First suckling influences behaviour

Research from France may change the way we manage newborn foals. Scientists have found that helping the foal to find the teat can influence the foal's behaviour as it grows up.

The importance of making sure newborn foals drink an adequate amount of colostrum is well known. A normal foal will usually suck within 2 hours of birth. Many stud managers advocate helping the foal to the teat to ensure that it gets off to a good start in life.

But scientists at the University of Rennes suggest that the practice may have unexpected consequences on the foal's behaviour. Dr Martine Hausberger and others looked at whether encouraging the foals to suck influenced their behaviour later in life.

For a start, the researchers studied the behaviour of 3-month old foals on a farm where foals were routinely taken to the teat two hours after birth . Now, it may be that by waiting that long before helping the foals, allowed the stronger foals to start sucking on their own. Perhaps only the weaker foals were helped.

So to avoid this influencing the findings, they carried out a second study in which they led the foals to the mares after half an hour. The foals that were helped were chosen at random. The other foals were left to find the teat themselves.

Foals that were brought to their dams to suck for the first time behaved differently when observed at 1 - 3 months of age. They tended to stay closer to their mothers and spend less time playing with their fellows.

In contrast, foals that had been allowed to suck spontaneously seemed more independent. They were more playful and were more likely to leave their dams to play and explore the environment.

Why does that matter? The bonding process between mother and offspring has an ongoing influence on the behaviour of the offspring. In previous work, Dr Hausberger and others showed that foals that spend more time playing away from their dams tend to react better to novel objects and new experiences when they are older.

Other than the assistance given at first suckling, both groups were treated the same both at birth and afterwards. All other management factors were the same. So the only explanation for the different behaviour was the presence or absence of help to start suckling. Why should this be? Dr Hausberger observes that mares tended to be restless while the foal was being handled. Perhaps this produced an emotional response in the foals.

The scientists conclude that first suckling is a crucial part of forming the bond between mare and foal. They suggest that it may be best to let the foal "set the agenda". Foaling attendants should give assistance according to the individual foal's need rather than adhere to a rigid routine.

Reference:

First suckling: A crucial event for mother - young attachment? An experimental study in horses (Equus caballus).
M Hausberger , S Henry, C Larose, MA Richard-Yris.
J Comp Psychol (2007) 121, 109 - 112

Early handling influences foal behaviour

Does handling newborn foals make them more manageable, calmer and improve their learning ability?

Dr Léa Lansade and others working in the Laboratory of Animal Behaviour at the National Institute for Agricultural Research, in Tours, France, have been investigating the effect of early handling on the subsequent behaviour of foals. Their findings were reported in the Journal of Applied Animal Behaviour Science.

They used 26 Welsh pony foals, which had all been born outside without human interference. Half of the foals were handled daily until they were two weeks old. Handling consisted of fitting a halter, patting the foal all over its body, picking up all the feet and leading the foal for 40m. A white plastic bag was shaken in front of the foal. For ease of management each of these foals was penned individually with its mother during the day and turned out to pasture at night. The other foals were not handled and were kept at pasture where they had little human contact.

To assess the effect of the handling the researchers conducted a series of behavioural tests the first being done when the foals were 16 days old, two days after the end of the handling. Further tests were performed three, six and twelve months after the end of the handling period

They found that although there was a difference in behaviour between the handled and unhandled group two days after the end of the handling period, any effects were short lived.

Two days after the end of handling period, they assessed the response to various tests. They recorded the time need to fit a halter and to pick up the feet. They measured the "walk ratio" - an indication of how much resistance the foal showed to being led over 40 metres. A foal that was tugging on the halter all the time would have a walk ratio of 1. Its walk ratio would be lower if it showed less resistance. They also recorded the number of defensive reactions the foal showed during the procedure, and its reaction to surprise events.

They found that handled foals were significantly easier to handle than the unhandled ones. Handled foals took less time to have a halter fitted and have their feet picked up. They showed a lower walk ratio and fewer defensive reactions.

Handled foals showed less reaction to the surprise event that they had previously experienced (the white plastic bag.) But both handled and unhandled foals reacted similarly to a previously unknown surprise - such as suddenly placing a saddle cloth and circingle on the foal's back and taking them away again. So early handling did not seem to make the foals generally less fearful.

Three months later, the handled foals were still slightly easier to handle. The foals took less time to fit a halter and when walked spent significantly less time resisting the halter. But all other tests showed no difference between the groups

Additional tests were carried out when the foals were 6 and 12 months old to assess their reaction to being isolated from other foals, and how they reacted to the presence of an unknown human and a novel object. The researchers found no significant difference in response between the two groups of foals.

Finally, when the foals were 14 months old, the researchers tested their learning ability. In one test of discriminative learning foals had to learn to choose between two buckets according to their colour to receive a reward (food). A second test assessed the foals` spatial learning ability. They had to learn to select one of eight buckets, all the same colour, according to its position. In neither test was there any difference in response between the foals that had been handled regularly after birth and those that had not.

Dr Lansade suggests that as handling newborn foals only has a temporary effect, the handling procedure needs to be repeated regularly until the horse is broken in.

Reference:
Effects of neonatal handling on subsequent manageability, reactivity and learning ability of foals.
Lea Lansade, Magali Bertrand, Marie-France Bouissou.
Applied Animal Behaviour Science (2005) 92, 143 - 158.

Imprint training ineffective

New research casts doubt on the value of imprint training in foals.

"Imprint training" has been popular, especially in the USA, for the early training of foals. It is a procedure in which young foals are forced to accept certain stimuli and taught to perform certain actions during a series of training sessions. Its advocates claim that foals exposed soon after birth to stimuli (such as clippers, fly spray, naso-gastric tube, and leading) will react less to the same stimuli when they encounter them later in life. They suggest that this may make subsequent handling and training easier.

A study to investigate the value of imprint training of foals has been carried out by Dr. Ted Friend's Applied Ethology Program at Texas A&M University. Forty-seven foals were used in the study: forty-six Quarter horse foals and one Thoroughbred. All foals were born in spring 2000 and lived on the same commercial stud farm in Texas. Twenty five foals were subject to the imprint training procedure. Twenty two foals received no training. Foals were allocated to each group at random with the exception of some foals whose owners requested that they receive training.

The imprint training sessions were carried out at 30-45 minutes, and 12, 24 and 48 hours after birth. The first session did not start until the foal had stood up and sucked from the mare. (Foals which had difficulty sucking or standing , or that had special treatment or nursing requirements were excluded from the study.)

The investigators based the imprint training procedure on that suggested by Miller in 1991 . It comprised two parts: For the first part the researchers restrained the foal lying on its side. They ran their hands over all the foal's body, picked up each foot in turn and slapped the hoof several times. They rubbed fingers inside each nostril and in the mouth where the bit would go. They handled the ears and lifted the foal's tail and move d it about. A blue plastic bag was rubbed all over the foal's body. Fly spray was sprayed nearby, so the foal could hear and smell it. The foal's body was sprayed with water from a spray bottle. For the second part, the foal was restrained standing . A halter was put on. The foal was pushed sideways until it moved away from the pressure. The foal was taught to lead and to stand still.

Jennifer Williams, carried out the research for her MS. thesis. She points out that the imprint training procedure used in the study differed in some respects from that described by Miller. However, it was thought to be representative of the imprint training generally carried out. At 1, 2, and 3 months of age they tested the foals' responses to a number of stimuli to assess the effect of the training. (The number of foals available for testing declined as mares and foals returned home from stud. Only 9 foals remained at the time of the 3 month test.)

A standard procedure was followed for each foal. The researchers caught the foal, applied a head collar, attached a heart monitor and repeated the actions done during training, One new stimulus was introduced at each test - such as waving a black plastic bag up and down 3 times, a metre away from the foal. For each stimulus, they recorded the foals highest heart rate and the time taken to complete the test. They also assessed the foal's behaviour in response to the stimuli and scored it from 0 (no movement or reaction) to 6 (unable to perform/complete the test). If the heart rate did not return to resting levels within five minutes after each stimulus, the test was stopped, and no further tests were performed.

