the past. BH

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