Jennifer Williams describes the results of the study. "Foals that had not received the imprint training, actually tended to approach the researcher more rapidly, but the trend was not significant. Foals that had been treated were no easier to halter than foals that had not. Attaching a heart rate monitor took as long in control as treated foals. Behavioural scores were similar in the two groups. We found no significant difference between the responses to the stimuli in the 2 groups. Early training was not efficacious."

ref 1: Miller R (1991) Imprint training of the newborn foal. Western Horseman . Colorado Springs, CO.

Reference:
The effects of early training sessions on the reactions of foals at 1,2, and 3 months of age. JL Williams, TH Friend, MJ Toscano, MN Collins, A Sisto-Burt, CH Nevill. Applied Animal Behaviour Science (2002) 77, 105-114

Gender determines zebra weaning time

What factors influence the age at which foals are weaned?

Many lactating mares are also pregnant. So it is often necessary to balance the needs of the sucking foal with those of its future sibling and the mare herself. It is important to allow the mare enough time after weaning to devote her resources to her next foal.

The actual time of weaning is often laid down by tradition. Current equine stud practice is to wean foals at about 5 -6 months of age. The timing is often determined by the need to prepare foals for sale. Sometimes early weaning may be required. Foals with developmental orthopaedic disease may have to be weaned early to reduce their food intake.

But what would happen if mares were left to decide for themselves when to wean the foal? In feral horses, weaning occurs shortly before the mare gives birth to the next foal, when the foal is up to a year old. If the mare is barren the foal may stay on her for up to two years.

According to studies in captive zebra mares in the Czech Republic, one factor that can influence the time of weaning is the sex of any unborn foal the mare is carrying. Dr Jan Pluhácek of the Research Institute of Animal Science at Praha-Uhrineves and his colleagues studied three herds of captive plains zebra at the Dvur Králové Zoo,

The gestation period of the plains zebra is longer than that of the domestic horse, ranging from 360 - 385 days. As in mares a “foaling heat” occurs after about a week after foaling. Most zebra mares conceive when they are nursing a foal - so mares often provide for two offspring at the same time.

The researchers looked at various factors - such as the sex of the weaned foal; the parents’ age; size of herd; and number of other foals in the herd.

They found that pregnant mares weaned their foals at least 50 days earlier than did non-pregnant mares.

Mares carrying a male foetus weaned their foal earlier than mares carrying a female foetus. The sex of the foetus was the most significant factor affecting time of weaning of the current foal.

Dr Pluhácek points out that this is the first time the sex of the foetus has been shown to influence weaning age in hoofed mammals.

Reference:

Sex of the foetus determines the time of weaning of the previous offspring of captive plains zebra (Equus burchelli)
Jan Pluhácek, Ludek Bartos, Miroslava Dolezalova, Jitka Bartosova-Vichova
Applied Animal Behaviour Science (2007) 105, 192 - 204

Foal behaviour in winter

Do foals suffer in a cold environment? Research from Finland suggests that, provided they have access to a sheltered sleeping accommodation, weanling foals appear to cope well with temperatures as low as to -20C.

The study, by Dr Elena Autio and Dr Minna - Liisa Heiskanen at the University of Kuopio, sought to establish some basic facts about the behaviour of weanling foals in the winter.

Ten foals (7 American Standardbreds and 3 Finnish cold-blooded) of average age about 6 months were used in the study. They were loose - housed with free access to a paddock.

The foals were housed in a sleeping hall, an insulated building with a deep litter bed of peat and straw. They had access, through a shelter, to a paddock. Each foal was fed individually in the sleeping hall. They received concentrates three times a day and silage twice a day. They had access at all times to timothy hay in racks outside the sleeping hall. Dr Autio emphasizes that the feeding of the foals was planned carefully and the effect of cold weather on maintenance energy need was taken into account.

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On 23 occasions between December and March, the researchers recorded the foals` behaviour over 24-hour periods. They noted the location of each foal and what it was doing every 15 minutes.

Overall, the foals spent about 43% of the time in the sleeping hall, 52% out in the paddock and 5% in the shelter that separated the paddock and sleeping hall. The foals spent most time in the sleeping hall during feeding times and at night, although they did go outside at night. They rested mostly at night.

The foals spent most time outside when the temperature was between -5C and -10C. At slightly higher temperatures (0 to -5C,) they actually spent more time inside. .Dr Autio explains that this was probably because those temperatures coincided with windy and rainy conditions.

When the temperature fell below -10C the foals spent about 10% more time inside the sleeping hall, but they did not spend more time lying down or huddling together. The time spent inside did not increase further as the temperature continued to fall.

The foals were most active during the daytime, they rested most at night and they tended to eat morning and evening. Overall they spent third of the time eating. This is less than recorded in some other studies. Dr Autio suggests that this is probably because of the high quality hay and silage fed. The foals remained in good body condition throughout the study.

The researchers noticed no obvious changes in behaviour to indicate that the foals were suffering from the cold. The time spent on different activities did not differ between winter and late winter. The foals did not spend more time eating hay at lower temperatures; neither did they become less active. They showed no sign of shivering.

Dr Autio concludes that on the basis of their behaviour, the weanling foals did not appear to suffer from the cold environment.

For more details see:
Foal behaviour in a loose housing/paddock environment during winter.
E Autio, M-L Heiskanen.
Applied Animal Behaviour Science (2005) 91, 277 - 288.

Conformation and breeding

Are stud fees a good indicator of future success on the racecourse? Not necessarily - according to research carried out at the University of Edinburgh.

The goal of mare owners is to breed successful foals. How can they judge between potential stallions? It is not unreasonable to assume that higher quality stallions command higher stud fees. But does the size of the stud fee give a good indication of the genetic quality of the stallion?

Drs Alastair J Wilson and Andrew Rambaut, working in the Institute of Evolutionary Biology, reviewed the breeding and performance records of over 4000 Thoroughbred racehorses. Their findings were published in the Royal Society's Biology Letters.

They collected information on lifetime earnings (as an indication of how successful the horses had been during their racing career) and stud fee for 554 breeding thoroughbred stallions. The lifetime earnings of each stallion's ancestors, both male and female, going back four generations were also noted. This gave them data on over 4000 horses, which they subjected to genetic analysis to see whether success as a racehorse was inherited.

They found that the trait for higher lifetime's earnings could be passed on from one generation to the next. Heredity accounted for less than 9% of the variation - environmental factors, such as the training regime, choice of races and jockeys, played a more important role. Nevertheless, the fact that lifetime earnings are inherited means that the mare owner has the opportunity to try to select better genes.

On the other hand, although lifetime earnings are heritable, the size of the stud fee is not. The stud fee of the stallion had no effect on the earnings of the offspring. Lifetime earnings and stud fees were related, but this was purely due to environmental factors. There was no underlying genetic component involved.

Indeed, Wilson and Rambaut calculated that for an extra dollar spent on stud fees, you could expect only a $0.02 increase in the lifetime's earnings of the offspring.

Evolutionary biologists speak of an "honest signal", a physical characteristic that is a good indicator of the underlying genetic makeup. It appears that the equine stud fee is not an honest signal of the stallion's genetic quality.

"There are good genes to be bought, but you don't always get what you pay for" warns Dr Wilson. If the goal is to maximise the lifetime prize winnings of the future foal, stud fees do not accurately reflect a stallion's genetic quality.

Reference:

Breeding racehorses; what price good genes?
Biology letters. doi 10.1098/rsbl.2007.0588
AJWilson, A Rambaut

Effect of conformation on soundness

Recent research has sought to identify factors that increase the risks of musculoskeletal injury in athletic horses. Many factors may be involved such as racing surface, race conditions, and the horse's experience, fitness, and pre-existing injuries. Conformation also plays a part, but so far there has been little scientific work to investigate the influence that it has on racing injuries. Over the years the significance of conformation has usually been

subjective and has been based on personal experience and opinion.

Professor Wayne McIlwraith, of Colorado State University, reported on work that his research team had conducted to get objective data on the significance of equine conformation. Speaking at the Thoroughbred Breeding and Racing seminar in Cheltenham, November 2005, he described the results of a two-part study to investigate the relationship between conformation and musculoskeletal problems in racing Thoroughbreds.

The first part of the study looked at change in conformation with age. The aim was to take objective measurements of conformation and assess how they changed from weaning to 3 years of age. Various lengths and joint angles were measured from photographs taken from in front, behind, and from the left side of each horse. A measuring stick included in all the photographs allowed accurate measurements to be made.

The study revealed some interesting findings, which contradict a few commonly held beliefs. They found that the length of the forearm is highly correlated to the height at the withers. So, a long forearm simply means the horse is taller - not necessarily faster. Contrary to popular belief, the angle of the scapular spine (shoulder) is not correlated with pastern angle. They also found that, in young animals, visual assessment of the scapula angle might not be accurate.

As the horse ages, the angles of the shoulder, shoulder joint and knee increase, and the leg becomes straighter. The adult height is due to both growth of the long bones and change in angle of the joints.

They found that knee conformation changed from being "back at the knee" in foals and weanlings, to "over at the knee" at three years of age. They advise against selecting foals or yearlings that are over at the knee, as they are likely to get worse as they mature. On the other hand, a foal that is back at the knee will probably improve.

Having established a reliable system for recording conformation, the scientists looked at the effect of conformation on racing soundness. They assessed the conformation of 115 Thoroughbreds, firstly when they were foals and then yearly until they were three years old. When the horses entered training they were examined at least weekly and any abnormalities were recorded.

Carpal valgus, ("knock-knees") in which the front feet are further apart than the knees, is commonly seen in foals. Affected foals are often subjected to surgery to "correct" the perceived abnormality. However, the study showed that a small amount of outward deviation at the knee is beneficial. A small degree of carpal valgus actually reduced the risk of knee fracture when the horse started racing. Horses that were straight in the knee were more likely to have a knee fracture than were those with carpal valgus.

McIlwraith recommended that surgery to correct carpal valgus is rarely indicated. Only foals with severe deviation at the knee (more than 10º) should be treated. On the other hand, carpal varus ("bow-legged") is a problem and should be treated.

Among other things, they found that horses with longer necks were more likely to develop swollen front fetlock joints, possibly due to increased weight. (An increase in neck length of 10cm increased the risk of fetlock joint swelling by 5.1times). They also found that an increase in shoulder length actually decreased the risk of knee fracture or forelimb fracture. On the other hand, increased length of the front pastern gave an increased risk of forelimb fracture.

Prof McIlwraith pointed out that the study was based on elite horses. So some conformational abnormalities, such as sickle hocks or back at the knee, were not seen. However, he has noticed that Quarter horses with chip fractures of the knee are invariably back at the knee. He suggested that similar studies need to be performed on a wider range of horses to assess the significance of other features.

References:

Longitudinal development of equine conformation from weanling to age 3 years in the Thoroughbred.
TM Anderson, CW McIlwraith.
Equine Vet Journal (2004) 36, 563 - 570

The role of conformation in musculoskeletal problems in the racing Thoroughbred.
TM Anderson, CW McIlwraith, P Douay
Equine Vet Journal (2004) 36, 571 - 575.

Assessment and foot care for limb deformities in foals

At a meeting at Addington Manor, near Buckingham, leading UK farrier, Simon Curtis, described how he assessed foal conformation and what, as a farrier , he could do for medio-lateral deformities.

To properly assess the foal's conformation, he required a level surface 3-4 meters by 20 meters. “So you can walk around the foal and inspect it from all sides, and you can have the foal walked up and down.”

The first step is to make a static assessment. He stressed the importance of looking from the front of the leg, not the front of the horse. “If we only assess from the front of the horse, the leg may appear to be deviated from the fetlock when in fact the leg is straight.”

Walking is often a better way of assessing them. With each step any deviation is exaggerated as the foal bears weight. He advised “ concentrate on the front legs when the foal is walking towards you and the hind legs when it walks away.” If necessary, repeat the process. “Walking the foal is a great way of spotting any slight deviations.”

Thirdly look at the leg to see how the hoof relates to the leg (“eye-lining”). Even in one month old foals with a slight deviation, there may already be a distortion of the hoof capsule. The hoof problem is caused by the limb deviation.

“These problems relate to every breed of horse, not just Thoroughbreds. They are all entitled to good hoof care from an early age.”

He pointed out that the foal's hoof grows more quickly (15mm/month) than that of a mature horse (9mm/month). So he recommends that foals should have their feet trimmed from 4 weeks of age, and should be trimmed every four weeks.

He described three categories of medio-lateral deformities.

Rotational.
The leg is rotated outwards. A huge proportion of these correct themselves. The hoof tends to collapse on the inside and flare on the outside. “ I think the farrier`s job is just to balance the foot and keep their fingers crossed” he said. “ I do not believe it is possible to turn the leg in by trimming the foot.” It is certainly possible to make matters worse by over zealous foot trimming.

Offset knee.
The forearm and the cannon bone do not appear to line up through the knee (carpus). This deformity is always associated with a varal deformity of the fetlock (see below). If severe, the foal will not go on to be an athlete. More subtle cases cannot be fixed by either the farrier or by surgery. But by keeping the pastern and cannon in better alignment, the farrier can reduce the incidence of splints on the inside of the leg.

Angular limb deformity.
There is a clear angulation of the limb when viewed from in front. The angulation is caused by one side of the limb growing faster than the other. It usually occurs at one of the growth plates (or “physes”) which are responsible for most of the increase in length of growing bones.

Carpal valgus - in which the leg bends outwards below the knee - is the most common. *Fetlock varus*, an inward deviation of the limb below the fetlock, is the next most common deformity and is often found with carpal valgus. “The good news is that they respond well to

farriery, or to surgery in severe cases" he said. "What we do is to reduce the stresses in the leg and the horse straightens the leg itself."

Carpal varus - where the leg bends inwards from the knee downwards (giving a bow-legged appearance) is very rare.

Often foals display a combination of problems. Curtis emphasized the importance of not concentrating on one and ignoring another.

"All foals are slightly valgal when born, and straighten as they grow." He explained that some compression on the growth plate increased the rate of bone growth. But excessive compression reduced the growth rate and made the deviation worse.

There is a window of opportunity for treating angular limb deformities. It is only possible to make changes to the fetlocks up to three months of age - that is why you must check your foals early.

For deviations at the knee there is far longer - up to twelve months. He pointed out that these times are not the same as the published times for closure of the growth plate, which are slightly longer. Making significant corrections to the shape of the leg is only possible during the period of rapid bone growth.

Trimming to correct medio-lateral deformities.

The aim when trimming the foot is to

- put the foot in balance with the pastern
- correct distortion and wear of the hoof capsule
- reduce uneven compression.

He emphasized the importance of not over correcting. "It is much better to trim level at two week intervals"

What can be done if there is not enough hoof to allow adequate trimming? Extensions can be fixed to the inside (or outside) of the foot depending on the deformity. Curtis uses polyurethane for extensions, rather than shoes. "You can trim the extensions as you would the foot , according to the same principles."

He suggested one reason extensions are effective is that they put the foot where it should be. "But probably of greater importance is that the extension reduces compression in the leg by moving the limb under the body."

But he warned "You can be over aggressive with extensions and can cause deviation of the hoof."

"We mustn't think that farriers work in isolation. Other things need looking at - management, feeding exercise, maybe surgery or shock wave treatment. But it doesn't make sense to start putting implants in the leg without first working on the foot."

Thoroughbred breeding efficiency

Thoroughbred breeding is remarkably efficient despite the restrictions placed on it, according to Professor Twink Allen of Cambridge University's Equine Fertility and Development Unit.

Speaking at the 2005 Thoroughbred Racing and Breeding seminar at Cheltenham racecourse, he indicated the challenges faced in Thoroughbred breeding. Horses are not selected for fertility. They are expected to breed outside their natural breeding season which, in the northern hemisphere, would extend from April to October. We try to breed from aged mares and stallions. Many of the modern breeding techniques such as artificial insemination, embryo transfer and gender selection of sperm are not permitted. "So there are formidable barriers imposed by the Thoroughbred industry - but despite that we do remarkably well."

He discussed the results of recent studies into the efficiency of breeding practices on Thoroughbred farm studs.

There were no significant differences between flat race or national hunt mares in either efficiency or breeding success. Overall the conception rate per oestrous cycle was 63.8%. Allen pointed out that this was 14% higher than that achieved in high yielding dairy cows. " It reflects well on all of us to get a conception rate of 64% per cycle".

Some people worry that using hormones in breeding mares results in lower fertility rates. However, there is no evidence that using hormones such as prostaglandin, Regumate ® or Chorulon® to manage the mare's oestrous cycle has an adverse effect on conception rate.

On the other hand, covering mares on the first oestrous cycle after foaling ("foal heat") is less successful. Not only do such mares have a lower conception rate but they are also more likely to suffer early pregnancy loss. So it is better not to mate on the foal heat, but to use hormones to induce an early return to oestrous.

In 1998, each flat race Thoroughbred mare was mated, on average, 1.04 times per cycle. Professor Allen pointed out that this was the result of good veterinary control of the breeding process. ie using the scanner to determine the best time to breed the mare. By 2003, this figure has remained at less than 1.1 matings per cycle.

The number of matings per pregnancy increases with the age of the mare, confirming that more work is needed to get older mares pregnant.

One disturbing trend is the increase in twin conceptions. In 1987 only 3.2% of successful matings resulted in twins. By 1998 the figure had risen to 8.4%, and by 2003 the twin conception rate has reached 11%.

The treatment of twins before day 17 of gestation is so successful that now we are increasingly breeding mares that genetically tend to bear twins. "We must recognise that we have developed a "job for the boys." We have not done the Thoroughbred breed any service."

The overall pregnancy loss rate has remained the same over the past 18 years. Around 60% of the losses occur within the first 35-40 days. In fact, in 2003 about 8% of all pregnancies were lost before 40 days.

He suggested factors in early pregnancy loss include :

- failure of the mare's uterus to recognise the presence of the embryo
- inadequate "uterine milk" - the secretion from the uterine glands that nourishes the embryo before the placenta develops.
- accidental chromosomal abnormalities.

Professor Allen added that there is no good evidence that a lack of progesterone in the mare`s blood is involved in early pregnancy loss.

Professor Allen concluded that, on the whole, Thoroughbred mares are remarkably fertile - despite the fact that there is very little selection for fertility. The same can not be said for Thoroughbred stallions. He pointed out that there is a wide range of inherent fertility between stallions which tends to be masked by the efficient breeding practices and close control of breeding.

Acetylcysteine enemas for meconium impaction

Acetylcysteine retention enemas are effective for treating meconium impaction in foals according to a recent report.

Meconium is the faecal material produced by the foal in the first few days of life. It is composed of intestinal gland secretions, bile, mucus, epithelial cell debris and swallowed amniotic fluid. It varies in consistency from firm pellets to a more gelatinous pasty material.

The foal usually starts to pass the meconium within 30 minutes of first sucking. Some people recommend giving enemas as a routine to newborn foals to aid the passage of the meconium. Giving mineral oil (liquid paraffin) by mouth during the first day of life is no longer recommended as it may interfere with the absorption of colostrum.

Evacuation of meconium is usually complete within 24 hours but may take up to 48 hours in some foals. However, it is not the length of time taken to clear the meconium that is the important feature of this condition, but the amount of pain shown by the foal.

Colic due to meconium impaction is one of the most common problems encountered in foals in the first few days of life. It is seen more commonly in colt than in fillies, probably due to the relative narrowness of the pelvis in colts. Foals with prolonged gestation may also be more likely to be affected.

Signs vary from restlessness, with frequent attempts to pass faeces, to abdominal distension and colic. Usually, treatment with a combination of enemas, fluid therapy and analgesics is sufficient. On rare occasions surgical treatment may be necessary if the impaction can not be cleared by other means.

Vets at the Veterinary Medicine Teaching Hospital of the University of California, Davis have been using an acetylcysteine retention enema in foals with meconium impaction since 1987. They recently looked back on the cases they have treated since that time to evaluate the usefulness of the technique. A report of their findings appeared in Equine Veterinary Education.

Between 1987 and 2002 they treated 44 foals with meconium. Many of the foals had already been treated with other types of enema before being admitted to the hospital. Forty-one foals were treated with acetylcysteine enemas. Three foals were treated surgically at the owners` request.

Acetylcysteine acts by breaking down the mucus component of the meconium. It was prepared as a 4% solution. As it is more effective in alkaline conditions, the solution was adjusted to pH 7.6 by the addition of sodium bicarbonate (baking soda) (20g in 200ml)

The research team explain that a Foley catheter was used to administer the acetylcysteine solution. (A Foley catheter is a tube with an balloon at one end, which is inflated when inside the rectum. This prevents the acetylcysteine solution from passing out of the rectum until the catheter is removed.) The catheter, and acetylcysteine solution, was kept in place in the rectum for up to 45 minutes.

The foals were also given intravenous received fluids, and analgesic medication. Electrolyte balance was monitored and treated as necessary.

All 41 foals treated with the acetylcysteine enema responded to the treatment, although some required two or three doses. The signs resolved within 24 hours in all but two foals that took 48 and 96 hours to respond.

No complications occurred with the use of the acetylcysteine enemas. However, the records showed that three foals suffered a ruptured bladder whilst in the hospital. The authors advise that foals with severe meconium impaction should be monitored carefully for bladder distension, which could precede rupture.

They conclude that acetylcysteine retention enema is a valuable treatment for meconium impaction.

Reference:

Retrospective evaluation of the use of acetylcysteine enemas in the treatment of meconium retention in foals: 44 cases. (1987 - 2002)
N Pusterla, KG Magdesian, K Maleski, SJ Spier, JE Madigan.
Equine Veterinary Education (2004) 16, 133 - 136.

Blood tests for gastric ulcers

Gastric ulcers in foals seem to have become more common in recent years. It is hard to say how common they really are because of the difficulty in confirming the diagnosis.

They are often seen in foals following a stressful situation - such as transportation and treatment for other diseases. Nonsteroidal anti-inflammatory drugs (NSAIDs) such as phenylbutazone, can precipitate the disease. But by no means is the condition seen only in foals that have been treated with NSAIDs.

Affected foals typically have diarrhoea, grind their teeth and salivate excessively. They may go off their food and lie on their backs

Severe cases may die if the ulcer perforates, but most cases are not as dramatic. If the ulceration has spread to the duodenum, scarring may occur as it heals. This can cause on-going problems, as the flow of food through the bowel is restricted.

Many cases of gastric ulceration in foals do not show specific signs. So the challenge is, how do you confirm that a foal has gastric ulcer?

The best way is to examine the stomach lining and duodenum using a flexible endoscope. However, this is technically difficult, and if possible foals over 3 weeks of age should be starved of solid food for 12 hours and milk for 4 hours (milk) before examination.

Researchers in Japan may have found a simpler way of identifying animals with gastric ulcers. Work carried out in the Rakuno Gakuen University School of Veterinary Medicine suggests that it may be possible to use blood samples to identify foals with gastric ulcers.

Dr S Taharaguchi and others isolated a specific protein in the blood of foals with gastric ulcers.

They found a 55kDa protein, which they identified as an isoform of α1-antitrypsin . It was present in 44 of 47 samples from foals with ulcers confirmed by endoscopy. In contrast, they found it in only three of 22 samples from healthy foals.

Ulcers occur when the acids and enzymes that are present in the stomach start to attack the stomach itself. The scientists suggest that this specific form of α1-antitrypsin may be produced as a protective response to damage by the proteolytic enzymes, or it may be the result of intact α1-antitrypsin being broken down by the ulcer.

They suggest that future studies need to look how the protein is produced and at what stage of the disease it appears. If the serum concentration of the 55kDa α1-antitrypsin proves to be correlated with the severity of the ulcer, it may even be possible in the future to assess the severity of gastric ulcers by analysing the serum samples.

Reference:

Detection of an isoform of α1-antitrypsin in serum samples from foals with gastric ulcers.
S Taharaguchi, A Nagano, K Okai, T Miyasho, M Kuwano, H Taniyama, H Yokota.
Vet Rec (2007) 338 - 342

Measuring foals' weights

A new formula will make it easier to estimate a foal's weight, according to researchers in Chile.

It is often important to know how much a foal weighs. Records of body weight can be used to monitor growth rate and ensure accurate dosing of anthelmintics and other medications.

Obviously a weighbridge or scale that measures the weight accurately is the "gold standard". But often scales are not available. Visual estimates are often inaccurate. Many weigh tapes are not intended for use in foals under six months of age.

Various indirect methods of estimating the weight have been described. These usually involve a calculation based on measurements of parts of the body. While such systems might be practical in adult horses, they can present difficulties in uncooperative foals.

Researchers at the University of Concepcion, in Chile have devised a formula that they claim provides an simple way of estimating a foal's weight . A full report of their research was published in the Veterinary Record.

The method requires only one measurement to be taken. The distance around the girth is measured just behind the elbow and 2.54 cm behind the highest point of the withers. The measurement is taken just after the foal has breathed out.

Dr Rodriguez and colleagues took measured 80 Thoroughbred foals weighing between 50 and 250kg. Analysis of the data produced a formula that could be used to predict the weigh from the heart girth.

Estimated weight (kg) = G3 x90
(where G= heart girth measurement in metres.)

A more complex formula (wt = G2.9945 x 0.000088, where G is the girth measurement in centimetres) was found to give a more accurate result, but the scientists suggest that this might prove too complicated for use on the farm.

They also found that their method was not quite as accurate as one previously described by Staniar and others. However, it does have the advantage of simplicity. In addition to heart girth measurement, Staniar's formula also includes the length from point of shoulder to point of buttock, length of the left foreleg and circumference of the knee.

The scientists recommend their new formula for estimating foal's weights on farms. Not only does it give acceptable results from a single measurement, it is relatively simple and can easily be remembered.

Reference:

New formula for bodyweight estimation of Thoroughbred foals.
C Rodriguez, L Muñoz, H Rojas, M Briones.
Veterinary Record (2007) 161, 165 - 166

Pasture mineral supplements needed

Mineral levels in pasture may be insufficient to supply the requirements of growing foals according to work presented at the recent equine nutrition conference in Hannover. Louise Jones described the findings of an investigation carried out in the UK with colleagues at Dodson and Horrell . They assessed the mineral content of pastures in areas where foals were commonly reared and compared the differences between spring and summer pasture.

Adequate mineral intake is especially important for growing animals. The mineral content of pasture is affected by factors such as the underlying soil type, species of grasses in the pasture, and whether fertiliser has been used.

The investigators found that overall there was a wide variation in mineral content. Some pasture samples contained minerals levels that would not meet the requirements of fast growing 6 month old horses. (NRC minimum requirements)

They also noticed variation between pasture at different times of the year. Spring (March to June) and summer (July to September) pastures differed significantly in their mineral content. Summer pasture had lower levels of potassium, copper, zinc and phosphorus. And spring pasture had lower calcium levels compared with summer pasture.

Several factors might be responsible for the higher calcium levels found in the summer. Clover, with relatively high calcium content, is more abundant in the summer. Perhaps the most significant factor was that half of the summer samples were collected in the Newmarket area, where the underlying soil has a high calcium content.

At top end of range all major minerals were present in excess of requirements. However, some samples had levels of calcium, phosphorus and potassium that were so low that they would not supply the minimum requirements for growing horses.

The investigators advise that foals should be fed a supplement to ensure they receive adequate minerals if they are reared on pasture.

The range of mineral levels published for cattle pasture (especially calcium, phosphorus, copper, and zinc) do not accurately describe pasture used for horses. Jones suggests that further investigation is needed to assess the various factors that influence the mineral content of pasture used for grazing growing horses.

Further reading.

The mineral content of spring and summer pasture grazed by young growing Thoroughbred in the UK.
Louise Jones, Jennifer Lax, Teresa Hollands.
Proceedings Equine Nutrition Conference. Pferdeheilkunde (2005) 21, 21 - 23.

Probiotics and foal diarrhoea

Do probiotics help prevent diarrhoea in foals? One micro-organism identified in laboratory tests as a potential probiotic for horses failed to live up to expectations in a clinical trial. It did not prevent foal heat diarrhoea in foals. In fact, treated foals were more likely to have diarrhoea and other abnormalities such as loss of appetite, depression and colic.

"Foal heat diarrhoea" is the most common cause of diarrhoea in foals. It usually produces mild signs and resolves without treatment. Although it occurs around the time of the mare's first oestrus cycle after foaling, it is more likely due to changes in the microbial population of the foal's intestines than to any change in the mare's milk.

Probiotics are live micro-organisms that, when given by mouth at adequate levels, provide a beneficial effect greater than their nutritional value. They are becoming popular in horses to maintain a healthy microbial population within the gastrointestinal tract. In particular, they are often used to try to prevent foal heat diarrhoea. Despite their widespread use, there has been little research to assess their value.

Dr J Scott Weese, of the Ontario Veterinary School in Canada, is a leading researcher into the use of probiotics in horses. He has been assessing the value of one particular micro-organism for preventing diarrhoea in foals.

Previous work by his research team* found that Lactobacillus pentosus WE7 was the most promising of 47 organisms that they isolated from horse faeces. In the laboratory cultures, the organism could grow in the presence of either acid or bile. So it should survive the conditions in the stomach and small intestine. It also inhibited the growth of disease-causing organisms such as salmonella, clostridia and *E. coli.*

One hundred fifty three foals entered the study on the day after they were born. The researchers divided them at random into two groups. The first group received the trial probiotic (2 x 10^{11} *Lactobacillus pentosus* WE7 organisms) once daily for a week; the others were given a placebo. All of the foals were monitored for two weeks.

Dr Weese found that foals treated with *L pentosus* WE7 were actually more likely to develop diarrhoea than were those that had only received the placebo. They were also more likely to show signs of depression, loss of appetite and colic.

Blood samples taken from some of the foals showed that most had adequate levels of

immunoglobulins. Only four had antibody levels less than 8g/L, and they were evenly distributed between the probiotic and control groups. So the adverse effects of feeding the probiotic could not be attributed to the foals receiving inadequate colostral antibodies.

The results do not necessarily indicate that all probiotics will be similarly ineffective or unsafe. However, they do raise concerns over the wide range of commercially available probiotics that have not been tested to see if they are safe and effective. Dr Weese suggests that all potential equine probiotics should be tested for safety and efficacy.

Reference:
Evaluation of *Lactobacillus pentosus* WE7 for prevention of diarrhoea in neonatal foals.
J Scott Weese, Joyce Rousseau.
JAVMA (2005) 226, 2031 - 2034

*ref:
Screening of the equine intestinal microflora for potential probiotic organisms.
JS Weese, MEC Anderson, A Lowe, R Penno, TM Da Costa, L Button, KC Goth.
Equine Vet J (2004) 36, 351 - 355.

Dangers of ivermectin overdose

A recent report highlights the dangers of over-dosing when using anthelmintics containing ivermectin in young foals.

Dr Caryn Plummer and colleagues at the University of Florida Veterinary Medicine Teaching Hospital, writing in Veterinary Ophthalmology, describe a case of suspected ivermectin poisoning in a miniature mule foal.

The nine-week old foal had been given over twice the recommended dose of a dewormer containing ivermectin and praziquantel. It was weak and uncoordinated and was unable to drink or eat. The foal was also blind.

Ivermectin is generally safe in adult animals, but has been known to cause toxic effects when the recommended dose is exceeded. This is especially the case in young animals. On the other hand, praziquantel, which is used to treat tapeworm infections in horses, is generally considered to be very safe. The clinicians felt it was much more likely that the signs were due to too much ivermectin, rather than too much praziquantel..

Ivermectin is a member of the avermectin group of anthelmintics. It works by increasing the release of gamma amino butyric acid (GABA). GABA is an inhibitory neuro-transmitter, which blocks transmission at junctions between nerves, leading to paralysis and death of the parasites.

GABA is also present in the mammalian central nervous system. Ivermectin does not usually cause toxicity in adult horses as it can not pass the "blood brain barrier." However, in young animals the "blood brain barrier" is not fully developed. So the ivermectin is more likely to reach the brain in sufficient quantities to cause problems.

When the clinicians examined the foal's eyes they found no abnormalities. Even an electroretinogram, which assesses the activity in the light-sensitive retina in response to light, appeared normal. The clinicians concluded that the eyes themselves were undamaged and that the blindness was due to inhibition or depression of the cerebral cortex (the part of the brain that processes visual signals.)

With careful nursing the foal survived and regained its vision. The clinicians treated the foal with both intravenous and oral fluids, anti-inflammatory medication, and vitamin E. By the third day the foal's condition had started to improve. He was able to eat and drink. By the fourth day of treatment he could walk normally. By the sixth day he seemed to see well enough to avoid bumping into objects.

After six months, the foal had made a complete recovery, with no lasting effects of the poisoning.

The incident serves as a reminder to follow the manufacturers' dosing instructions and ensure that the correct dose is given. Particular care should be taken in young animals.

Reference:

Suspected ivermectin toxicosis in a miniature mule foal.
Caryn E Plummer, Maria E Kallberg, Franck J Ollivier, Dennis E Brooks, Kirk N Gelatt.
Veterinary Opthalmology. (2006) 9, 29 - 32.

Ivermectin-resistant Parascaris equorum

The importance of making sure that worm control measures are effective has been highlighted once again.

In a letter to the Veterinary Record, Sarah Stoneham, of the Rossdales veterinary practice in Newmarket and Dr Gerald Coles, from the Bristol Veterinary School, reported the death of a 4 month old Thoroughbred foal from intestinal perforation secondary to infection with the large roundworm, *Parascaris equorum*. This occurred despite the foal having been treated every 4 weeks with ivermectin.

Parascaris equorum, the large roundworm of horses, is a common parasite of foals. Older foals develop immunity to it, and it rarely causes problems in adult horses. Under optimum conditions, *Parascaris equorum* eggs become infective within about two weeks of being passed in the faeces. At lower temperatures the eggs may survive for many years in stables and on pasture.

Infective eggs contain larvae, which hatch within the foal's intestines. The larvae penetrate the gut wall and migrate through the liver and lung before passing up the trachea and back to the intestines. They may cause a mild cough and nasal discharge during the migratory phase. A heavy intestinal infection leads to failure to thrive, and may cause intestinal impaction or rupture.

Anthelmintic resistance is most commonly encountered in the cyathostomins or small redworms. Resistance to the benzimidazole group of wormers is widespread, and resistance to pyrantel is being found. Because of this it has become common practice to use ivermectin as a routine treatment for foals.

But *Parascaris equorum* resistant to ivermectin has been identified in Europe and North America. This incident demonstrates that we can no longer assume that ivermectin will be effective.

Stoneham and Coles advise stud owners to be aware that ivermectin-resistant *Parascaris equorum* might be present. They recommend faecal samples be taken 3-4 weeks after treatment to ensure that the drug has been effective.

They suggest that two different types of anthelmintic may now be required to control round worms in foals. It may no longer be possible to rely on a single class of anthelmintics.

Reference:
Ivermectin resistance in *Parascaris equorum*.
Stoneham S, Coles G. (2006) Vet Record. 158, 572.

Ivermectin-resistant worms

Further evidence of parasitic worms becoming resistant to ivermectin and moxidectin has been found.

Parascaris equorum, the large roundworm of horses, is a common parasite of foals. Older foals develop immunity to it, and it rarely causes problems in adult horses. Under optimum conditions, *P. equorum* eggs become infective within about two weeks of being passed in the faeces. At lower temperatures the eggs may survive for many years in stables and on pasture.

Infective eggs contain larvae, which hatch within the foal's intestines. The larvae penetrate the gut wall and migrate through the liver and lung before passing up the trachea and back to the intestines. They may cause a mild cough and nasal discharge during the migratory phase. A heavy intestinal infection leads to failure to thrive, and may cause intestinal impaction or rupture.

In a report in Veterinary Parasitology, Professor Owen Slocombe of the Ontario Veterinary College, and others describe how they found ivermectin- and moxidectin - resistant *P. equorum* on stud farms in Canada.

Ivermectin has been used for deworming horses for over 20 years. Its efficacy against a wide range of equine internal parasites has made it a popular choice. It is highly effective against migrating large strongyles. Early reports suggested that it was effective against *P. equorum*. Ivermectin has been widely used in foals, especially since the problem of cyathostomin resistance to fenbendazole has been recognised.

The problem was first suspected in 2001 by one of the authors of the report, Dr Rolph de Gannes. He had been monitoring faecal worm egg counts on various horse farms in Ontario for over twenty years. These routine tests alerted him to the apparent failure of ivermectin to remove *P. equorum*. Over the next two years, in conjunction with Professor Slocombe and technician Mary Lake, he carried out a series of trials on two Thoroughbred farms and one Standardbred farm. Faecal worm egg counts were monitored before and after treatment with one of four anthelmintics. Some foals were left untreated to act as controls.

Overall, they found that ivermectin reduced the *Parascaris equorum* faecal worm egg count by only 33.0% and moxidectin by 47.2%. In contrast, fenbendazole and pyrantel pamoate were highly effective, reducing the faecal egg count by 97.6%. In fact, many foals had no *P. equorum* eggs in the faeces after treatment with fenbendazole or pyrantel.

It was a different story with strongyle eggs. All strongyle eggs look similar. It is only possible to tell them apart by culturing them and examining the larvae. However, resistance to anthelmintics is a particular feature of the cyathostomins (or small redworms).

The scientists found that neither pyrantel nor fenbendazole was fully effective at reducing the number of strongyle eggs in the faeces. All foals treated with pyrantel still had strongyle eggs in the faeces after treatment. Foals on the Standardbred farm had eggs in the faeces after treatment with fenbendazole, suggesting that resistant cyathostomins were present. However, no foals had strongyle eggs in the faeces after treatment with ivermectin or moxidectin.

This study emphasises that a single dewormer cannot be assumed to control all species of worms in foals. It may well be necessary to use more than one type of dewormer to control all the potential parasite problems in foals.

Reference:

Macrocyclic lactone-resistant *Parascaris equorum* on stud farms in Canada and effectiveness of fenbendazole and pyrantel pamoate.
J OD Slocombe, RVG de Gannes, Mary C Lake.
Veterinary Parasitology (2007) 145, 371 - 376.

Growing resistance problem

Worm control routines that have been used successfully for many years may no longer be appropriate. Further evidence that ivermectin is becoming ineffective against the large horse roundworm is presented in a recent report.

The study looked at the extent of *Parascaris equorum* infection on a Swedish stud farm. It was prompted by the death of a foal that on post mortem examination was found to contain a massive burden of *P equorum.* This was despite the foal having been treated regularly with ivermectin.

Dr K Lindgren, of the Swedish Institute of Agricultural and Environmental Engineering, and others, monitored the droppings of 15 foals on a stud farm in Sweden for parascarid eggs. They collected samples on five occasions from late August to November. Foals had been treated with ivermectin every two months from two months of age. Ivermectin is widely used in foals, as it is effective against the small roundworms (cyathostomes) that are often resistant to benzimidazoles such as fenbendazole.

They first found *P equorum* eggs in the faeces when the foals were 3-4 months old. Most foals started to excrete large numbers of eggs by the time they were 4 months old. Egg production peaked a couple of months later and then declined.

The adult worms live in the small intestine. They may grow up to 50cm in length. A heavy infection leads to failure to thrive, and may cause intestinal impaction or rupture. Deaths have been reported in foals up to 4 months of age. The females are prolific egg-layers. On a single day, an infected foal can shed millions of eggs to contaminate the environment.

Ivermectin appeared to have no effect on the egg production. Manure samples were taken from the five foals with the highest egg counts ten days after treatment. In four of the foals the egg count had actually increased. However, treatment with either fenbendazole or pyrantel was effective at removing the worms.

The researchers also checked soil samples from the various paddocks in which the foals were kept. The most infected pasture was a permanent grass paddock used by mares and foals all summer. Previously, it had been grazed by horses throughout the year. It had significantly higher egg counts (15 eggs /10g soil) than did a temporary soil paddock and two paddocks used only in the summer.

Adult horses rarely excrete many *P equorum* eggs. The likely source of infection was pasture contaminated by foals in previous years.

This study emphasises that a single dewormer cannot be assumed to control all species of worms in foals. Because foals may be infected with both ivermectin resistant *P equorum* and benzimidazole-resistant cyathostomes, it may be necessary to use two different compounds to adequately control the parasites.

Reference:

Parascaris equorum in foals and in their environment on a Swedish stud farm, with notes on treatment failure of ivermectin.
K Lindgren, Ö Ljungvall, O Nilsson, B-L Ljungström, C Lindahl, J Höglund.
Veterinary Parasitology (2008) 151, 337 - 343.

Assessing colostrum quality

Foals rely on immunoglobulins passed from the mare in the colostrum to protect them from infection during the first weeks of life. If the foal receives inadequate colostrum, or if the colostrum is of poor quality, it is at greater risk of succumbing to infectious disease.

Mares that foal early, or drip milk before foaling, often produce poor quality colostrum

Methods that have been used to assess colostrum quality include colostrometry and refractometry. In colostrometry, a float measures the specific gravity, which is correlated to the immunoglobulin (IgG) content. Colostrum with a specific gravity greater than 1.06 usually contains adequate immunoglobulins. The refractometer measures the refractive index of the colostrum which, again, can be related to the immunoglobulin concentration.

Dr Monica Venner and her colleagues at University of Veterinary Medicine in Hannover have been assessing methods of evaluating colostrum that can be used “in the field” - that is, at the stable or on the farm, rather than in the laboratory.

They also wanted to identify the best time to collect colostrum from donor mares and check if the quality of the colostrum is affected by the number of foals a mare has had.

Thirty six Warmblood mares were used for the study. Samples of colostrum were collected from both sides of the udder on five occasions within the first 12 hours after the foals had been born. The foals were muzzled for the first six hours of life to prevent them sucking and allow the investigators to evaluate the volume of colostrum produced by the mare.

The researchers used both a colostrometer and a sugar refractometer to measure the immunoglobulin levels in the colostrum and compared the values with those given by the "gold standard" measure of immunoglobulin, the ELISA test.

Both density (as measured by the colostrometer) and the refractive index (measured by the refractometer) gave a good indication of the immunoglobulin concentration. The refractometer was the most reliable and practical technique, but was also the more expensive.

The researchers found that there was no difference in colostrum production between the two sides of the udder. Mares foaling for the first time had the most concentrated colostrum, but the IgG concentration halved within three hours.

Mares foaling for the first time produced less colostrum than more experienced mares. (In the first three hours, the average volume of colostrum produced was 527ml and 1020 ml respectively). So the total amount of immunoglobulins first-time mares produced was significantly lower.

The results show that mares in their third lactation produced a high concentration of IgG. They also produced a large volume of colostrum. So Dr Venner suggests that a good colostrum donor would be a mare that has just foaled for the third time.

For more details:

Investigation on immunoglobulin G concentration by colostrometry and an ELISA-technique in colostrum of mares.
Robert G Markus, Katrin Strutzberg-Minder, Erich Klug, Monica Venner.
Pferdeheilkunde (2005) 21, 119 - 120.

Identifying rib trauma in foals

Fractured ribs are surprisingly common in new born foals. Up to 20% of apparently healthy foals may show signs of damage to the chest wall, without any associated problem. But, in sick foals, rib fractures are often thought to contribute to the severity of their condition and influence the chance of recovery.

Physical examination of the foal may reveal fractures, or dislocation of the junction between the bony and cartilaginous portions of the rib (the costochondral junction). The foal's chest may appear asymmetrical.

Radiography can be used to confirm suspected fractures, and may detect some fractures that are not apparent on clinical examination.

In human medicine it has been noted that an ultrasound scan is more effective than radiography at identifying rib fractures. Ultrasound does not penetrate the bone and so does not produce an image of the internal bone structure, but it can show the surface of the bone. Any disruption of the surface contour, such as occurs in fractures, will usually be visible. An ultrasound scan can also reveal changes within the structure of the cartilaginous parts of the ribs.

One disadvantage of the ultrasound scan for detecting rib fractures could be the time required to perform the examination. Unlike radiography, where images of several ribs can be produced at once, with ultrasonography each rib has to be scanned individually. This can be time consuming - especially in an uncooperative foal that has difficulty breathing. It is also difficult to examine the ribs that lie underneath the shoulder - and these are often the very ribs that are likely to be injured.

Which technique offers the best chance of identifying rib fractures in young foals? A study, published in the Equine Veterinary Journal, compared the value of radiography and ultrasonography for identifying rib fractures in foals admitted to a critical care unit. Dr Daniel Jean led the investigation at the Département des Sciences Cliniques, Faculté de Médecine Vétérinaire, Université de Montreal

Jean and his colleagues examined twenty-nine newborn foals that were admitted to the Centre Hospitalier Universitaire Vétérinaire. They found that most of the foals had one or more rib fractures.

Chest radiography revealed rib fractures in 19% foals. Radiographs were taken from both sides and with the foal lying on its back. This latter view was the one on which fractures were most easily detected.

With ultrasonography, the clinicians found that 65% of the foals had fractures. In only one foal did the clinicians detect a fracture on the radiographs that they did not find with the ultrasound scan. Ultrasonography was four times more likely than radiography to detect fractures.

Most of the rib fractures occurred in the second to seventh ribs. And 90% of fractures occurred within 3cm of the costochondral junction. The location of the fractures suggests that they are probably caused during the birth process. They are probably due to pressure of the flexed elbow on the ribs as the foal passes through the mare's pelvis.

They found more fractures in fillies, and the left side of the chest was more often involved than was the right.

Dr Jean concludes that ultrasonography is a sensitive way of identifying rib fractures in newborn foals. and recommends that it should be considered the "gold-standard" technique.

He advises that the possibility of rib fractures should be considered in all sick foals and that they should be handled carefully to avoid causing further damage.

Reference

Detection of rib trauma in newborn foals in an equine critical care unit: a comparison of ultrasonography, radiography and physical examination.
D Jean, V Picandet, S Maciera, G Beauregard, MA D'Anjou, G Beauchamp
Equine Vet J (2007) 39, 158 - 163

Rotavirus vaccine studies

Research in the United States has demonstrated that mares vaccinated in late pregnancy produce high levels of rotavirus-specific Immunoglobulin G (IgG) antibodies in the colostrum and milk.

Rotavirus is an important cause of diarrhoea in young foals, and in the young of other species. Vaccinations during pregnancy are widely used in other species to protect the young after birth.

Dr Sheoran and colleagues investigated the efficacy of a vaccine prepared from an inactivated H2 strain of equine rotavirus with an oil-in-water adjuvant. Five previously unvaccinated quarter horse mares were vaccinated three times at monthly intervals during the last 4 months of pregnancy. The final dose was given about one month before

foaling. Three unvaccinated mares were given a placebo at the same time. Colostrum and milk samples were collected from the mares 1, 7, 14, and 28 days after foaling. Blood samples were collected from the foals at 1, 7 and 28 days of age.

Immunisation in late pregnancy induced a significant increase in rotavirus-specific IgG antibodies in colostrum and milk. Levels fell dramatically after the first day but were still significantly elevated at the end of the study one month later. Foals of vaccinated mares had significant levels of rotavirus-specific IgG in the blood.

One of the three unvaccinated mares showed a moderate increase in rotavirus IgG antibodies in the milk on the first day, but no antibodies were detected thereafter.

Neither the vaccinated nor the unvaccinated group produced rotavirus specific IgA in colostrum or milk, or in foal serum. Prof Timoney pointed out that this is consistent with an earlier study which showed that IgG is the dominant immunoglobulin in milk for 2 weeks after foaling and is then replaced by IgA. It is possible that a live orally administered rotavirus vaccine would elicit a stronger IgA response in colostrum and milk. This has not been studied in the horse.

The authors conclude that "..vaccination of mares with inactivated rotaviral vaccine stimulates production of high levels of specific IgG, and not IgA, in colostrum and milk. It is possible, therefore, that passive immunity to rotavirus may be meditated exclusively through IgG, although the true functional role of the IgG measured in this experiment must await a challenge experiment."

Reference:
Prepartum equine rotavirus vaccination inducing strong specific IgG in mammary secretions.
A S Sheoran, S S Karzenski, J W Whalen, M V Crisman, D G Powell, J F Timoney.
Veterinary Record (2000) 146, 672-673

Do Thoroughbred foals race after septic arthritis?

Thoroughbred foals that develop septic arthritis are significantly less likely than unaffected animals to embark on a racing career. A recent report shows that even those foals that recover from the condition are less likely to start on a racecourse compared to controls.

Bacteria, which originate in infected tissue such as navel or lungs, travel to the joint in the bloodstream. Once in the joint they provoke a vicious circle of inflammatory changes that lead to damage to the articular cartilage. These changes occur rapidly, and although foals have more able to regenerate the cartilage than adult horses, permanent damage to the joint can occur leading to degenerative joint disease.

Typically, foals with septic arthritis are lame. The affected joint is warm and swollen and painful when palpated. The joint fluid contains raised numbers of white blood cells (more than 30,000/mcl) which are mostly neutrophils.

Treatment is often prolonged and expensive and so it is helpful to know at the start whether it is likely to be successful. Success, in the context of Thoroughbred foals, includes not only overcoming the infection, but also being able to embark on a career in racing.

Luise Smith and her colleagues at the Beaufort Cottage Equine Hospital in Newmarket reviewed the medical records of sixty-nine foals with septic arthritis that had been treated in the practice between 1988 and 2001. A report of their study is published in the current edition of the Equine Veterinary Journal.

Only those Thoroughbred foals that were less than four months old, and were destined for use as racehorses were considered. The joints most commonly affected were the stifle, (17/69) hock (15/69) and fetlock joints (10/69). The outcome did not appear to be affected by which joint was affected.

Treatment consisted of flushing the affected joints to remove the inflammatory material and antibiotics by injection. The exact treatment regime used varied according to the personal preference of the clinician involved and so it was not possible to tell from the data whether one particular treatment was better than another.

The authors compared the subsequent racing careers of each of these foals with up to two siblings (i.e. foals from the same mare.)

They found that, overall, 40.5% of foals that developed septic arthritis reached a racecourse. This included some foals that failed to respond to treatment and were euthanased. If only those foals that responded to treatment were considered, 48.3% of them eventually raced. This success rate was higher than in previous studies. The authors suggest that this may be partly due to the foals being identified and treated earlier, before the cartilage could be too severely damaged.

In contrast, 66.2% of the control animals (foals that had not had septic arthritis) appeared at least once on a racecourse. (This figure agrees with statistics produced by Weatherbys that show that only about two-thirds of all the TB foals born in the UK start in at least one race.)

Foals that had recovered from septic arthritis also took longer than their unaffected siblings did to actually start their first race. On average, horses that had been treated for septic arthritis as foals were nearly five years old before they raced for the first time. In contrast, the control horses reached the racecourse at an average of three and a half years of age.

None of the five foals with more than one joint affected raced, even though two were treated successfully. However it was not possible to demonstrate a greater risk of not racing if more than one joint was affected because of the low numbers involved.

The researchers also found that foals that had other problems at the same time as the septic arthritis (such as ruptured bladder) were less likely to respond to treatment and return home from the hospital. Once they had done so, however, they were no less likely to race than foals with only septic arthritis.

What is the likelihood that Thoroughbred foals treated for septic arthritis will race?
LJ Smith, CM Marr, RJ Payne, SJ Stoneham, SWJ Reid.
Equine Veterinary Journal (2004) 36, 452 - 456

Preventing infection in foals

How can you reduce the risk of infectious diseases among young foals? Is it a good idea to give new born foals antibiotics to prevent infections?

A recent study carried out in Newmarket looked at factors affecting infectious diseases in young foals. Thirty six stud farms participated in the study which was carried out over one season. Nine hundred and ninety two foals that were healthy at birth were followed for the first thirty days of their lives.

Some of the foals were routinely treated with antibacterial medication (usually potentiated

sulphonamides) for 3 days. Others received no preventative antibacterial treatment.

The stud and the veterinary practice in charge determined the policy on preventive treatment. Either all foals on a stud were routinely treated or they received no prophylactic antibiotics and were only given antimicrobial drugs in rare cases of foals being considered at high risk of infection.

Overall, infectious disease occurred in 8.27% of the foals. The most common infectious condition was systemic disease with diarrhoea (5.85% of foals).

The study found no significant difference between treated and untreated foals in the incidence of infectious disease in the first 30 days.

So, giving preventative antibiotics (in this case mostly potentiated sulphonamide) for the first three days did not reduce the incidence of infectious disease in the first 30 days of life. However, it is mentioned by the authors that this study was not a randomised controlled trial and therefore does not provide the strongest possible evidence for this conclusion.

The authors recommend that antimicrobial drugs should only be given as a preventive measure to high risk foals - for example when the foal has not received adequate good quality colostrum or has experienced a difficult foaling.

The study also identified some other factors that were associated with an increase in infectious disease in foals, such as:

- Foals that experienced complications at birth - including premature separation of the placenta - had a higher risk of the two infectious disease categories "total infectious diseases" and "total infectious diseases excluding diarrhoea"

- Foals given colostrum by stomach tube (as opposed to by a bottle) were at an increased risk of severe diarrhoea and infectious disease.

Why should that be? Perhaps foals were already weak and had a poor suck reflex when they were given colostrum by stomach tube. The majority of foals that received colostrum by stomach tube were weak or "slow" (they did not drink on their own during the first 3-4 hours after birth). In most cases bottle feeding would have been tried but often this was not successful. So to make sure they received colostrum within the first 4 hours they were stomach tubed.

Maybe giving colostrum by stomach tube influences absorption in some way. Or perhaps the tube introduces bacteria into the gastrointestinal tract.

- Poor colostrum quality and low IgG - levels in the day old foal were not associated with an increased risk of infectious disease. At first glance this is surprising. The explanation probably lies in the high standard of care given at Newmarket. Poor colostrum was supplemented with extra good quality colostrum, and foals that still had low IgG levels were given hyperimmune plasma transfusions.

Reference:

Diseases in neonatal foals. Part 1: The 30 day incidence of disease and the effect of prophylactic antimicrobial drug treatment during the first three days post partum.
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FD Wohlfender, FE Barrelet, MG Doherr, R Straub, HP Meier.
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